RESEARH METHODOLOGY FOR TOURISM

MBA (Tourism & Travel Management)

SECOND YEAR, PAPER –IV

Lesson Writers

Dr. G. Jyothi
Teaching Faculty
Dept. of Tourism & Hospitality Manag.
Acharya Nagarjuna University

K.Rajesh
Teaching Faculty
Dept. of Tourism & Hospitality Manag.
Acharya Nagarjuna University

Editor & Lesson Writer
Dr. P. Purna Chandra Rao
M.Com, M.A. (Hist), B.L, PGDTTM, M.Phil, Ph.D.
Associate Professor,
Chairman, Board of Studies
Department of Tourism & Hospitality Management
Acharya Nagarjuna University.

Director, I/c
Prof.V.VENKATESWARLU
MA.,M.P.S., M.S.W.,M.Phil., Ph.D.
CENTREFORDISTANCEEDUCATION
ACHARAYANAGARJUNAUNIVERSITY
NAGARJUNANAGAR – 522510
Ph:0863-2346222,2346208,
0863-2346259(Study Material)
Website:www.anucde.info
e-mail:anucdedirector@gmail.com

M.B.A (TTM) : RESEARCH METHODOLOGY FOR TOURISM

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FOREWORD

Since its establishment in 1976, Acharya Nagarjuna University has been forging ahead in the path of progress and dynamism, offering a variety of courses and research contributions. I am extremely happy that by gaining 'A^{+}' grade from the NAAC in the year2024, Acharya Nagarjuna University is offering educational opportunities at the UG, PG levels apart from research degrees to students from over221 affiliated colleges spread over the two districts of Guntur and Prakasam.

The University has also started the Centre for Distance Education in 2003-04 with the aim of taking higher education to the doorstep of all the sectors of the society. The centre will be a great help to those who cannot join in colleges, those who cannot afford the exorbitant fees as regular students, and even to housewives desirous of pursuing higher studies. Acharya Nagarjuna University has started offering B.Sc., B.A., B.B.A., and B.Com courses at the Degree level and M.A., M.Com., M.Sc., M.B.A., and L.L.M., courses at the PG level from the academic year 2003-2004 onwards.

To facilitate easier understanding by students studying through the distance mode, these self-instruction materials have been prepared by eminent and experienced teachers. The lessons have been drafted with great care and expertise in the stipulated time by these teachers. Constructive ideas and scholarly suggestions are welcome from students and teachers involved respectively. Such ideas will be incorporated for the greater efficacy of this distance mode of education. For clarification of doubts and feedback, weekly classes and contact classes will be arranged at the UG and PG levels respectively.

It is my aim that students getting higher education through the Centre for Distance Education should improve their qualification, have better employment opportunities and in turn be part of country's progress. It is my fond desire that in the years to come, the Centre for Distance Education will go from strength to strength in the form of new courses and by catering to larger number of people. My congratulations to all the Directors, Academic Coordinators, Editors and Lesson-writers of the Centre who have helped in these endeavors.

Prof. K. Gangadhara Rao

M.Tech., Ph.D.,
Vice-Chancellor I/c
Acharya Nagarjuna University

204TT26: RESEARCH METHODOLOGY FOR TOURISM

Objectives:

a. To understand the theories and practices of research in tourism;
b. To be acquainted with scientific methods of research; and
c. To acquire research knowledge, skills, and competencies for undertaking independent research activities.

Unit-I

INTRODUCTION: Significance - Nature and Scope of Research in Tourism - Research Process and Organization - Criteria of Good Research.

Learning outcome:

- Understand the importance of research and the process of research in tourism.

Unit-II

RESEARCH PROBLEM & RESEARCH PROPOSAL IN TOURISM - Selecting the problem - Definition - Need for Research Proposal- Different Proposals: Exploratory, Descriptive and Conclusive Research

Learning outcome:

- Identifying the research problem and understanding the various research proposals.

Unit-III

DATA RESOURCES: Primary, Secondary, and Online Data - Data collection - Methods - Questioning - Techniques - Questionnaire preparation - observation method - Online Surveys.

Learning outcome:

- A clear understanding of various sources of data and tools of data collection.

Unit-IV

SAMPLING DESIGN: Need for Sampling, Sampling Frame - Types - Steps in Sample Design - Sampling Techniques - Processing operations - Elements and types of Analysis in Tourism.

Learning outcome:

- Design the sampling frame, its process, Technique, and data analysis for understanding the case.

Unit- V

INTERPRETATION AND REPORTING: Techniques of Interpretation - Significance of Report writing - Layout of Report writing - Types of Reports - Precautions for writing Reports - Research and Computer Applications in Tourism.

Learning outcome:

- Understand the layout of report writing and computer applications in the research process in tourism.

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CONTENT

Lesson-1

RESEARCH METHODOLOGY – AN INTRODUCTION

Objectives

After studying this lesson, you should be able to

- Explain the meaning and objectives of research
- Elucidate the types of research
- Discuss the criteria of a good research

Structure

1.1 INTRODUTION

As a manager, you will have to make several decisions each day at work. What would help you to make the right decisions? Will it be your experience on the job, your sixth sense or hunch, or will you just hope for good luck? For sure, all of these will play a part after you have thoroughly investigated or researched the problem situation and generated some alternative solutions to choose from. Whether or not managers realize it, they are constantly engaged in research as they try to find solutions to the day-to-day problems, big and small, that confront them at work. Some of the issues are solved with relative ease, as when a machine on the shop floor stops working, and the foreman, with his past experience, hastens to do the necessary repair and gets it to run smoothly again. A few problems may present moderate difficulty,

requiring some time and effort for the manager to investigate into and find a solution, as for example, when many employees absent themselves from work frequently. Yet other problems could be quite complex and the manager might proceed to seek the help of an expert researcher‖ to study the issue and offer solutions, as in the case of a company consistently incurring losses to the perplexity and dismay of everyone.

Research in management is a systematic way to collect information and get knowledge out of it with a methodology so that the derived knowledge can be used to make decisions. Usually, managers face major issues like ongoing complaints from customers; need to convince financers/ bankers for advances, unmet needs among customers, the need to polish an internal process, issues while managing men, machines, materials and money, issues of forecasting and future plans. Research helps us decide rationally. Business research is the process and the tool needed to reduce risk in managerial decision-making. Business research is a systematic inquiry that provides systematic knowledge to guide managerial decisions. More specifically, it is a process of planning, acquiring, analyzing, and disseminating relevant data, information, and insights to decision-makers in ways that mobilize the organization to take appropriate actions that, in turn, maximize business performance.

1.2 DEFINITION OF RESEARCH

Research is a way of thinking and finding answers to the questions that come into your mind. In our day-to-day life, we formulate several questions in our mind. We want to get answers for these questions. Some of these questions can be answered easily without any need of scientific scrutiny. While there are also some questions that need to be answered in a logical manner. The process that needs to be followed in finding answers to such question should have to be empirical and subjective. The techniques and procedures that need to be used should also be valid and logical. In this way, we are able to get answers that are authentic and verifiable. Research simply means a search for facts — answers to questions and solutions to problems. It is a purposive investigation. It is an “organized inquiry.” It seeks to find explanations to unexplained phenomenon, to clarify the doubtful propositions and to correct the misconceived facts. How is this search made? What are possible methods or approaches

A broad definition of research:

"Research is a careful enquiry or examination iseeking facts or principles, a diligent investigation to ascertain something." — Clifford Woody

"Research includes any gathering of data, information, and facts for the advancement of knowledge." - Godwin Colibao

"Research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue." - John W. Creswell

"In the broadest sense of the word, the definition of research includes any gathering of data, information and facts for the advancement of knowledge."- Martyn Shuttleworth.

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 generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art."

Kerlinger defines research as a "systematic, controlled, empirical and critical investigation of hypothetical propositions about the presumed relations among natural phenomena." The term "systematic, controlled, empirical and critical" describe the characteristics of scientific method. Whether research needs to be an "investigation of hypothetical propositions about presumed relations" is debatable. Research does not always call for a hypothesis. It may also be carried out for the formulation of hypotheses. It may also be designed to gather descriptive information on a phenomenon.

Emory defines research as "any organized inquiry designed and carried out to provide information for solving a problem." This definition is an inclusive one. But it emphasizes the problem – solving purpose only. Research may also aim at finding answer to questions

According to Young, research can be defined as "a scientific undertaking which, by means of logical and systematic techniques aims to: (i) discover new facts or verify and test old facts, (ii) analyse their sequences, interrelationships and causal explanations. (iii) develop new scientific tools, concepts and theories which would facilitate reliable and valid study of human behaviour".

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 generalization and the formulation of a theory is also research.

1.3 CHARACTERSTICS OF RESEARCH

The various characteristics of research are summarized below:

1. Research is a systematic and critical investigation into a phenomenon.
2. It is not a mere compilation, but a purposive investigation; it aims at describing, interpreting and explaining a phenomenon.
3. It adopts scientific method
4. It is objective and logical, applying possible tests to validate the measuring tools and the conclusions reached.
5. It is based upon observable experience or empirical evidence.
6. Research is directed towards finding answers to pertinent questions and solutions to problems.
7. It emphasizes the development of generalization, principles or theories.
8. The purpose of research is not to arrive at an answer, which is personally pleasing to the researcher, but rather one, which will stand up the test of criticism

1.4 OBJECTIVES OF RESEARCH

The objectives or purposes of research are varied. They are:

Research extends knowledge of human beings, social life and environment. Scientists and researchers build up the wealth of knowledge through their research findings. They search answers for various types of questions: What, Where, When, How and Why of various phenomena, and enlighten us. The bodies of knowledge have been developed by research in gene

1. ral and pure or fundamental research in particular.
2. Research unravels the mysteries of nature; brings to light hidden information that might never be discovered fully during the ordinary course of life.

3. Research establishes generalizations and general laws and contributes to theory building in various fields of knowledge. Our knowledge of isolated events is connected together to draw generalizations and general laws. Law of gravitation, Law of demand, and principles of organization such as unity of command and scalar principle, the theory of consumer behaviour and motivation theories are some examples for such generalizations, laws and theories.
4. Research verifies and tests existing facts and theory and these help improving our knowledge and ability to handle situations and events.
5. General laws developed through research may enable us to make reliable predictions of events yet to happen.
6. Research aims to analyse inter-relationships between variables and to derive causal explanations; and thus enables us to have a better understanding of the world in which we live.
7. Applied research aims at finding solutions to problems…. socio-economic problems (e.g., social unrest, unemployment, poverty) health problems, human relations problems in organizations and so on. Thanks to the fruits of research, we have better quality of life, longer life span and better control over events.
8. Research also aims at developing new tools, concepts, and theories for a better study of unknown phenomena.
9. Research aids planning and thus contributes to national development
10. Analytical studies of internal and external environment of business and non-business organizations provide factual data for rational decision making – formulation of strategies and policies. Studies of their operational problems contribute to an improvement in their performance.

1.5 TYPES OF RESEARCH (KOTHARI 2004, Raju et al.2018)

The basic types of research are as follows:

Descriptive Research:

Descriptive research seeks to provide an accurate description of observations of a phenomenon. It is a fact finding investigation with adequate interpretation. It is the simplest type of research which focuses on particular aspects or dimensions of the problem studied. It is designed to gather descriptive information and provide information for formulating more sophisticated studies. The objective of descriptive

research is to map the terrain of a specific phenomenon. A descriptive study identifies relevant variables but does not aim at testing hypothesis. It applies simple statistical techniques like averages and percentages.

Analytical Research:

In analytical research, the researcher has to use facts or information already available, and analyze these to make a critical evaluation of the material.

Applied Research:

It is designed to solve practical problems of the modern world, rather than to acquire knowledge for knowledge sake. It is also known as action research. The goal of applied research is to improve the human condition. It focuses on analysis and solving social and real life problems. This research is generally conducted on a large scale basis. As such, it is often conducted with the support of some financing agency like government, public corporations, World Bank, UNICEF, UGC etc. Applied research aims at finding a solution for an immediate problem facing a society or an industrial/business organisation. For example: Improve agriculture crop production, treat or cure a specific disease, improve energy efficiency homes and offices, improving communication among workers in large companies.

Fundamental Research/Pure Research:

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. Pure research generates new ideas, principles and theories, which may not be immediately utilized; though are the foundations of modern progress and development in different fields.

Research concerning some natural phenomenon or relating to pure mathematics are examples of fundamental research. Similarly, research studies, concerning human behaviour carried on with a view to make generalisations about human behaviour, are also examples of fundamental research.

Quantitative Research:

Quantitative research is based on measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity. It aims to measure the quantity or amount and compares it with past records and tries to project for future periods. In social sciences, "quantitative research refers to the systematic empirical investigation of quantitative properties and phenomena and their relationships". The process of measurement is central to quantitative research because it provides fundamental connection between empirical observation and mathematical expression of quantitative relationships. Statistics is the most widely used branch of mathematics in quantitative research. For example, Total sales of soap industry in terms of rupees and quantity in terms of for a particular year, say 2019, could be researched, compared with past 5 years and then projection for 2020 could be made.

Qualitative Research:

Qualitative research refers to the meanings, definitions, characteristics, symbols, metaphors and description of things. Qualitative research is concerned with qualitative phenomenon, i.e., phenomena relating to or involving quality or kind. This type of research aims at discovering the underlying motives and desires, using in depth interviews for the purpose. It presents non-quantitative type of analysis. Qualitative research is specially important in the behavioural sciences where the aim is to discover the underlying motives of human behaviour. Through such research we can analyse the various factors which motivate people to behave in a particular manner or which make people like or dislike a particular thing. It may be stated, however, that to apply qualitative research in practice is relatively a difficult job and therefore, while doing such research, one should seek guidance from experimental psychologists. The nature of this type of research is exploratory and open ended. Other techniques of such research are word association tests, sentence completion tests, story completion tests and similar other projective techniques. Attitude or opinion research i.e., research designed to find out how people feel or what they think about a particular subject or institution is also qualitative research.

Conceptual research:

Conceptual research is that related to some abstract idea(s) or theory. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret

existing ones. Conceptual research involves investigation of thoughts and ideas and developing new ideas or interpreting the old ones based on logical reasoning. A conceptual framework is used in research to outline possible courses of action or to present a preferred approach to an idea or thought.

Empirical research:

Empirical research relies on experience or observation alone, often without due regard for system and theory. It is data-based research, coming up with conclusions which are capable of being verified by observation or experiment. We can also call it as experimental type of research. In such a research, it is necessary to get at facts firsthand, at their source, and actively to go about doing certain things to stimulate the production of desired information. In such a research, the researcher must first provide himself with a working hypothesis or guess as to the probable results. He then works to get enough facts (data) to prove or disprove his hypothesis. He then sets up experimental designs which he thinks will manipulate the persons or the materials concerned so as to bring forth the desired information. Such research is thus characterised by the experimenter's control over the variables under study and his deliberate manipulation of one of them to study its effects. Empirical research is appropriate when proof is sought that certain variables affect other variables in some way. Evidence gathered through experiments or empirical studies is today considered to be the most powerful support possible for a given hypothesis.

Experimental Research:

Experimental research is designed to assess the effects of particular variables on a phenomenon by keeping the other variables constant or controlled. It aims at determining whether and in what manner variables are related to each other. The factor which is influenced by other factors is called a dependent variable and the other factors which influence it are known as independent variables. It is conducted mostly in laboratories in the context of basic research. The principle advantage of experimental designs is that it provides the opportunity to identify cause and effect relationships. Non-experimental research (case studies, surveys, correlation studies) is non-manipulative observational research usually conducted in natural settings. While laboratory controlled experimental studies tend to be higher in internal validity, non-experimental studies tend to be higher in external validity. One major limitation of

experimental research is that studies are typically conducted in contrived or artificial laboratory settings. Results may not generalize or extrapolate to external settings. Two exceptions to this rule are natural experiments and field experiments.

Cross sectional or longitudinal research:

Form the point of view of time, we can think of research either as one-time research (cross sectional 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.

Exploratory research:

Exploratory research is a preliminary study of an unfamiliar problem about which the researcher has little or no knowledge. The objective of exploratory research is the development of hypotheses rather than their testing. It involves a literature search or conducting focus group interviews. The exploration of new phenomena in this way may help the researcher's need for better understanding, may test the feasibility of a more extensive study or determine the best methods to be used in a subsequent study. For these reasons, exploratory research is broad in focus and rarely provides definite answers to specific research issues.

Formalized research studies:

Formalized research studies are those with substantial structure and with specific hypotheses to be tested.

Historical research:

Historical research refers to the induction of principles through research into the past and social forces which have shaped the present. It is that research 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. It is the process of systematically studying past records with a view to reconstruct the origin and development of an institution or a movement or a system and discovering trends in the past. It is not a mere accumulation of facts and dates or even a description of past events. It is a flowing, dynamic account of past events which involves an interpretation of these events in an attempt to recapture the nuances,

personalities and ideas that influenced these events. One of the goals of historical research is to communicate an understanding of past events.

Conclusion-oriented and decision-oriented research:

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:

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.

1.6 CRITERIA OF A GOOD RESEARCH

The purpose of the research should be clearly defined. The research procedure used should be described in sufficient detail to permit another researcher to repeat the research for further advancement, keeping the continuity of what has already been attained. The procedural design of the research should be carefully planned to yield results that areas objective as possible. The researcher should report with complete frankness, flaws in procedural design and estimate their effects upon the findings. The analysis of data should be sufficiently adequate to reveal its significance and the methods of analysis used should be appropriate. The validity and reliability of the data should be checked carefully. Conclusions should be confined to those justified by the data of the research and limited to those for which the data provide an adequate basis. Thus, the qualities of a good research are as follows –

1. Good research is systematic:

It means that research is structured with specified steps to be taken in a specified sequence in accordance with the well-defined set of rules. Systematic characteristic of the research does not rule out creative thinking but it certainly does reject the use of guessing and intuition in arriving at conclusions.

2. Good research is logical:

This implies that research is guided by the rules of logical reasoning and the logical process of induction and deduction are of great value in carrying out research. Induction is the process of reasoning from a part to the whole whereas deduction is the process of reasoning from some premise to a conclusion which follows from that very premise. In fact, logical reasoning makes research more meaningful in the context of decision making.

3. Good research is empirical:

It implies that research is related basically to one or more aspects of a real situation and deals with concrete data that provides a basis for external validity to research results.

4. Good research is replicable:

This characteristic allows research results to be verified by replicating the study and thereby building a sound basis for decisions.

Qualities of a Good Researcher:

1. **Method of Approach**: The researcher should adopt correct course of action for identifying a problem and then for working on it, to find a solution for that problem.
2. **Knowledge:** The researcher should have complete knowledge and information of the field of investigation so that he can go in for correct planning and then application of the correct and efficient methods for selection of the problem and then for solving it.
3. **Qualification:** The researcher should have a good background of study, which will facilitate the researcher to have a better knowledge and understanding of the subject.
4. **Motivation:** The researcher must be motivated to perform his work. For that, he should have a proper attitude, vision of his own, and an aim with some objectives to achieve something.
5. **Perseverance**: Perseverance means to carry on work strongly even though there are certain problems and difficulties in carrying out work. As a result researcher should be stable and must have consistent thinking.

6. **Communication Skills:** Good Communication skills are required by researcher as he can interact with respondents efficiently and understand their opinions.
7. **Organisational Skills:** Researcher should use time management techniques so that work can be completed on time. Whereas maintaining budget, keeping records, filing necessary documents, keeping paper cuttings is needed to carry on work successfully.
8. **Independent:** Researcher must be able to work without close supervision, managing your own time and projects.

1.7 SUMMARY

Research simply means a search for facts — answers to questions and solutions to problems. It is a purposive investigation. It is an "organized inquiry." It seeks to find explanations to unexplained phenomenon, to clarify the doubtful propositions and to correct the misconceived facts.

Research is a systematic and critical investigation into a phenomenon. It is not a mere compilation, but a purposive investigation; it aims at describing, interpreting and explaining a phenomenon.

Research extends knowledge of human beings, social life and environment. Scientists and researchers build up the wealth of knowledge through their research findings. They search answers for various types of questions: What, Where, When, How and Why of various phenomena, and enlighten us. The bodies of knowledge have been developed by research in general and pure or fundamental research in particular.

Applied research aims at finding solutions to problems…. socio-economic problems (e.g., social unrest, unemployment, poverty) health problems, human relations problems in organizations and so on. Thanks to the fruits of research, we have better quality of life, longer life span and better control over events.

The purpose of the research should be clearly defined. The research procedure used should be described in sufficient detail to permit another researcher to repeat the research for further advancement, keeping the continuity of what has already been attained.

1.8 KEYWORDS

Research can be defined as "a scientific undertaking which, by means of logical and systematic techniques aims to: (i) discover new facts or verify and test old facts, (ii) analyse their sequences, interrelationships and causal explanations. (iii) develop new scientific tools, concepts and theories which would facilitate reliable and valid study of human behaviour".

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Cross sectional or longitudinal research: Form the point of view of time, we can think of research either as one-time research (cross sectional 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.

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Operations research: 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.

1.9 SELF ASSESSMENT QUESTIONS

1. Define research and examine its objectives.
2. Discuss the types of research.
3. Analyze the criteria of a good research.
4. Short notes on:
    a. Basic research
    b. Research design
    c. Literature survey
    d. Quantitative research

1.10 FURTHER READINGS

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Lesson Writer:

Dr. G. Jyothi

Lesson –2

RESEARCH PROCESS AND RESEARCH PROBLEM

OBJECTIVES

After studying this lesson, you should be able to:

- Understand the research process
- Define research problem
- Understand the selection of research problem
- Know the techniques in selecting a research problem

STRUCTURE

2.1 INTRODUCTION

Research, no matter what the objective and thrust behind it, essentially needs to follow a sequential and structured path. The stages might overlap and sometimes be bypassed or eliminated in some research studies. While conducting research, information is gathered through a sound and scientific research process.

Problem means a question or an issue to be examined. The identification of research problem is the first and foremost step that every researcher has to undertake. At times, it becomes rather difficult for an inexperienced researcher or a novice/beginner in research to conceptualize a research problem. In general, a research problem should be understood as some difficulty, unclear situation which a researcher experiences in practical or theoretical context and wants to obtain a tangible explanation, clarification or offer solution to it. For students, this problem

may be as a result of theoretical encounter in the area of specialization. As such, before embarking on any research, you should identify the major research area of your interest, mostly the area of your specialization.

2.2 RESEARCH PROCESS

Research process involves execution of a series of phases towards accomplishment of the objectives of research. One should remember that the various steps involved in research are not mutually exclusive; nor they are separate and distinct. The following order concerning various steps provides a useful procedural guideline regarding the research process:

(1) Formulating the research problem

(2) Extensive literature survey

(3) Developing the hypothesis

(4) Preparing the research design

(5) Determining sample design

(6) Collecting the data

(7) Execution of the project

(8) Analysis of data

(9) Hypothesis testing

(10) Generalisations and interpretation and

(11) Preparation of the report or presentation of the results

1. Formulating the research problem:

This task of formulating, or defining, a research problem is a step of greatest importance in the entire research process.

a. At the very outset the researcher must single out the problem he wants to study, i.e., he must decide the general area of interest or aspect of a subject-matter that he would like to inquire into.
b. Initially the problem may be stated in a broad general way and then the ambiguities, if any, relating to the problem be resolved. Then, the feasibility of a

particular solution has to be considered before a working formulation of the problem can be set up.

c. The formulation of a general topic into a specific research problem, thus, constitutes the first step in a scientific enquiry.
d. Essentially two steps are involved in formulating the research problem, viz., understanding the problem thoroughly, and rephrasing the same into meaningful terms from an analytical point of view.
e. The researcher must examine all available literature to get himself acquainted with the selected problem. He may review two types of literature—the conceptual literature concerning the concepts and theories, and the empirical literature consisting of studies made earlier which are similar to the one proposed.
f. The basic outcome of this review will be the knowledge as to what data and other materials are available for operational purposes which will enable the researcher to specify his own research problem in a meaningful context.
g. After this the researcher rephrases the problem into analytical or operational terms i.e., to put the problem in as specific terms as possible.

2. Extensive literature survey:

a. Once the problem is formulated, a brief summary of it should be written down.
b. At this juncture the researcher should undertake extensive literature survey connected with the problem.
c. Academic journals, conference proceedings, government reports, books etc., must be tapped depending on the nature of the problem.
d. The earlier studies, if any, which are similar to the study in hand should be carefully studied.

3. Development of working hypotheses:

a. After extensive literature survey, researcher should state in clear terms the working hypothesis or hypotheses.
b. Working hypothesis is tentative assumption made in order to draw out and test its logical or empirical consequences. As such the manner in which research hypotheses are developed is particularly important since they provide the focal point for research.

c. They also affect the manner in which tests must be conducted in the analysis of data and indirectly the quality of data which is required for the analysis.
d. Hypothesis should be very specific and limited to the piece of research in hand because it has to be tested.
e. The role of the hypothesis is to guide the researcher by delimiting the area of research and to keep him on the right track.
f. It also indicates the type of data required and the type of methods of data analysis to be used.
g. How does one go about developing working hypotheses? The answer is by using the following approach:
    i. Discussions with colleagues and experts about the problem, its origin and the objectives in seeking a solution;
    ii. Examination of data and records, if available, concerning the problem for possible trends, peculiarities and other clues;
    iii. Review of similar studies in the area or of the studies on similar problems; and
    iv. Exploratory personal investigation which involves original field interviews on a limited scale with interested parties and individuals with a view to secure greater insight into the practical aspects of the problem.

4. Preparing the research design:

a. The research problem having been formulated in clear cut terms, the researcher will be required to prepare a research design, i.e., he will have to state the conceptual structure within which research would be conducted.
b. The function of research design is to provide for the collection of relevant evidence with minimal expenditure of effort, time and money.
c. The preparation of the research design, appropriate for a particular research problem, involves usually the consideration of the following: (i) the means of obtaining the information; (ii) the availability and skills of the researcher and his staff (if any); (iii) explanation of the way in which selected means of obtaining information will be organised and the reasoning leading to the selection; (iv) the time available for research; and (v) the cost factor relating to research, i.e., the finance available for the purpose.

d. A flexible research design which provides opportunity for considering many different aspects of a problem is considered appropriate if the purpose of the research study is that of exploration. But when the purpose happens to be an accurate description of a situation or of an association between variables, the suitable design will be one that minimises bias and maximises the reliability of the data collected and analysed.
e. There are several research designs, such as, experimental and non-experimental hypothesis testing. Experimental designs can be either informal designs (such as before-and-after without control, after-only with control, before-and-after with control) or formal designs (such as completely randomized design, randomized block design, Latin square design, simple and complex factorial designs), out of which the researcher must select one for his own project.

5. Determining sample design:

All the items under consideration in any field of inquiry constitute a 'universe' or 'population'. We select only a few items from the universe for our study purposes. The items so selected constitute what is technically called a sample. The researcher must decide the way of selecting a sample or what is popularly known as the sample design.

6. Collecting the data:

In dealing with any real life problem it is often found that data at hand are inadequate, and hence, it becomes necessary to collect data that are appropriate. There are several ways of collecting the appropriate data which differ considerably in context of money costs, time and other resources at the disposal of the researcher. Primary data can be collected either through experiment or through survey. If the researcher conducts an experiment, he observes some quantitative measurements, or the data, with the help of which he examines the truth contained in his hypothesis.

7. Execution of the project:

a. Execution of the project is a very important step in the research process.
b. If the execution of the project proceeds on correct lines, the data to be collected would be adequate and dependable.
c. The researcher should see that the project is executed in a systematic manner and in time.

d. If the survey is to be conducted by means of structured questionnaires, data can be readily machine-processed. In such a situation, questions as well as the possible answers may be coded.
e. If the data are to be collected through interviewers, arrangements should be made for proper selection and training of the interviewers. The training may be given with the help of instruction manuals which explain clearly the job of the interviewers at each step.
f. Occasional field checks should be made to ensure that the interviewers are doing their assigned job sincerely and efficiently.
g. A careful watch should be kept for unanticipated factors in order to keep the survey as much realistic as possible.

8. Analysis of data:

a. After the data have been collected, the researcher turns to the task of analysing them.
b. The analysis of data requires a number of closely related operations such as establishment of categories, the application of these categories to raw data through coding, tabulation and then drawing statistical inferences.
c. The unwieldy data should necessarily be condensed into a few manageable groups and tables for further analysis. Thus, researcher should classify the raw data into some purposeful and usable categories.
d. Coding operation is usually done at this stage through which the categories of data are transformed into symbols that may be tabulated and counted. Editing is the procedure that improves the quality of the data for coding. With coding, the stage is ready for tabulation.
e. Tabulation is a part of the technical procedure wherein the classified data are put in the form of tables.
f. Analysis work after tabulation is generally based on the computation of various percentages, coefficients, etc. by applying various well-defined statistical formulae. In the process of analysis, relationships or differences supporting or conflicting with original or new hypotheses should be subjected to tests of significance to determine with what validity data can be said to indicate any conclusion(s).

9. Hypothesis-testing:

a. After analysing the data as stated above, the researcher is in a position to test the hypotheses, he had formulated earlier.
b. Various tests, such as Chi square test, t-test, F-test, have been developed by statisticians for the purpose.
c. The hypotheses may be tested through the use of one or more of such tests, depending upon the nature and object of research inquiry.
d. Hypothesis-testing will result in either accepting the hypothesis or in rejecting it.

10. Generalisations and interpretation:

a. If a hypothesis is tested and upheld several times, it may be possible for the researcher to arrive at generalisation, i.e., to build a theory.
b. As a matter of fact, the real value of research lies in its ability to arrive at certain generalisations.
c. If the researcher had no hypothesis to start with, he might seek to explain his findings on the basis of some theory. It is known as interpretation.
d. The process of interpretation may quite often trigger off new questions which in turn may lead to further researches.

11. Preparation of the report or the thesis:

Finally, the researcher has to prepare the report of what has been done by him.

1. Writing of report must be done with great care keeping in view the following:

a. The layout of the report should be as follows: (i) the preliminary pages; (ii) the main text, and (iii) the end matter.
b. In its preliminary pages the report should carry title and date followed by acknowledgements and foreword. Then there should be a table of contents followed by a list of tables and list of graphs and charts, if any, given in the report.

2. The main text of the report should have the following parts:

a. Introduction: It should contain a clear statement of the objective of the research and an explanation of the methodology adopted in accomplishing the research. The scope of the study along with various limitations should as well be stated in this part.

b. Summary of findings: After introduction there would appear a statement of findings and recommendations in non-technical language. If the findings are extensive, they should be summarised.
c. Main report: The main body of the report should be presented in logical sequence and broken-down into readily identifiable sections.
d. Conclusion: Towards the end of the main text, researcher should again put down the results of his research clearly and precisely. In fact, it is the final summing up. At the end of the report, appendices should be enlisted in respect of all technical data.
e. Bibliography, i.e., list of books, journals, reports, etc., consulted, should also be given in the end. Index should also be given specially in a published research report.

3. Report should be written in a concise and objective style in simple language avoiding vague expressions such as 'it seems,' 'there may be', and the like.
4. Charts and illustrations in the main report should be used only if they present the information more clearly and forcibly.

2.3 RESEARCH PROBLEM

A problem need not necessarily mean that something is wrong in the current situation which needs to be rectified immediately. It simply indicates an issue for which finding a solution could help to improve an existing situation. Problem can be defined as any situation where a gap exists between the actual and the desired state. Problem statement or problem definition refers to a clear, precise and succinct statement of question or issue that is to be investigated with the goal of finding an answer or solution.

A research problem refers to some kind of problem which a researcher experiences or observes in the context of either a theoretical or practical situation. The researcher has to find out suitable course of action by which the objective can be attained optimally in the context of given environment. Thus, selection of research problem has high value to the society and the researcher must be able to identify those problems that need an urgent solution. For instance from: Education, Social sciences, Humanities, Business administration among others. Once you have the broad area, you narrow down the area by selecting a particular topic. This should be done after

going through most of the literature related to the area. The topic should further be narrowed down to a specific researchable problem. For a research problem to exist, there are a number of core elements that have to be inherent. There must be:

1. An individual or community or an organization/institution to whom the problem could be attributed

These occupy a certain geographical area. For instance, teacher/parental factors affecting students' performance in private secondary schools in Vijayawada Municipality. In this study, there are individuals (parents, teachers, students), there are institutions (private secondary schools) and there is the area of study (Vijayawada Municipality).

2. Some Objectives for pursuing the problem repugnant to reason and common understanding to undertake the research. For example: To find out teacher/ parental factors affecting the students' academic performance in private secondary schools in Vijayawada Municipality.
3. Some lines of action to be taken

There must be at least two lines of action to be taken to attain the objective. For example, poor academic performance may be attributed to negative teacher and parental factors. Thus altering negative teacher factors and parental factors become the lines of action to be pursued. Here, the underlying question is "what is the cause of this problem – poor academic performance?" It is in answering this question that you must pursue some lines of action through stating some variables (teacher factors and parental factors).

Thus, a research problem is one which requires a researcher to find out the best solution for the given problem, i.e., to find out by which course of action the objective can be attained optimally in the context of a given environment. There are several factors which may result in making the problem complicated. For instance, the environment may change affecting the efficiencies of the courses of action or the values of the outcomes; the number of alternative courses of action may be very large; persons not involved in making the decision may be affected by it and react to it favourably or unfavourably, and similar other factors. All such elements (or at least the important ones) may be thought of in context of a research problem.

2.4 SELECTING THE RESEARCH PROBLEM

Research problems trigger the research process. Defining the research problem is a critical activity. A thorough understanding of research problem is a must for achieving success in the research endeavor. Defining the research problem begins with identifying the basic dilemma that prompts the research. It can be further developed by progressively breaking down the original dilemma into more specific and focus oriented objectives.

Five steps could be envisaged:

(1) Identifying the broad problem area

(2) Literature review

(3) Identifying the research question

(4) Refining the research question

(5) Developing investigative questions.

The following criteria can be kept in the minds of researchers in selecting the research problem:

i. Subjects on which the research is carried on amply should not be normally chosen as there will not be a new dimension to reveal.
ii. Too narrow or too vague problems should be avoided.
iii. The researcher should be familiar with the subject chosen for research. The researcher should have enough knowledge, qualification and training in the selected problem area.
iv. The resources needed to solve the problem in terms of time, money, efforts, manpower requirement should be taken into account before embarking on a problem.
v. The subject of research should be familiar and feasible so that related research material or sources of research can be obtained easily.
vi. The selection of a problem must be preceded by a preliminary study.

2.5 TECHNIQUES IN SELECTING A RESEARCH PROBLEM

Defining a problem involves the tasks of laying down boundaries within which a researcher shall study the problem with a pre-determined objective in view.

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 a frequently overlooked which causes a lot of problems later on. Hence, the research problem should be defined in a systematic manner, giving due weightage to all relating points. The technique for the purpose involves the undertaking of the following steps generally one after the other:

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. 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.

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 understanding of the nature of the problem involved, he can enter into discussion with those who have a good knowledge of the problem concerned or similar other problems. The researcher should also keep in view the environment within which the problem is to be studied and understood.

Discussions with industry and subject experts – These individuals are knowledge about the industry as the organization. They could be found both within and outside the company. The information on the current and probable scenario required is obtained with the assistance of a semi-structured interview.

Review of existing 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. 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.

Organizational analysis:

Another significant source for deriving the research problem is the industry and organizational data. In case the researcher/investigator is outsourced, the detailed background information of the organization must be compiled, as it serves as the environmental context in which the research problem has to be defined. It is to be remembered at this junction that the organizational context might not be essential in case of basic research, where the nature of study is more generic.

Developing the ideas through discussions:

Discussion concerning a 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 not only 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. For example, in the organic food research, focused group discussions with young and old consumers revealed the level of awareness about

organic food and consumer sentiments related to purchase of more expensive but a healthy alternative food product.

The Unit of Analysis:

The researcher must specify in the problem statement, the individual(s) from whom the research information is to be collected and on whom the research results are applicable. This could be the entire organization, departments, groups or individuals.

Research variables:

Further, the researcher problem also requires identification of the key variables under the particular study. To carry out an investigation, it becomes imperative to convert the concepts and constructs to be studied into empirically testable and observable variables. .

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 (within which the problem has got to be studied) 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:

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

5. 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.

2.6 SUMMARY

Research process involves execution of a series of phases towards accomplishment of the objectives of research. One should remember that the various steps involved in research are not mutually exclusive; nor they are separate and distinct.

A research problem refers to some kind of problem which a researcher experiences or observes in the context of either a theoretical or practical situation. The researcher has to find out suitable course of action by which the objective can be attained optimally in the context of given environment. A thorough understanding of research problem is a must for achieving success in the research endeavor. Defining the research problem begins with identifying the basic dilemma that prompts the research. Defining a problem involves the tasks of laying down boundaries within which a researcher shall study the problem with a pre-determined objective in view. Defining a research problem properly and clearly is a crucial part of a research study and must in no case be accomplished hurriedly.

2.7 SELF ASSESSMENT QUESTIONS

Shorts notes:

1. Define research problem
2. Literature survey
3. Selecting a research problem

Long answers

1. What is a research problem? Explain the steps involved in selecting research problem.
2. Elucidate the techniques in selecting a research problem.
3. Describe the research process.

2.8 FURTHER READINGS

1. Raju S, Tamilselvi T A, Somu A, Vanithamani M R, Vidhya M, Thiyagu R and Rajendra Kumar R (2018), 'Business Research Methods (Text & Cases), Himalaya Publishing House, Mumbai.

2. Hitesh Parmar, Dhaval Maheta and Harishchandra Singh Rathod (2018), 'Research Methodology (Text & Cases)', Himalaya Publishing House, Mumbai.
3. Deepak Chawla and Neena Sondhi (2011), 'Research Methodology – Concepts and Cases', VIKAS Publishing House Private Limited, New Delhi.
4. Kothari, C.R. (2005), 'Research Methodology – Methods & Techniques', Second Edition, New Age International Publishers, New Delhi.
5. Shraddha M. Bhome, Rajiv S. Mishra, Swati Subhash Desai and Suyash Pradhan (2018), 'Research Methodology', Himalaya Publishing House, Mumbai.

Lesson Writer:

Dr. G. Jyothi

Lesson – 3

RESEARCH DESIGN

Objective

After studying this lesson, you should be able to :

- Define research design
- Understand the need for research design
- Outline the types of research design
- T]Know the features of a good research design

Structure

3.1 INTRODUCTION

A research design is nothing but a detailed plan of action for the research. A researcher attempting to solve the research problem should necessarily prepare a plan which will help him to attain his ultimate motto. This plan is nothing but a research design. It is a plan which defines research problem, identifies data needed, decides on tool of data collection, type of study, etc. It is a tentative plan which undergoes many modifications as the research study progresses. It presents a series of guide posts to enable the researcher to progress in the right direction.

A research design is a “Blue Print” for collection, measurement and analysis of data. It outlines how the research will be carried out. It is like glue which sticks

together the entire process of research. It provides answers to various questions like - What techniques will be used to gather data. What kind of sampling will be used? How time and cost constraints be dealt with?

3.2 RESEARCH DESIGN

Several definitions of Research Design have been advanced by several writers on the subject of research methodology. Few of them are presented here:

According to Claire Seltiz, "Research Design is a catalogue of the various facts relating to the formulation of a research effort. It 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".

According to Paul E. Green and Tull, "a Research Design is the specification of methods and procedures for acquiring the information needed. It is the overall operational pattern or framework, of the project that stipulates what information is to be collected from which sources by what procedures. If it is a good design, it will ensure that the information obtained is relevant to the research questions and that it was collected by objective and economical procedures".

According to Fred N. Kerlingar, "Research Design is the plan, structure and strategy of investigation conceived so as to obtain answers to research questions and to control variance. The plan is the overall scheme or programme of research. It includes an outline of what the investigator will do from writing the hypotheses and their operational implications to the final analysis of the data. To structure the research is to outline the scheme and paradigm of the operations of the variables strategy. It includes the methods to be used to gather and analyse the data. In other words, strategy implies how the research objectives will be reached and how the problems encountered in the research will be tackled".

3.3. Need for Research Design

Research method is different from research design. While the design is the specific framework that has been related to seek answers to the research question, the research method is the technique to collect the information required to answer the research problem, given the created framework. Thus, research designs have a critical and directive role to play in the research process.

a. The execution details of the research question to be investigated are referred to as the research design.

   A research design provides a framework for the collection and analysis of data.

b. A choice of research design reflects decisions about the priority being given to a range of dimensions of the research process.

c. These include the importance attached to:

   i. expressing causal connections between variables;

   ii. generalizing to larger groups of individuals than those actually forming part of the investigation;

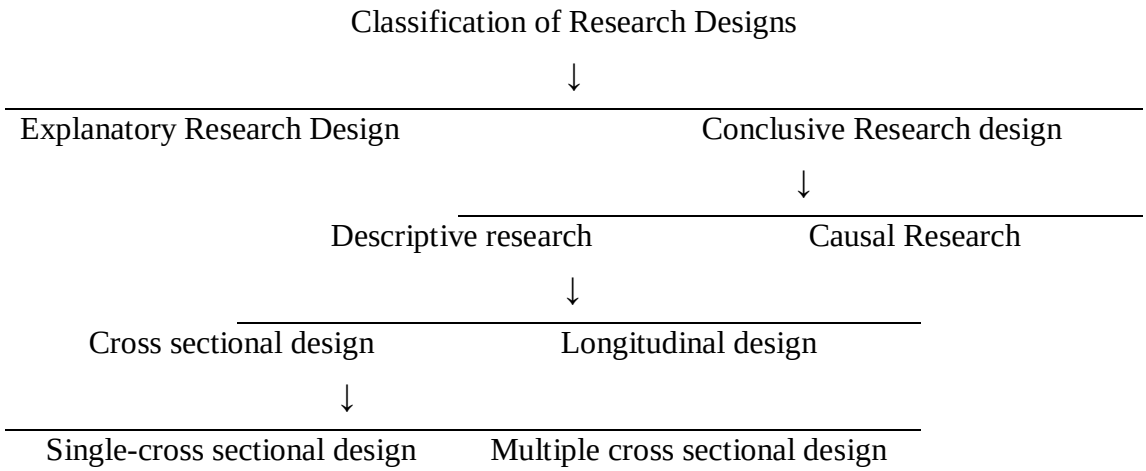
   iii. understanding behaviour and the meaning of that behaviour in its specific social context;

   iv. having a temporal (i.e. over time) appreciation of social phenomena and their interconnections.

Thus, 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.

3.4 TYPES OF RESEARCH DESIGN

The researcher has a number of designs available to him for investing the research objectives. The classification that is universally allowed and is simple to comprehend is the one based upon the objectives or the purpose of the study. A simple classification that is based upon the research needs ranging from simple and loosely structured to the specific and more formally structured is given below.



Exploratory research

Exploratory research focuses on collecting data using an unstructured format or informal procedure to capture data and to interpret them. It is often used to classify the problems or opportunities and it is not intended to provide conclusive information from which a particular course of action can be determined. Exploratory research studies are also termed as formulative 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.

Generally, the following three methods in the context of research design for such studies are talked about:

(a) the survey of concerning literature;

(b) the experience survey and

(c) the analysis of 'insight-stimulating' examples.

The survey of concerning literature:

a. The survey of concerning literature happens to be the most simple and fruitful method of formulating precisely the research problem or developing hypothesis.
b. Hypotheses stated by earlier workers may be reviewed and their usefulness be evaluated as a basis for further research.
c. It may also be considered whether the already stated hypotheses suggest new hypothesis.
d. 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.

e. Besides, the bibliographical survey of studies, already made in one's area of interest may as well as made by the researcher for precisely formulating the problem.
f. He should also make an attempt to apply concepts and theories developed in different research contexts to the area in which he is himself working.

Experience survey:

a. Experience survey means the survey of people who have had practical experience with the problem to be studied.
b. The object of such a survey is to obtain insight into the relationships between variables and new ideas relating to the research problem.
c. For such a survey people who are competent and can contribute new ideas may be carefully selected as respondents to ensure a representation of different types of experience.
d. The respondents so selected may then be interviewed by the investigator.
e. The researcher must prepare an interview schedule for the systematic questioning of informants. But the interview must ensure flexibility in the sense that the respondents should be allowed to raise issues and questions which the investigator has not previously considered.
f. An experience survey may enable the researcher to define the problem more concisely and help in the formulation of the research hypothesis. This survey may as well provide information about the practical possibilities for doing different types of research.

The analysis of 'insight-stimulating' examples:

a. Analysis of 'insight-stimulating' examples is also a fruitful method for suggesting hypotheses for research.
b. It is particularly suitable in areas where there is little experience to serve as a guide.
c. This method consists of the intensive study of selected instances of the phenomenon in which one is interested.
d. For this purpose the existing records, if any, may be examined, the unstructured interviewing may take place, or some other approach may be adopted.

e. Attitude of the investigator, the intensity of the study and the ability of the researcher to draw together diverse information into a unified interpretation are the main features which make this method an appropriate procedure for evoking insights.

Thus, in an exploratory of formulative research study which merely leads to insights or hypotheses, whatever method or research design outlined above is adopted, the only thing essential is that it must continue to remain flexible so that many different facets of a problem may be considered as and when they arise and come to the notice of the researcher.

2. Research design in case of 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. Descriptive research uses a set of scientific methods and procedures to collect raw data and create data structures that describe the existing characteristics of a defined target population. For example, the profile of the consumers, pattern of purchase behaviour etc. In descriptive research design the researcher looks for answers to the how, who, what, when and where questions concerning the different components of a market structure. The data and information generated through the descriptive designs can provide the decision makers with evidence that can lead to a course of action.

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 cut definition of 'population' he wants to study. Since the aim is to obtain complete and accurate information in the said studies, the procedure to be used must be carefully planned. The research design must make enough provision for protection against bias and 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 following:

a. Formulating the objective of the study (what the study is about and why is it being made?)
b. Designing the methods of data collection (what techniques of gathering data will be adopted?)
c. Selecting the sample (how much material will be needed?)
d. Collecting the data (where can the required data be found and with what time period should the data be related?)
e. Processing and analysing the data.
f. Reporting the findings. In a descriptive/diagnostic study the first step is to specify the objectives with sufficient precision to ensure that the data collected are relevant.

If this is not done carefully, the study may not provide the desired information. Then comes the question of selecting the methods by which the data are to be obtained. In other words, techniques for collecting the information must be devised.

While designing data-collection procedure, adequate safeguards against bias and unreliability must be ensured. Whichever method is selected, questions must be well examined and be made unambiguous; interviewers must be instructed not to express their own opinion; observers must be trained so that they uniformly record a given item of behaviour.

It is always desirable to pre-test the data collection instruments before they are finally used for the study purposes. In other words, we can say that "structured instruments" are used in such studies. In most of the descriptive/diagnostic studies, the researcher takes out sample(s) and then wishes to make statements about the population on the basis of the sample analysis or analyses. More often than not, sample has to be designed.

Cross-sectional studies:

Cross sectional studies involves a slice of the population just as in scientific experiments one takes a cross-section of the leaf or the check cells to study the cell structure under microscope, similarly one takes a current subdivision of the population and studies the nature of the relevant variables being investigated. There are two essential characteristics of cross-sectional studies:

i. The cross – sectional study is carried out at a single movement in time and thus the applicability is more relevant for a specific period. For example, a cross – sectional study on the attitude of Chinese towards health, pre and post Coronavirus, was vastly different and a study done before Coronavirus would reveal a different attitude, while the study conducted post Coronavirus might show a different attitude.
ii. Secondly, these studies are carried out on a section of respondents from the population units under study (say, organizational employees, tourists, voters, consumers etc.). This sample is under consideration and under investigation only for the time coordinate of the study.

Longitudinal studies:

A single sample of the indentified population that is studied over a stretched period of time is termed as a longitudinal study design. A panel of consumers specifically chosen to study their grocery purchase pattern is an example of a longitudinal design. There are certain distinguishing features of the same:

a. The study involves the selection of a representative panel, or a group of individuals that typically represent the population under study.
b. The second feature involves the repeated measurement of the group over fixed intervals of time. This measurement is specifically made for the variables under study.
c. A distinguishing and mandatory feature of the design is that once the sample is selected, it needs to stay constant over the period of the study. That means the number of panel members has to be the same. Thus, in case a panel member due to some reason leaves the panel, it is critical to replace him/her with a representative member from the population under study.

Thus, the two descriptive designs basically differ in their temporal component and secondly on the stability of the sample unit selection over time. However, which one is selected depends upon the research objectives.

3. Research design in case of hypothesis-testing research studies:

Hypothesis-testing research studies (generally known as experimental 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.

4. Casual research design:

Casual research design deals with collecting raw data, creating data structures and information that will allow the decision maker or researcher to model cause-effect relationships between two or more market variables. The casual research design enables to identify, determine and explain the critical factors that affect the decision making. However, the research process is more complex, expensive and time-consuming.

For example, suppose a manufacturer has sold his product at two points of time t_1 and t_2. The sale in t_2 is much higher than that in the previous year. During the year, the firm also launched an advertising campaign for its product. The manufacturer is interested in knowing whether advertising has caused the increase in sales in the year t_2. The design of casual research is based on reasoning. It uses inductive logic for confirming or rejecting hypothesis with the help of further evidence.

3.5 FEATURES OF A GOOD RESEARCH DESIGN

1. Generally, the design which minimises bias and maximises the reliability of the data collected and analysed is considered a good design.
2. A god research design is often characterised by adjectives like flexible, appropriate, efficient, economical and so on.
3. The design which gives the smallest experimental error is supposed to be the best design in many investigations.

4. A design which yields maximal information and provides an opportunity for considering many different aspects of a problem is considered most appropriate and efficient design in respect of many research problems.
5. A good research design must consider the following factors to be appropriate for a particular research problem:
   a. the means of obtaining information;
   b. the availability and skills of the researcher and his staff, if any;
   c. the objective of the problem to be studied;
   d. the nature of the problem to be studied; and
   e. the availability of time and money for the research work.
6. In the case of exploratory or a formulative research studies, 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.
7. In the case of a descriptive research, where the accuracy becomes a major consideration, a research design which minimises bias and maximises the reliability of the evidence collected is considered a good design.
8. 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.
9. 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.
10. Research ethics are a critical part of formulating your research design.

Thus, the question of good design is related to the purpose or objective of the research problem and also with the nature of the problem to be studied.

3.5 SUMMAY

Research design is the way a research question and objectives are operationalised into a research project. The researh design process involves a series of decisions that need to combine into a coherent research project. Research design will be informed by your research philosophy. The focus of your research will be

exploratory, descriptive, casual or a combination of these. Research ethics play a critical part in formulating a research design. Establishing the quality of research is also a critical part of formulating a research design. Researchers from different research traditions have developed different criteria to judge and ensure the quality of research. Practical considerations will also affect research design, including the role of the researcher.

3.6 keywords

Design - A research design is a "Blue Print" for collection, measurement and analysis of data. It is the specification of methods and procedures for acquiring the information needed. It is the overall operational pattern or framework, of the project that stipulates what information is to be collected from which sources by what procedures.

Exploratory research - Exploratory research focuses on collecting data using an unstructured format or informal procedure to capture data and to interpret them.

Descriptive research studies - Descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual, or of a group.

Diagnostic research studies - Diagnostic research studies determine the frequency with which something occurs or its association with something else.

Cross – sectional studies - The cross – sectional study is carried out at a single movement in time and thus the applicability is more relevant for a specific period.

Longitudinal research studies - A single sample of the indentified population that is studied over a stretched period of time is termed as a longitudinal study design.

Casual Research - Casual research design deals with collecting raw data, creating data structures and information that will allow the decision maker or researcher to model cause-effect relationships between two or more market variables.

3. 7 SELF ASSESSENT QUESTIONS

Short Notes on

1. Essentials of good research design

2. Evaluation of research design

3. Research design in the case of Descriptive research studies

4. Cross sectional Vs. Longitudinal research studies.

Long Questions

1. Define research design. State the need and characteristics of a research design.

2. What are the different types of research design?

3.8 FURTHER READINGS

1. Raju S, Tamilselvi T A, Somu A, Vanithamani M R, Vidhya M, Thiyagu R and Rajendra Kumar R (2018), 'Business Research Methods (Text & Cases), Himalaya Publishing House, Mumbai.
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Lesson Writer:

Dr. G. Jyothi.

Lesson – 4

Sampling

4.0 Objectives

After studying this lesson, you should be able to:

- To clearly understand the role of the Sampling in research
- To learn the business environment affecting the managerial decisions

Structure

4.1 Introduction

Sample : Sample is a group of people, objects, or items that are taken from a larger population for measurement. The sample should be representative of the population to ensure that we can generalize the findings from the research sample to the population as a whole.

Sampling : Sampling means the process of selecting a part of the population. A population is a group people that are studied in a research. These are the members of a town, a city or a country. It is difficult for a researcher to study the whole population due to limited resources e.g. time, cost and energy. Hence, the researcher selects a part of the population for his study, rather than studying the whole population. This process is known as sampling. It makes the research activity manageable and convenient for the research. The reliability of the findings of a research depends upon

how well you select the sample. A sample should be a true representative of the whole population. It should include persons from various sections and spheres of the population in order to become a true representative of the population.

The terminologies relevant to sampling are as follows:

1. **Sample**: -The selected part of the population is known as a sample.
2. **Sample Size:-**The number of people in the selected sample is known as sample size.
3. **Sampling Frame**:-Sampling frame means the list of individual or people included in the same. It reflects who will be included in the sample. For making a sampling frame, the researcher has to make a list of names and details of all the items of the sample.
4. **Sampling Technique**:-It refers to the technique or procedure used to select the members of the sample. There are various types of sampling techniques.

4.2 Needs of sampling in Research Methodology

Sampling is used in practice for a variety of reasons such as:

- Sampling can save time and money. A sample study is usually less expensive than a census study and produces results at a relatively faster speed.
- Sampling may enable more accurate measurements for a sample study is generally conducted by trained and experienced investigators.
- Sampling remains the only way when population contains infinitely many members.
- Sampling remains the only choice when a test involves the destruction of the item under study.
- Sampling usually enables to estimate the sampling errors and, thus, assists in obtaining information concerning some characteristic of the population.

Importance of Sampling

- A sample saves money and timeto collect data
- More comprehensive data is obtained than in a census
- Less non response error
- Reliability of data
- Better motivation

Principles of Sampling

- Selection of sample must be systematic and objective manner
- Sample unit must be clearly define and easily identifiable
- Sample units must be independent of each other
- Same units of sample must be used throughout the study
- The selection process must be on sound criteria.
- It should avoid error,

4.4 Sampling plan

A sampling plan is used in research studies; it provides a detailed outline on the basis of which research is conducted. The Sampling plan is very useful to start the research process.

A sampling plan is a detailed outline of which measurements will be taken at what times, on which material, in what manner, and by whom. Sampling plans should be designed in such a way that the resulting data will contain a representative sample of the parameters of interest and allow for all questions, as stated in the goals, to be answered.

4.4 Steps in the sampling plan

The steps involved in developing a sampling plan are:

- Identify the parameters to be measured, the range of possible values, and the required resolution
- Design a sampling scheme that details how and when samples will be taken
- Select sample sizes
- Design data storage formats
- Assign roles and responsibilities

Verify and execute the Sampling plan - Once the sampling plan has been developed, it can be verified and then passed on to the responsible parties for execution.

The Sampling plan includes three major decisions, i.e. **Sampling Unit, Sampling size, Sampling Procedure.**

1. **Sampling unit** means to choose the category of the population to be surveyed is the first and the foremost decision in a sampling plan. It also initiates the entire research work.
2. **Size of the sample** means how many objects are taken in the sample is to be surveyed.
3. **Sampling procedure** means which type of sampling method is to be used to select the members in the population.

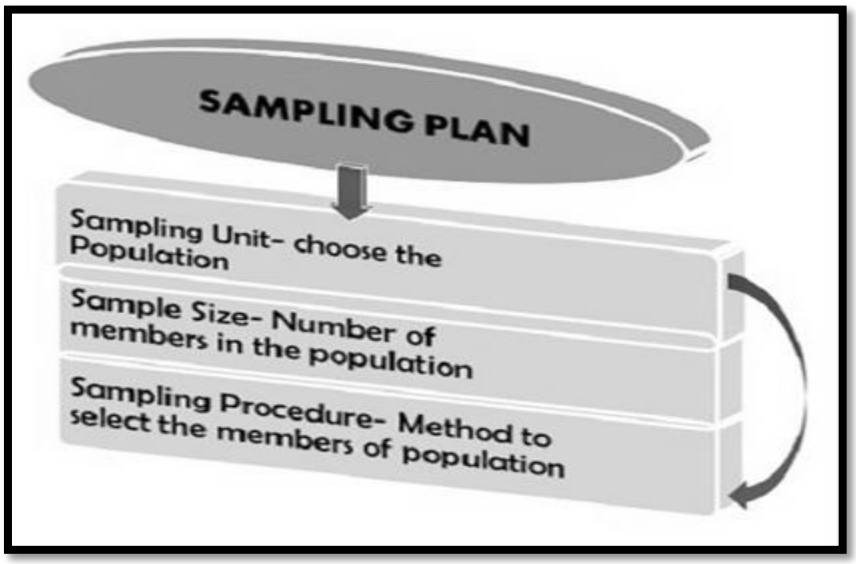

Fig 4.1 Sampling Plan

4.4 Sample Size

The sample size is a term used in market research for defining the number of subjects included in a sample size. By sample size, we understand a group of subjects that are selected from the general population and is considered a representative of the real population for that specific study. The Sample size is generally represented by the variable "n".

4.4 A) Sample Size Process

The sampling size process involves several specific activities, which are

1. Defining the population that is the object of the research;
2. Choosing the sampling size frame;
3. Choosing the sampling size method;
4. Establishing the modalities of the selection of the sample size units;
5. Determining the mother of the sample size;
6. Choosing the actual units of the sample size;
7. Conducting field activity.

Defining the target population must be done with great care to avoid either the tendency to choose an unjustified large population or the inclination to select an unjustifiably narrow population. In the random sampling, the sample will be chosen from a list of the population that often differs, to some extent, from the population that is the subject of the research. The establishment of the sample implies the establishment of the sampling unit. The sampling unit is represented by a distinct element or a group of different elements within the investigated population, which can be selected to form the sample. The sampling unit may be a person, a family, a household, a company or a company, a locality, etc. It is necessary to specify that the sampling unit is not always identical with the unit of analysis. For example, in the study of family expenses, the sampling unit may be the home or the household, and the unit of analysis may be a person or a family.

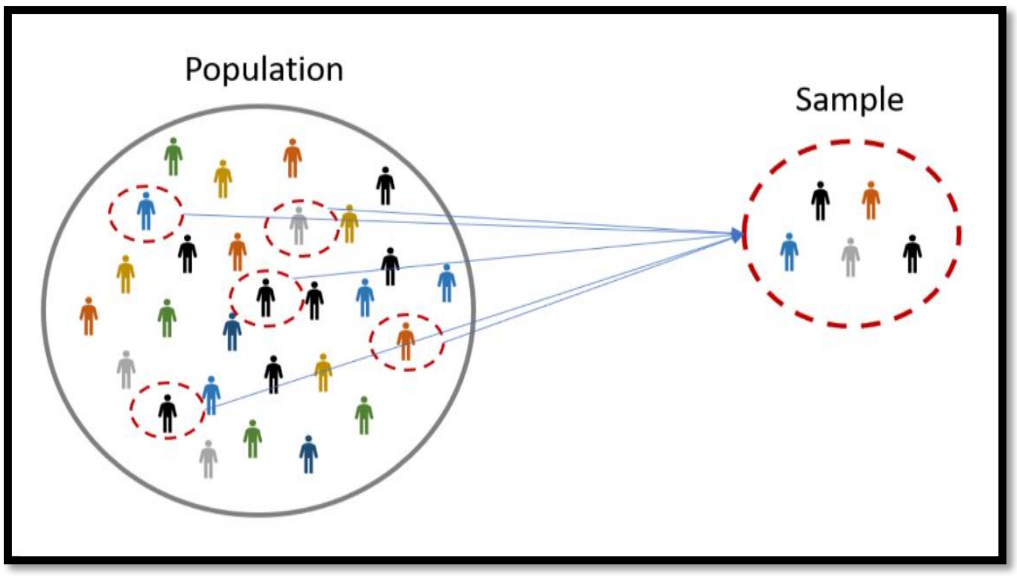

Fig 4.2 Sample Selection

Sample size formula

N = population size • e = Margin of error (percentage in decimal form) • z = z-scoreAnother sample size formula is: n = N*X / (X + N – 1),

where,X = Zα/22 *p*(1-p) / MOE2,And Zα/2 is the critical value of the Normal distribution at α/2 (for a confidence level of 94%, α is 0.04 and the critical value is 1.96), MOE is the margin of error, p is the sample proportion, and N is the population size. Note that a Finite Population Correction has been applied to the sample size formula.

4.6 Different types of Sampling Sizes

A. Random sample size

1. Identification and definition of the population
2. Determining sample size (descriptive research)
3. We make a list of all the members of the population.
4. A number is assigned to each listed.
5. There are tables with random numbers, and then a name from the tables with random numbers is randomly selected.
6. From the extracted number, all the numbers or how many numbers are required depending on the population from which we extract.
7. If we have imprisonment at the set number, we enter it in the table on the sample size list.
8. Go to the next number on the column.

   Variant: We choose the method of the ballot box if we do not agree with the process, that is, all the order numbers of the participants or their names are included in the ballot box, and we extract the number necessary for the preparation of the sample size.

B. Systematic sample size

It is established according to the type of research: descriptive, correlational

1. Identification and definition of the population.
2. Determining sample size (descriptive research). Ex. Suppose it is descriptive research, it turns out that 10% of the population = 400 people
3. We make a list with all the members of the population. Ex. The 4000 teachers are arranged in alphabetical order; already, the list is not randomly made up, but the procedure is valid.
4. Determine the parameter or step K = population size / sample size.Ex. K = 4000/400 = 10
5. It starts with a certain position at the beginning of the list. Ex. Suppose I put my finger on the 3rd name (using the list directly).
6. Starting with the chosen position, each K name is chosen. Ex. In our sample size: 3-13-23-33-etc.

C. Stratified sample size

1. Identification and definition of the population.
2. Determining the sample size (calculating sample size)

3. The variable and the subgroups are established, the layers for representing the representativeness (Equal number / Proportional number in each subgroup. Ex. The desired subgroups are established based on three levels of self-esteem: medium, high, low (age, level of training, male-female)
4. The members of the population are divided into one of the established subgroups. Ex.300 managers are classified according to the level of self-esteem: 44 high self-esteem, 224 average self-esteem, 40 low self-esteem.
5. By simply sampling (we use the table with numbering in disorder or drawing in lots). The number of participants from each subgroup (proportional number) is established

D. Multistage sample size

The selection of the participants who make up the sample size is made indirectly through the selection of the groups of which the participants are part.

1. Identification and definition of the population.
2. Determining sample size (Descriptive research)
3. Establish the logical type (Cluster)
4. The list containing the groups that make up the population is made
5. The population number for each group is estimated. (Cluster)
6. The number of groups is determined by dividing the sample size by the estimated size of the groups.
7. The number of groups is randomly selected through the table with random numbers or the ballot box.
8. All members of the selected groups are part of the sample size.

4.7 Keywords

Hypothesis : Guessing, assumption, tentative answer

Bias : Neutral, without favoring any side

Research question : The problem which need to study and solve.

Asserting : believe confidently

4.8 Self-Assessment Questions

1. What is meant by Sample?

2. Write a brief note on the Sampling Plan?
3. Briefly explain the process of Sampling?
4. Explain the different types of sampling sizes with suitable examples?

4.9 Further Readings

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3. Research Methodology: Concepts and Cases: Concepts & Casesby Deepak Chawla and Neena Sondhi, January 2016
4. Research Methodology by Dr Kirti Gupta, September 2013
5. Research Methodology by Panneerselvam R, January 2013

Lesson Writer:

K. Rajesh

Lesson – 5

Sampling Techniques/ Methods

5.0 Objectives

After studying this lesson, you should be able to:

- To know how to use sampling techniques in research
- To clearly understand the different types sampling techniques used in research

Structure

5.1 Sampling Techniques

A sampling technique is the identification of the specific process by which the entities of the sample have been selected. The Sampling technique uses randomization to make sure that every element of the population gets an equal chance to be part of the selected sample.

Sampling is a method that allows researchers to infer information about a population based on results from a subset of the population, without having to investigate every individual. Reducing the number of individuals in a study reduces the cost and workload, and may make it easier to obtain high quality information, but this has to be balanced against having a large enough sample size with enough power to detect a true association.

5.2 Types of Sampling Techniques

There are different types of sampling based on two factors viz., 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.

There are two major types of sampling i.e. Probability and Non-probability Sampling, which are further divided into sub-types as follows:

A. Probability Sampling

a) Simple Random Sampling
b) Stratified Random Sampling
c) Systematic Sampling
d) Cluster Sampling
e) Multi-stage Sampling

B. Non-Probability Sampling

a) Purposive Sampling
b) Convenience Sampling
c) Snow-ball Sampling
d) Quota Sampling

5.2 A) Probability Sampling

Probability sampling is a type of sampling where each member of the population has a known probability of being selected in the sample. When a population is highly homogeneous, its each member has a known chance of being selected in the sample. For example, if we want to pick some sugar from any part of a bag containing sugar, the selected part will have similar characteristics. In such a case, each member has a known chance of being selected in a sample.

Hence, the sample collected from any part of a bag containing sugar will be a true representative of the whole sugar. In such a situation, probability sampling is adopted. The extent of homogeneity of a population usually depends upon the nature of the research e.g. who are the target respondents of the research. For instance, you want to know community attitude towards a phenomenon. For such a study, the population serves as relatively a homogeneous group as every member of the population is the target respondents of the research.

Types of Probability Sampling

a) **Simple Random Sampling:** Insimple random sampling, the members of the sample are selected randomly and purely by chance. As every member has an equal chance of being selected in the sample, random selection of members does not affect the quality of the sample. Hence, the members are randomly selected without specifying any criteria for selection. Sometimes, the researcher may use a lottery system to select the members randomly. Simple random sampling is a suitable technique for a population which is highly homogeneous.

Advantages

- Easy to implement with random dialing
- Simplicity
- Requires little prior knowledge of the population

Disadvantages

- Lower accuracy
- Higher cost
- Lower efficiency
- Samples may be clustered spatially
- Samples may not be representative of the feature attribute(s)
- Time consuming
- Produces larger errors

b) **Stratified Random Sampling :** In stratified random sampling, first, the population is divided into sub-groups (known as strata) and then members from each sub-group are selected randomly. This technique is adopted when the population is not highly homogeneous. Hence, firs the population is divided into homogeneous sub-groups on the basis of similarities of the members. Then, members from each sub-group are randomly selected. The purpose is to address the issue of less homogeneity of the population and to make a true representative sample.

Advantages

- Control of sample size in strata
- Higher accuracy
- Increased statistical efficiency
- Provides data to represent and analyze subgroups

- Enables use of different methods in strata

Disadvantages

- Increased error if subgroups are selected at different rates
- Especially expensive if strata on population must be created
- The existing knowledge used to construct strata may be flawed.
- High cost

c) Systematic Sampling : In systematic sampling, a member occurring after a fixed interval is selected. The member occurring after fixed interval is known as K^{th} element. For instance, if a research wants to select member occurring after every ten members, the K^{th} element become 10th element. It means for selecting a sample from 100 members will be as follows:

Sample = (10, 20, 30, 40, 50, 50, 70, 80, 90,100)

As it follows a systematic technique for selecting members, it is called systematic sampling. The Kth element or fixed interval depends upon the size of the population and desired sample. For example, if we want to select a sample of 20 members of from the population of total 1000 member. We will divide total population over the desired sample e.g. 1000/50 = 50. It means we will select every 50th member from the population to make a sample of 20 members.

Advantages

- Simple to design
- Easier than simple random
- Easy to determine sampling distribution of mean or proportion
- Greater efficiency
- Moderate Cost

Disadvantages

- Periodicity within population may skew sample and results
- Trends in list may bias results
- Lower precision

d) Cluster Sampling : In cluster sampling, various segments of a population are treated as clusters and members from each cluster are selected randomly. Though it seems similar to stratified sampling but there is difference in both. In stratified sampling, the researcher divides the population into homogeneous sub-groups on the basis of similar characteristics e.g. age, sex, profession, religion and so on. On

the other hand, in cluster sampling, the does not divides the population into sub-groups or cluster but randomly select from already existing or naturally occurring sub-groups (clusters) of the population e.g. families within a society, towns within a district, and organizations within a city and so on. A researcher may treat each family within a community as a cluster. Similarly, a researcher may treat each town within a big district as a cluster. Unlike stratified sampling where the focus is on ensuring homogeneity, in cluster sampling the focus is on ensuring the convenience for a research study. Each cluster may be more or less homogeneous but the focus is on tactfully and conveniently studying the population in terms of clusters.

Advantages

- Provides an unbiased estimate of population parameters if properly done
- Economically more efficient than simple random
- Lowest cost per sample
- Easy to do without list
- Greater efficiency

Disadvantages

- Often lower statistical efficiency due to subgroups being homogeneous rather than heterogeneous
- Lower precision

e) Multi-stage sampling : Multi-stage sampling is a complex form of cluster sampling. In multi-stage sampling, each cluster of the sample is further divided into smaller clusters and members are selected from each smaller cluster randomly. It is called a multi-stage sampling as it involves many stages. First, naturally occurring groups in a population are selected as clusters, then each cluster is divided into smaller clusters and then from each smaller cluster members are selected randomly. Even the smaller cluster can be further divided into smallest cluster depending upon the nature of the research.

Advantages

- Greater efficiency
- Lower Cost

Disadvantages

- Lower precision

- Stronger clustering than simple random sampling

5.2 B) Non-Probability Sampling

Non-Probability sampling is a type of sampling where each member of the population does not have known probability of being selected in the sample. In this type of sampling, each member of the population does not get an equal chance of being selected in the sample. Non-probability sampling is adopted when each member of the population cannot be selected or the researcher deliberately wants to choose members selectively. For example, to study impacts of domestic violence on children, the researcher will not interview all the children but will interview only those children who are subjected to domestic violence. Hence, the members cannot be selected randomly. The researcher will use his judgment to select the members.

Types of Non probability sampling

a) **Purposive Sampling :** It is a type of sampling where the members for a sample are selected according to the purpose of the study. For example, if a researcher wants to study the impact of drugs abuse on health. Every member of the society is not the best respondent for this study. Only the drug addicts can be the best respondents for this study as they have undergone impacts of drug abuse on their health and they can provide the real data for this study. Hence, the researcher deliberately selects only the drug addicts as respondents for his study.

   Advantages

   - Ensures balance of group sizes when multiple groups are to be selected

   Disadvantages

   - Samples are not easily defensible as being representative of populations due to potential subjectivity of researcher

b) **Convenience Sampling :** It is a type of sampling where the members of the sample are selected on the basis of their convenient accessibility. Only those members are selected which are easily accessible to the researcher. For example, a research may visit a college or a university and get the questionnaires filled in by volunteer students. Similarly, a researcher may stand in a market and interview the volunteer persons. A convenience sampling is used when the universe is not clearly defined, Where sampling unit is not clear and When a complete source list is not available.

   Advantages

- Inexpensive way of ensuring sufficient numbers of a study

Disadvantages

- Can be highly unrepresentative

c) Snow-ball Sampling : Snow-ball sampling is also called chain sampling. It is a type of sampling where one respondent identifies other respondents (from his friends or relatives) the study. Snow-ball sampling is adopted in situations where it is difficult to identify the members of the sample. For example, a researcher wants to study 'problems faced by migrants in an area'. The researcher may not know enough number of migrants in the area to collect data from them. In such a case, the researcher may ask a migrant to help him locate other migrants to be interviewed. The respondents may tell the researcher about his other friends who are also migrants in the area. Similarly, the new respondents (identified by last respondent) may suggest some other new respondents. In this way, the sample goes on growing like a snow-ball. Research continues this method until the required sample-size is achieved.

Advantages

- Possible to include members of groups where no lists or identifiable clusters even exist (e.g., drug abusers, criminals)

Disadvantages

- No way of knowing whether the sample is representative of the population

d) Quota Sampling : In this type of sampling, the members are selected according to some specific characteristics chosen by the researcher. These specific characteristics serve as a quota for selection of members of the sample. Hence, the members are selected on the basis of these specific characteristics such as age, sex, religion, profession, ethnicity, interest and so on.

Advantages

- Quota sampling ensures convenience in executing sampling study.
- When the respondent refuses to cooperate, he may be replaced by another person who is ready to furnish information.
- Quota sampling is less expensive and speedy
- When the population has no suitable frame, quota sampling is the only practical method.

- Collection of data through Quota sampling method is not a time consuming one.

Disadvantages

- The interviewer interviews people who are easily available and accessible. So, the possibility of collecting valuable data is affected in Quota sampling.
- Bias arises in the matter of selection of sample units.
- The work of the interviewer cannot be supervised properly. So, there is no certainty of correctness of data.
- Quota sampling method requires several investigators. Each one cannot be equally competent. So, the results derived from the study may not be uniform.

5.3 Keywords

Sample : Subset of a larger population

Sampling : The process of using a small number of items or parts of larger population to make a conclusions about the whole population

Population : A population is the total collection of elements about which we wish to make some inferences

Census : A census is a count of all the elements in a population.

5.4 Self-Assessment Questions

1. What is meant by Sampling Techniques?
2. Explain the different types of sampling methods?

5.5 Further Readings

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2. Kothari, C.R, (2014), “Research Methodology- Methods and Technique”, New Age International Publishers, 3rd Edition, Chennai.
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Lesson Writer:

K. Rajesh.

Lesson – 6

Sampling Procedure, Sampling Design & Variables

6.0 Objectives

After studying this lesson, you should be able to:

- To learn the selecting a sampling procedure
- To clearly understand the Sampling Design & its steps
- To know the different Variables used in Research

Structure

6.1 Criteria for Selecting a Sampling Procedure

Two costs are involved in a sampling analysis, which governs the selection of a sampling procedure. They are:

1. The cost of data collection, and
2. The cost of drawing incorrect inference from the selected data.

The 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:

I. Inappropriate sampling frame

- If the sampling frame is inappropriate, i.e., a biased representation of the universe, it will result in systsxvbw2vcx2 RFSNY Gematic bias.

II. Defective measuring device

- If the measuring device is constantly making errors, it will result in systematic bias.
- In survey work, systematic bias can result if the questionnaire or the interviewer is biased.
- Similarly, if the physical measuring device is defective there will be a systematic bias in the data collected through such a measuring device.

III. 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.

IV. Indeterminacy principle

- Individuals act differently when kept under observations than what they do when kept in non-observed situations. This indeterminacy principle may also be a cause of systematic bias.

V. Natural bias in the reporting of data

- The Natural bias of respondents in the reporting of data is often the cause of a systematic bias in many queries.
- There is usually a downward bias in the income data collected by the government taxation department, whereas we find an upward bias in the income data collected by some social organizations.
- 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.
- Generally in psychological surveys, people tend to give what they think is the 'correct' answer rather than revealing their true feelings.

Sampling errors are the random variations in the sample estimates around the true population parameters. Since they occur randomly and are equally likely to be in

either direction, their nature happens to be of the compensatory type and the expected value of such errors happens to be equal to zero.

Sampling error decreases with the increase in the size of the sample, and it happens to be of smaller magnitude in the case of a homogeneous population.

- Sampling error can be measured for given sample design and size.
- The measurement of a sampling error is usually called the 'precision of the sampling plan'.
- If we increase the sample size, the precision can be improved.
- But increasing the size of the sample has its own limitations viz., a large-sized sample increases the cost of collecting data and also enhances the systematic bias.
- Thus the effective way to increase precision is usually to select a better sampling design which has a smaller sampling error for a given sample size at a given cost.
- In practice, however, people prefer a less precise design because it is easier to adopt the same and also because of the fact that systematic bias can be controlled in a better way in such a design.
- In brief, while selecting a sampling procedure, the researcher must ensure that the procedure causes a relatively small sampling error and helps to control the systematic bias in a better way.

6.2 Sampling Design

Sampling design is a mathematical function that gives you the probability of any given sample being drawn. A sample design is a definite plan for obtaining a sample from a given population. It refers to the technique or the procedure the researcher would adopt in selecting items for the sample.Sampledesign may as well lay down the number of items to be included in the sample i.e., the size of thesample. 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/prepare a sample design which should be reliable and appropriate for his research study.

6.3 **Steps in Sampling Design**

While developing a sampling design, the researcher must pay attention to the following points:

I. Type of Universe

- First step is to clearly define the 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 infinite universe, the number of items cannot be determined.
- Examples of finite universe – the population of the city, the number of workers in a factory etc.
- Examples of infinite universe – the number of stars in the sky, the listeners of a specific radio program, throwing of dice etc.

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 a social unit such as family, club, school etc., or an individual.
- The researcher will have to decide one or more of such units that he/she has to select for his/her 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 (in case of finite universe only).
- 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.
- The size of the sample should neither be excessively large, nor too small.

- It should be optimum – an optimum sample is one which fulfills the requirements of efficiency, representativeness, reliability and flexibility.
- The parameters of interest in a research study must be kept in view, while deciding the size of the sample that we can draw.
- Budgetary constraints also should be considered when we decide 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 characteristics in the population, or we may be interested in knowing some average or the measure concerning the population.
- There also may 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 on the type of sample.
- This fact can even lead to the use of a non-probability sample.

VII. Sampling Procedure

- The researcher must decide the type of sample he/she will use, i.e., he/she 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 a researcher must choose one for his/her sample study.
- He/she must select that design which, for a given sample size and for a given cost, has a smaller sampling error.

6.4 Characteristics of good sample design:

1. **Sample design should be a representative sample:** A researcher selects a relatively small number for a sample from an entire population. This sample needs

to closely match all the characteristics of the entire population. If the sample used in an experiment is a representative sample then it will help generalize the results from a small group to large universe being studied.

2. **Sample design should have small sampling error**: Sampling error is the error caused by taking a small sample instead of the whole population for study. Sampling error refers to the discrepancy that may result from judging all on the basis of a small number. Sampling error is reduced by selecting a large sample and by using efficient sample design and estimation strategies.
3. **Sample design should be economically viable**: Studies have a limited budget called the research budget. The sampling should be done in such a way that it is within the research budget and not too expensive to be replicated.
4. **Sample design should have marginal systematic bias:** Systematic bias results from errors in the sampling procedures which cannot be reduced or eliminated by increasing the sample size. The best bet for researchers is to detect the causes and correct them.
5. **Results obtained from the sample should be generalized and applicable to the whole universe:** The sampling design should be created keeping in mind that samples that it covers the whole universe of the study and is not limited to a part.

6.5 Variables in Research

Variable - Any characteristic which is subject to change and can have more than one value such as age, intelligence, motivation, gender, etc.Any factor that can change in a scientific investigation or experiment.

Different Variables used in Research

1. Dependent Variable
2. Independent Variable
3. Intervening/Mediating Variable
4. Extraneous Variable
5. Control/Constant Variable
6. Organismic Variable
7. Interval variable
8. Ratio variable

9. Nominal variable
10. Ordinal variable

1. **Dependent Variable** – The Dependent variable depends on other factors that are measured. These variables are expected to change as a result of experimental manipulation of the independent variable or variables. It is the presumed effect. The Dependent Variable is affected by the independent variable.
2. **Independent Variable –** The Independent variable is stable and unaffected by the other variables you are trying to measure. It refers to the condition of an experiment that is systematically manipulated by the investigator. It is the presumed cause. The Independent Variable is presumed to influence other variables.
3. **Intervening variable** – An intervening variable is a hypothetical variable used to explain causal links between other variables. Intervening variables link the independent and dependent variables, but as abstract processes, they are not directly observable during the experiment. In psychology, the intervening variable is sometimes called a mediator variable. In statistics, an intervening variable is usually considered to be a sub-type of the mediating variable.
4. **Extraneous variable** – The Extraneous variables are all variables, which are not the independent variable but could affect the results of the experiment. The researcher wants to make sure that it is the manipulation of the independent variable that has changed the changes in the dependent variable. Extraneous variables are dangerous. They may damage a study's validity, making it impossible to know whether the effects were caused by the independent and moderator variables or some extraneous factors. If they cannot be controlled, extraneous variables must at least be taken into consideration when interpreting results.
5. **Controlled variable** – A Controlled variable is one which the researcher holds constant during an experiment. It is also known as a controlled variable are called as a “Constant Variables”. The control variable is not part of an experiment itself and it is neither the independent nor dependent variable, but it is important because it can have an effect on the results. It is not possible to consider every variable in a single study. Therefore, the variables that are not measured in a

particular study must be held constant, neutralized/balanced, or eliminated, so they will not have a biasing effect on the other variables. Variables that have been controlled in this way are called control variables.

6. **Organismic Variable** – The Organismic Variable of any characteristic of the research participant understudy that can be used for classification Such as personal characteristics of gender, height, weight, age, etc. in behavioral sciences.
7. **Interval Variable** – The Interval variables have a numerical value. They allow not only to rank order the items that are measured but also to quantify and compare the magnitudes of differences between them. Interval variables have the property that differences in the numbers represent real differences in the variable. Another way to say this is that equal differences in the numbers on the scale represent equal differences in the underlying variables being measured.
8. **Ratio variable** – Ratio variables have all the properties of interval variables plus a real absolute zero. That is, value of zero represents the total absence of the variable being measured. Examples of ratio variables are length measures in the metric systems, time measures in seconds, minutes, hours, etc., blood pressure measured in millimeters of mercury, age, and common measures of mass, weight, and volume.
9. **Nominal variable** – The Nominal variables comes from name and that is all you can do with variables measured on nominal scales. They can be measured only in terms of whether the individual items i.e. that are Sex (male, female), Race (Black, Hispanic, Oriental, White, Other), Political Party (Democrat, Republican, Other), Blood Type (A, B, AB, O), and Pregnancy Status (Pregnant, Not Pregnant).
10. **Ordinal variable –** An ordinal variable is a categorical variable for which the possible values are ordered. Ordinal variables can be considered “in-between” categorical and quantitative variables. They can be measured the higher and lower amounts. The Examples of Ordinal values are 1 = Very low, 2 = Low, 3 = Medium, 4 = Great, 5 = Very great.

6.6 Keyword

Sample Design - A sample design is the framework, or road map, that serves as the basis for the selection of a survey sample and affects many other important aspects of a survey.

Good research – Good Research is research that can influence the human condition whether in society at large or individual organizations

Population – A population is the total collection of elements about which we wish to make some inferences.

6.6 Self-Assessment Questions

1. Explain the steps of sampling design?
2. Briefly discuss the different variables used in research?
3. Explain the characteristics of a good sample design?

6.8 Further Readings

1. Sampling: Design and Analysis (Advanced Series) Hardcover – by Sharon L. Lohr, Feb 2009
2. Sampling Designs Dependent on Sample Parameters of Auxiliary Variables (SpringerBriefs in Statistics) by Janusz L. Wywiał, June 2015
3. Sample Design in Business Research (Wiley Series in Probability and Statistics – Applied Probability and Statistics Section) by W. Edwards Deming, January 1966

Lesson Writer:

K. Rajesh

INTRODUCTION OF SCALES

1.0 OBJECTIVES

. To understand the meaning of scales

.Aims and Objectives

. To understand the need and
importance of scales

STRUCTURE

7.1 Meaning of Scale

Scales of measurement in research and statistics are the different ways in which variables are defined and grouped into different categories. Sometimes called the level of measurement, it describes the nature of the values assigned to the variables in a dataset.

The term scale of measurement is derived from two keywords in statistics, namely; measurement and scale. Measurement is the process of recording observations collected as part of aresearch.

Scaling, on the other hand, is the assignment of objects to numbers or semantics. These two words merged together refers to the relationship among the assigned objects and the recorded observations.

What is a Measurement Scale?

A measurement scale is used to qualify or quantify data variables in statistics. It determines the kind of techniques to be used for statistical analysis.

There are different kinds of measurement scales, and the type of data being collected determines the kind of measurement scale to be used for statistical measurement. These measurement scales are four in number, namely; nominal scale,ordinal scale,interval scale, and ratioscale.

The measurement scales are used to measure qualitative and quantitative data. With nominal and ordinalscale being used to measure qualitative data while interval and ratio scales are used to measure quantitative data.

Characteristics of a Measurement Scale

Identity

Identity refers to the assignment of numbers to the values of each variable in a data set. Consider a questionnaire that asks for a respondent's gender with the options Male and Female for instance. The values 1 and 2 can be assigned to Male and Female respectively.

Arithmetic operations can not be performed on these values because they are just for identification purposes. This is a characteristic of a nominal scale.

Magnitude

The magnitude is the size of a measurement scale, where numbers (the identity) have an inherent order from least to highest. They are usually represented on the scale in ascending or descending order. The position in a race, for example, is arranged from the 1st, 2nd, 3rd to the least.

This example is measured on an ordinal scale because it has both identity and magnitude.

Equal intervals

Equal Intervals means that the scale has a standardized order. I.e., the difference between each level on the scale is the same. This is not the case for the ordinal scale example highlighted above.

Each position does not have an equal interval difference. In a race, the 1st position may complete the race in 20 secs, 2nd position in 20.7 seconds while the 3rd in 30 seconds.

A variable that has an identity, magnitude, and the equal interval is measured on an interval scale.

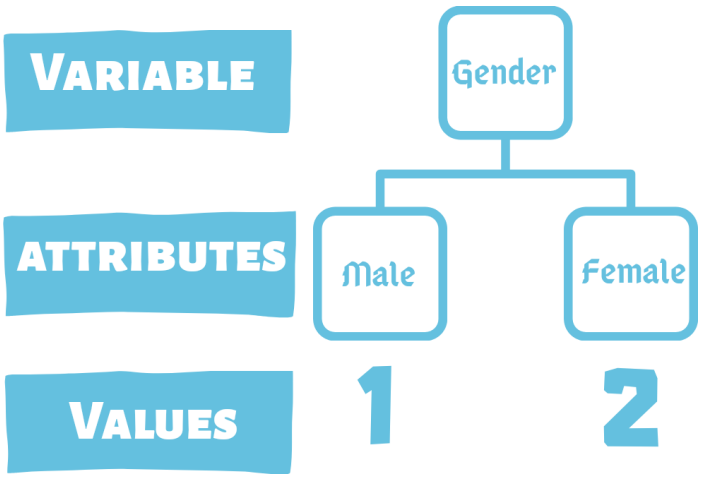
Absolute zero

Absolue zero is a feature that is unique to a ratio scale. It means that there is an existence of zero on the scale, and is defined by the absence of the variable being measured (e.g. no qualification, no money, does not identify as any gender, etc.

Levels of Data Measurement

The level of measurement of a given data set is determined by the relationship between the values assigned to the attributes of a data variable. For example, the relationship between the values (1 and

2) assigned to the attributes (male and female) of the variable (Gender) is "identity". This via. a nominal scale example.



By knowing the different levels of data measurement, researchers are able to choose the best method for statistical analysis. The different levels of data measurement are: nominal, ordinal, interval and ratio scales

7.2Aims and Objectives

Objective of Research in Research Methodology

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 broadgroupings:

Aims and Objectives of Research Methodology

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

7.2 Need and Importance ofscale

Measure is important in research. Measure aims to ascertain the dimension, quantity, or capacity of the behaviors or events that researchers want to explore. According to Maxim (1999), measurement is a process of mapping empirical phenomena with using system of numbers.

Basically, the events or phenomena that researchers interested can be existed as domain. Measurement links the events in domain to events in another space which called range (Figure 1). In another words, researchers can measure certain events in certain range. The range is consisting of scale. Thus, researchers can interpret the data with quantitative conclusion which leads to more accurate and standardized outcomes. Without measure, researchers can't interpret the data accurately and systematically.

Quantitative Measurements

Quantitative Measurement is a quantitative description of the events or characteristics which involves numerical measurement. For example, the description made as "There are three birds in the nest". This description includes the numerical measurement on the birds. Quantitative measurement enables researchers to make comparison between the events or characteristics. For example, researchers tend to know who the tallest person in a family is. So, they use centimeter to measure their height and make comparison between all the familymembers.

Levels of Measurement

Level of measurement refers to the amount of information that the variable provides about the phenomenon being measured (McClendon, 2004). For all variables, they should include exhaustive attributes and mutually exclusive attributes. These two attributes are related to the accuracy and precious measurement in a study.

Exhaustive and mutually exclusive attributes. For the exhaustive attributes, it assign a full range of attributes which possessed by all of the subjects (people) in the study. It enables all of the subjects in study can answer their preferred answer in each question. For instance, a question ask the marital status to all subjects in a study with four options, which are (a)married; (b)divorced; (c)widowed; and (d)never been married. However, subject who is in the legally separated status unable to choose the options that provided by researchers. Thus, this question is not applying the exhaustive attributes. The categories are not exhaustive may lead to missing data in the study and lastly affect the outcomes of thestudy.

For mutually exclusive attributes, it stated that researchers should assign only one attribute for each person in a study. For example, a question asked how much of the monthly income of each subjects in the study with four options, which are (a) RM0-RM500; (b) RM500-RM1000; (c) RM1000- RM1500; and (d) RM1500-RM2000. The four options in above is not mutually exclusive because each category contains the same income with another category. Subjects who have monthly income with RM1000 may feel confuse to choose option (a) or (b).

Nominal measurement. There are four levels of measurement, which are nominal, ordinal, interval, and ratio measurement. Nominal measurement is a process of assigning numerals to categories. In another words, nominal is in name or form only (McClendon, 2004). Researchers can't describe and differ the cases or events with using the adjective such as higher than, lower than, more than, less than, and others. So, it is the lowest level in measurement. Percentages, central tendency, chi square are appropriate used in this level of measurement.

One of an experiment in Social Psychology which conducted by Stanley Schachter

in year of 1957 aimed to measure the affiliation when people feel worry toward a situation. Experimenter told all subjects that they will assigned into two situations which are intense electrical shock and mild electrical. Then, experimenter asked whether they prefer to wait together with others or enter the room alone, and which situation that they prefer to engage in. The result showed that, subjects in intense electrical shock group prefer to wait together with others and there are no preferences in the subjects who in mild electrical shock group. Experimenter measure the reactions of subjects with using the nominal measurement, which were (1) prefer mild shock; (2) prefer intense shock; (3) prefer wait together with other and, (4) no preferences to wait together with others. The conclusion made by the experimenter was depending on the nominal measurement.

Ordinal measurement. Ordinal measurement permits researchers to make comparisons like “greater than”; “less than”, “higher than”, and “lower than” but not “how much” (McClendon, 2004). For example, researchers can make a comparison according to one of the example in table 1 as people who strongly agree with legalize abortion is higher than people who disagree with it.

Besides that, attributes also be rank-ordered. The academic rank if students such as freshman, junior, and senior is an example in this measurement. We can’t use arithmetic operations in this level of measurement because the distances or intervals between the attributes are unknown.

Some process involved in this level of measurement such as precedence or preference (Maxim, 1999). aPb, bPc, and aPc indicates that a precedes b, b precedes c, and a precedes c. These processes involve the measurement such as “greater than”, “higher than”, and other. For example, four students’ result ranking make by using their marks, they are 97, 71, 79, and 70. If 97 as “a”, 71 as “b”, 79 as “c”, and 70 as “d”, we can make a conclusion that aPb, aPc, aPd, bPc, bPd, and cPd.

Interval measurement. Characteristics of this level of measurement are the attributes are ordered and the distances between attributes are equal. However, it doesn’t have true zero point. The Fahrenheit and Celsius temperature scales always used as examples in this level of measurement. Fahrenheit and Celsius temperature scales don’t have true zero point because the zero temperature does not mean “notemperature”.

In this level of measurement, researchers can make a description that 40-50 degree is same as 70-90 degree because it has equal distances between the categories. However, they can't make a description like 70 degree is twice as 40 degree because it doesn't have true zero point. Forexample, researchers can't say that temperature in city A is twice hot than city B. As the Table 1 showed, 70 degree in Fahrenheit actually is same as 27 degree in Centigrade, and 40 degree in Fahrenheit Degree is same as 4 degree in Centigrade, and 27degree is not twice of 4degree.

Conceptualization and Operationalization in Measurement

Conceptualization is a process of specifying a term or concept that researchers want to measure. In Deductive research, it helps researchers to specify the theory and come out with a specific variable that can place in a hypothesis. For the Inductive research, it helps researchers to have an idea about what related behaviors or events that need to be observed.

For example, researchers tend to measure the influences of social status towards academic performances among adolescents. At first, researchers should define what "social status" is. In conceptualization aspect, social status can be defined as power, prestige, and privilege. Another example is deviant behavior. Researchers tend to study the relationship of deviant behavior and academic performance. At the first, researchers have to understand the meaning of deviant behavior is. Thus, they defined it as the behavior of smoking, fighting, underage drinking, and threatening. At here, a concept will defined without using any quantitative methods.

Operationalization defined as a process of defining a concept by measure it (Maxim,1999). Operationalization is specifying that how a concept in a research be measured. Scoring, coding, and scaling may used in operationalization measure of concept. For example, researchers tend to study the relationship between students happiness and school performances. School performances can include some performances such as students' examination results, on-time submission of assignment, and attendance. In the study, researchers aim to focus on these three performances. So, they start to make operationalization towardsit.

They plan to measure students' examination result by using the Cumulative of Grade Point Average (CGPA) and they assume that high happiness may have high CGPA in school. Then, they measure "on-time submission of assignment" by using frequency as how many times that they have submitted assignment on-time in a month and assume that high level of happiness may have high frequency of on-time submission assignment. Lastly, they measure students' attendance depends on the percentage they have attended to class in a month and assume that high level of happiness may have high percentage to attend class in amonth.

Difference between Conceptualization and Operationalization in Measurement

Conceptualization is a process of defining the concept without operates any quantitative methods or others methods that can indicates the values of a variable. Conceptualization only can make researchers and population understand what does a term or concept means. For operationalization, it define a term or a concept and also operates some methods especially the methods involve quantitative to indicate the values of a variable.

Indexes and Scales

Indexes and scales are measuring instruments or devices. Both of them used to measure variables or concept that researchers interested. Scale is a cluster of items that arranged into a unitary dimension or single domain of behavior, attitudes, and feelings. Scales are more specific than indexes do. Scales can predict outcomes such as behavior, attitudes, and feelings because it measures the underlying traits. For example, a scale tends to measure more specific variable such as Introversion. Thus, Introversion scale should consist of the items that related to Introversion only. The items in Scale used to measuring Introversion such as 1) I blush easily; 2) At parties, I tend to be a wallflower; 3) Staying home every night is all right with me; 4.I prefer small gatherings to large gatherings, and 5) When the phone rings, I usually let it ring at least a couple of times. Likert scale such as "Strongly Agreeâ€¦â€¦Strongly Disagree" will used. For another example, Hare Self-Esteem Scale includes three specific sub-scales which are Peer Self-Esteem Scale, Home Self-Esteem Scale, and School Self-Esteem Scale. These three sub-scales are used to measure the concept of self- esteem.

For indexes, it is a set of items that consist multiple aspects of dimensions which are

interrelated. These entire dimensions will be made into single indicator or score. Index is more general than scales. It is also designed for exploring the relevant causes or underlying symptoms of traits. Indexes tend to measure a concept depends on what happens in the real world.

An index tends to measure life satisfaction of college students. Due to the reason that life satisfaction may consist a lot of dimensions or categories, the index should includes items related to all categories. For example, life satisfaction should include satisfaction of career, satisfaction of family relationship, satisfaction of peer relationship, and satisfaction of marital relationship. Researchers total up the scores of all items and the scores will reflex the level oflife-satisfaction.

Reliability and Validity

Reliability is important because it enables researchers to have some confidence that the measure they taken are close to the true measure. Validity is important because it tell researchers that the measure they taken is actually measures what they hope it does. So, if researchers want to know how good the measurement is, they should depend on the reliability and validity of ameasurement.

Reliability is synonym of repeatability and consistency. Reliability defined as the degree to which test scores are free from errors of measurement (AERA et al., 1999, p.170 in Neukrug & Fawcett, 2006). The degree of reliability can decide whether the scores or data that researchers obtained can be relied to measure a variable or construct.

Measurement error. An unreliable measurement is caused by error source of variability. There are two types of error which are Systematic Measurement Error and Unsystematic Measurement Error. Systematic measurement error is the factors that affect measurement systematically across the time. It is predictable and can be eliminated if it gets identified. It is also related to validity of a measurement. Systematic measurement error arises when researchers unknown to the test developer and a test measure something others than the trait that researchers tend to measure. These may seriously influence the validity of atest.

Unsystematic measurement error is the effects or errors that unpredictable and inconsistent. It is related to reliability of a measurement. Item selection, test

administration, and test scoring are examples of unsystematic measurement error.

Item selection means that error happened in the instrument itself. The example of this error such as instrument which includes not valid questions or items, contents can't fair to all respondents even though it is already considered as good, and there are too many items inside the test. Test administration error includes uncomfortable room, dim lighting, noise in room, fatigue, nervous, and others which may influence respondents' performances. For the test scoring error, it happened when the format of test not using machine-score multiple-choice items. Subjective judgment in scoring occurred especially for the projective test and essay questions. Rorschah Inkblot Test, Sentence Completion Test, and Thematic Apperception Test are related to subjective judgment.

Types of reliability. There are two major types of reliability which are Reliability as Temporal Stability and Reliability as Internal Consistency. Reliability as Temporal Stability is related to the times to collect data. Reliability as Temporal Stability includes Test-retest and Alternate-forms Reliability. Internal Consistency includes Split-half, Coefficient Alpha, and Interscorer Reliability.

Test-retest reliability defined as the relationship between scores from one test given at two different administrations (Neukrug & Fawcett, 2006). Alternate-forms Reliability is the relationship between the scores from two version of same test. In this type of reliability, everything in the different version test such as the difficulty level, number of items, and content should be same. Split-half reliability defined as correlating one-half of the test to the other half. Researchers can divide the test into two parts which are first half and second half. They also can divide the items by odd numbers and even numbers of the items. Spearman-Brown used when the numbers of items in test is short. Spearman-Brown is more accurate when the numbers of items isfew.

Coefficient Alpha and Kuder Richardson determined by correlating the scores of each item with total scores on the test. Kuder Richardson used when the items need to be answered by "yes" and "no". Interscorer Reliability defined as correlating the scores from two or more observers' rating to the same phenomenon. Observers should be trained to rating on the events or behaviors of respondents.

Test-retest is appropriate be used when researchers aim to measure the behaviors of

respondents across times. Coefficient Alpha is appropriate to be used in both unidimensionality tests. Split the test by odd and even numbers is appropriate to be used when the difficulties of items have carefully ordered. If the difficulties level of items is not carefully orders, the method of split the test to first half and second half is appropriate. Interscorer reliability used when the test involves subjectivity of scoring.

Validity refers to an accuracy of a measure. A measurement is valid when it measures what the researchers suppose to measure (Gregory, 2007). For example, IQ tests are supposed to measure intelligence and depression tests are supposed to measure depression level or symptoms of respondents. Normally, the inferences drawn from a valid test are appropriate, meaningful, and useful.

Types of validity. There are three types of validity which are Content Validity, Criterion Validity, and Construct Validity. For the Criterion Validity, it includes Predictive Validity and Concurrent Validity. For the Construct Validity, it includes Convergent and Discriminant Validity.

Content validity determined by the degree to which the questions, tasks, or items on a test are representative of the universe of behavior the test was designed to sample (Gregory, 2007). The appropriateness of content of a measurement is determined by experts. Researchers make a judgment on whether the items in a measurement have covered all domains that they want to measure. For example, teacher would like to develop a test which tends to measure the understanding of students toward a subject from chapter 1 to 5. The type and number of questions are designed. Sixty multiple-choices questions and 60 minutes are given to the students to do the test. Ten questions will cover each chapter and the rest questions will cover chapter five which considered as the most important chapter in thetest.

Validity of content also can be made by the experts' rating towards each item to decide whether the items can indicate the content or not. Two experts evaluate each item on the four-point scale. The rating of each expert on each item can be dichotomized into weak relevance of content (rating of 1 and 2) and strong relevance of content (rating of 3 and 4). If both experts agree that the item is strongly relevance, then the item will be put in cell D; if both experts agree that the item has weak relevance, the item will be put in cell A. Cell B and C involved the items that

agreed by one expert and disagreed by another expert (Figure 2).

For the Criterion validity, both Predictive and Concurrent validity will made by comparing them with others criterion. Concurrent validity correlates test scores with criterion scores and these two types of scores are obtained in the same time. For example, researchers would like to measure the reading ability of students by using the Reading Achievement Test. Researchers compare the Reading Achievement Test scores of students with the teachers' rating scores on students' reading abilities. High correlation between the two scores indicates that there is high concurrent validity in the test.

For the Predictive validity, it correlates test scores with criterion scores which obtained in the future. It means that the scores or data are obtained in different time. For example, Employment Test used to measure the performances of employee in a company or organization. At first, researchers give the test to employee and after six months, the supervisors asked to give evaluation to the performances of employee. Then, researchers compare the test scores and supervisors' rating scores to see the level of validity. The difference between Concurrent and Predictive validity is the time frame used to obtain the data and scores.

For Construct validity, construct is a theoretical, intangible quality or trait in which individuals differ. It is abstract and hard to be measured. Thus, it needs some indicators or signs to represent it. A construct is a collection of related behaviors that can represent the things that researcher want to measure. Construct validity is evidence that an idea or concept is being measured by a test (Neukrug & Fawcett,2006).

For example, depression is a construct and it manifested by some behaviors such as lethargy, difficulty concentrate and loss of appetite. Homogeneity refers to a test measure a single construct. Homogeneous refers to the single component or subtest in a Homogeneity test. The purpose of homogeneity is selecting items which potential to form a homogeneous scale.

Convergent validity defined as a test highly correlates with other variables which have same or overlap constructs. For example, researchers would like to take the Beck Depression Inventory-II (BDI-II) to compare with others tests which have same variables as well. The result shows that, BDI-

IIhashighcorrelationwithScaleforSuicideIdeation(r=.37);BeckHopelessnessScale(r= .67); amiltonPsychiatricRatingScaleforDepression(r=.71);andHamiltonRatingScalefor Anxiety (r =.47). Lastly, for the Discriminant validity, it means that a test does not correlate with the variables or test which are not measure the different variables or constructs.

.Relationship between Reliability and Validity

A good validity need to have good reliability established first. However, a good reliability does not lead to a good validity. A good reliability only reflex that the scores in a measurement is appeared consistently.

A good validity may leads to reliability. When the measurement or test tends to measure what researchers tend to measure, the validity occurred and thus the reliability occurred also. In a test, reliability is necessary but not sufficient for validity. In other words, measure can be reliable but not valid; valid measures must be reliable, however.

Conclusion: As stated above, many measures (ie. personality, intelligence, psycho- social, etc.) within the behavioral and social sciences represent ordinal data. IQ scores may be computed for a group of individuals. They will represent differences between individuals and the direction of those differences but they lack the property of indicating the amount of the differences. Psychologists have no way of truly measuring and quantifying intelligence. An individual with an IQ of 70 does not have exactly half of the intelligence of an individual with an IQ of 140. Therefore, IQ scales should theoretically be treated as ordinal data. In both of the above illustrations, the statement is make that they should be theoretically treated as ordinal data. In practice, however, they are usually treated as if they represent parametric (interval or ratio) data. This opens up the possibility for use of parametric statistical techniques with these data and the benefits associated with the use oftechniques.

7.4 Keyword

Measurement scale : A measurement scale is used to qualify or quantify data variables in statistics. It determines the kind of techniques to be used for statistical

analysis.

Aims: a purpose or intention; a desired outcome.

Objectives: a thing aimed at or sought; a goal.

Validity refers to an accuracy of a measure

7.5 Self assessment Questions

1.What do you mean by Scale?

2.Write the need and Importance ofscales?

3.What are the levels of Measurement?

4.Write a short note on Reliability and Validity?

7.6 Further Readings

1.A..L. Edwards and K.C. Kenney, "A comparison of the Thurstone and Likert techniques of attitude scale construction", *Journal of Applied Psychology*, 30, 72–73, 1946.

2.John W. Best and James V. Kahn, "Research in Education", 5 ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 1976, p.173.

3.H. Odum, *An Introduction to Social Research,* p. 229.

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Lesson Writer:

K. N. Lokesh Kumar.

LESSON 8

Classification of Scales

OBJECTIVES

To understand the classification of scales

To understand the measuring ofvariables

To discuss the different types of scaling techniques

STRUCTURE

8.1MEASUREMENT SCALES

From what has been stated above, we can write that scales of measurement can be considered in terms of their mathematical properties. The most widely used classification of measurement scales are: (a) nominal scale; (b) ordinal scale; (c) interval scale; and (d) ratio scale.

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

players and come up with a meaningful value. Neither can one usefully compare the numbers assigned to one group with the numbers assigned to another. The counting of members in each group is the only possible arithmetic operation when a nominal scale is employed. Accordingly, we are restricted to use mode as themeasureofcentral tendency. Thereisnogenerallyused measure of dispersion for nominal scales. Chi-square test is the most common test of statistical significance that can be utilized, and for the measures of correlation, the contingency coefficient can be worked out.

Nominal scale is the least powerful level of measurement. It indicates no order or distance relationship and has no arithmetic origin. A nominal scale simply describes differences between things by assigning them to categories. Nominal data are, thus, counted data. The scale wastes any information that we may have about varying degrees of attitude, skills, understandings, etc. In spite of all this, nominal scales are still very useful and are widely used in surveys and other *ex-post-facto* research when data are being classified by major sub-groups of the population.

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

b) Thus, the use of an ordinal scale implies a statement of 'greater than' or 'less than' (an equality statement is also acceptable) without our being able to state how much greater or less. The real difference between ranks 1 and 2 may be more or less than the difference between ranks 5 and 6. Since the numbers of this scale have only a rank meaning, the appropriate measure of central tendency is the median. A percentile or quartile measure is used for measuring dispersion. Correlations are restricted to

various rank order methods. Measures of statistical significance are restricted to the non- parametricmethods.

c) Interval scale: In the case of interval scale, the intervals are adjusted in terms of some rule that has been established as a basis for making the units equal. The units are equal only in so far as one accepts the assumptions on which the rule is based. Interval scales can have an arbitrary zero, but it is not possible to determine for them what may be called an absolute zero or the unique origin. The primary limitation of the interval scale is the lack of a true zero; it does not have the capacity to measure the complete absence of a trait or characteristic. The Fahrenheit scale is an example of an interval scale and shows similarities in what one can and cannot do with it. One can say that an increase in temperature from 30° to 40° involves the same increase in temperature as an increase from 60° to 70°, but one cannot say that the temperature of 60° is twice as warm as the temperature of 30° because both numbers are dependent on the fact that the zero on the scale is set arbitrarily at the temperature of the freezing point of water. The ratio of the two temperatures, 30° and 60°, means nothing because zero is an arbitrarypoint.

Interval scales provide more powerful measurement than ordinal scales for interval scale also incorporates the concept of equality of interval. As such more powerful statistical measures can be used with interval scales. Mean is the appropriate measure of central tendency, while standard deviation is the most widely used measure of dispersion. Product moment correlation techniques are appropriate and the generally used tests for statistical significance are the 't' test and 'F'test.

(d) Ratio scale: Ratio scales have an absolute or true zero of measurement. The term 'absolute zero' is not as precise as it was once believed to be. We can conceive of an absolute zero of length and similarly we can conceive of an absolute zero of time. For example, the zero point on a centimeter scale indicates the complete absence of length or height. But an absolute zero of temperature is theoretically unobtainable and it remains a concept existing only in the scientist's mind. The number of minor traffic-rule violations and the number of incorrect letters in a page of type script represent scores on ratio scales. Both these scales have absolute zeros and as such all minor traffic violations and all typing errors can be assumed to be equal in significance. With ratio scales involved one can make statements like "Jyoti's" typing performance

was twice as good as that of "Reetu." The ratio involved does have significance and facilitates a kind of comparison which is not possible in case of an intervalscale.

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

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

8.2 Scale Classification Bases

The number assigning procedures or the scaling procedures may be broadly classified on one or more of the following bases: (a) subject orientation; (b) response form; (c) degree of subjectivity; (d) scale properties; (e) number of dimensions and (f) scale construction techniques. We take up each of these separately.

a) Subject orientation: Under it a scale may be designed to measure characteristics of the respondent who completes it or to judge the stimulus object which is presented to the respondent. In respect of the former, we presume that the stimuli presented are sufficiently homogeneous so that the between-stimuli variation is small as compared to the variation among respondents. In the latter approach, we ask the respondent to judge some specific object in terms of one or more dimensions and we presume that the between-respondent variation will be small as compared to the variation among the different stimuli presented to respondents for judging.

b) Response form: Under this we may classify the scales as categorical and comparative. Categorical scales are also known as rating scales. These scales are used when a respondent scores some object without direct reference to other objects. Under comparative scales, which are also known as ranking scales, the respondent is

asked to compare two or more objects. In this sense the respondent may state that one object is superior to the other or that three models of pen rank in order 1, 2 and 3. The essence of ranking is, in fact, a relative comparison of a certain property of two or moreobjects.

c) Degree of subjectivity: With this basis the scale data may be based on whether we measure subjective personal preferences or simply make non-preference judgements. In the former case, the respondent is asked to choose which person he favours or which solution he would like to see employed, whereas in the latter case he is simply asked to judge which person is more effective in some aspect or which solution will take fewer resources without reflecting any personalpreference.

d) Scale properties: Considering scale properties, one may classify the scales as nominal, ordinal, interval and ratio scales. Nominal scales merely classify without indicating order, distance or unique origin. Ordinal scales indicate magnitude relationships of 'more than' or 'less than', but indicate no distance or unique origin. Interval scales have both order and distance values, but no unique origin. Ratio scales possess all thesefeatures.

e) **Number of dimensions:** In respect of this basis, scales can be classified as 'unidimensional' and 'multidimensional' scales. Under the former we measure only one attribute of the respondent or object, whereas multidimensional scaling recognizes that an object might be described better by using the concept of an attribute space of 'n' dimensions, rather than a single-dimensioncontinuum.

f) Scale construction techniques: Following are the five main techniques by which scales can bedeveloped.

Arbitrary approach: It is an approach where scale is developed on *ad hoc* basis. This is the most widely used approach. It is presumed that such scales measure the concepts for which they have been designed, although there is little evidence to support such an assumption.

Consensus approach: Here a panel of judges evaluate the items chosen for inclusion in the instrument in terms of whether they are relevant to the topic area and unambiguous inimplication.

Item analysis approach: Under it a number of individual items are developed into a

test which is given to a group of respondents. After administering the test, the total scores are calculated for every one. Individual items are then analysed to determine which items discriminate between persons or objects with high total scores and those with low scores.

Cumulative scales are chosen on the basis of their conforming to some ranking of items with ascending and descending discriminating power. For instance, in such a scale the endorsement of an item representing an extreme position should also result in the endorsement of all items indicating a less extremeposition.

Factor scales may be constructed on the basis of intercorrelations of items which indicate that a common factor accounts for the relationship between items. This relationship is typically measured through factor analysis method.

8.3 Likert scale and Thurston scale Summated Scales (or Likert-type Scales)

Summated scales (or Likert-type scales) are developed by utilizing the item analysis approach wherein a particular item is evaluated on the basis of how well it discriminates between those persons whose total score is high and those whose score is low. Those items or statements that best meet this sort of discrimination test are included in the final instrument.

Thus, summated scales consist of a number of statements which express either a favourable or unfavourable attitude towards the given object to which the respondent is asked to react. The respondent indicates his agreement or disagreement with each statement in the instrument. Each response is given a numerical score, indicating its favourableness or unfavourableness, and the scores are totalled to measure the respondent's attitude. In other words, the overall score represents the respondent's position on the continuum of favourable-unfavourableness towards an issue.

Most frequently used summated scales in the study of social attitudes follow the pattern devised by Likert. For this reason they are often referred to as Likert-type scales. In a Likert scale, the respondent is asked to respond to each of the statements in terms of several degrees, usually five degrees (but at times 3 or 7 may also be used) of agreement or disagreement. For example, when asked to express opinion whether one considers his job quite pleasant, the respondent may respond in any one of the following ways: (i) strongly agree, (ii) agree, (iii) undecided, (iv) disagree, (v)

strongly disagree.

We find that these five points constitute the scale. At one extreme of the scale there is strong agreement with the given statement and at the other, strong disagreement, and between them lie intermediate points. We may illustrate this as under:

Strongly agree (1)	Agree (2)	Undecided (3)	Disagree (4)	Strongly disagree (5)

Fig. 2.3

Each point on the scale carries a score. Response indicating the least favourable degree of job satisfaction is given the least score (say 1) and the most favourable is given the highest score (say 5). These score—values are normally not printed on the instrument but are shown here just to indicate the scoring pattern. The Likert scaling technique, thus, assigns a scale value to each of the five responses. The same thing is done in respect of each and every statement in the instrument. This way the instrument yields a total score for each respondent, which would then measure the respondent's favourableness toward the given point of view. If the instrument consists of, say 30 statements, the following score values would be revealing.

$30 \times 5 = 150$ Most favourable response possible

$30 \times 3 = 80$ A neutral attitude

$30 \times 1 = 30$ Most unfavourable attitude.

The scores for any individual would fall between 30 and 150. If the score happens to be above 80, it shows favourable opinion to the given point of view, a score of below 80 would mean unfavourable opinion and a score of exactly 80 would be suggestive of a neutral attitude.

Procedure: The procedure for developing a Likert-type scale is as follows:

(i) As a first step, the researcher collects a large number of statements which are

relevant to the attitude being studied and each of the statements expresses definite favourableness or unfavourableness to a particular point of view or the attitude and that the number of favourable and unfavourable statements is approximatelyequal.

(ii) After the statements have been gathered, a trial test should be administered to a number of subjects. In other words, a small group of people, from those who are going to be studied finally, are asked to indicate their response to each statement by checking one of the categories of agreement or disagreement using a five point scale as statedabove.

(iii) The response to various statements are scored in such a way that a response indicative of the most favourable attitude is given the highest score of 5 and that with the most unfavourable attitude is given the lowest score, say, of1.

(iv) Then the total score of each respondent is obtained by adding his scores that he received for separatestatements.

(v) The next step is to array these total scores and find out those statements which have a high discriminatory power. For this purpose, the researcher may select some part of the highest and the lowest total scores, say the top 25 per cent and the bottom 25 per cent. These two extreme groups are interpreted to represent the most favourable and the least favourable attitudes and are used as criterion groups by which to evaluate individual statements. This way we determine which statements consistently correlate with low favourability and which with highfavourability.

(vi) Only those statements that correlate with the total test should be retained in the final instrument and all others must be discarded from it.

Advantages: The Likert-type scale has several advantages. Mention may be made of the important ones.

(a) It is relatively easy to construct the Likert-type scale in comparison to Thurstone-type scale because Likert-type scale can be performed without a panel ofjudges.

(b) Likert-type scale is considered more reliable because under it respondents answer each statement included in the instrument. As such it also provides more information and data than does the Thurstone-typescale.

(c) Each statement, included in the Likert-type scale, is given an empirical test for discriminating ability and as such, unlike Thurstone-type scale, the Likert-type scale permits the use of statements that are not manifestly related (to have a direct relationship) to the attitude beingstudied.

(d) Likert-type scale can easily be used in respondent-centred and stimulus-centred studies i.e., through it we can study how responses differ between people and how responses differ betweenstimuli.

(e) Likert-type scale takes much less time to construct, it is frequently used by the students of opinion research. Moreover, it has been reported in various research studies* that there is high degree of correlation between Likert-type scale and Thurstone-typescale.

Limitations: There are several limitations of the Likert-type scale as well. One important limitation is that, with this scale, we can simply examine whether respondents are more or less favourable to a topic, but we cannot tell how much more or less they are. There is no basis for belief that the five positions indicated on the scale are equally spaced. The interval between 'strongly agree' and 'agree', may not be equal to the interval between "agree" and "undecided". This means that Likert scale does not rise to a stature more than that of an ordinal scale, whereas the designers of Thurstone scale claim the Thurstone scale to be an interval scale. One further disadvantage is that often the total score of an individual respondent has little clear meaning since a given total score can be secured by a variety of answer patterns. It is unlikely that the respondent can validly react to a short statement on a printed form in the absence of real-life qualifying situations. Moreover, there "remains a possibility that people may answer according to what they think they should feel rather than how they dofeel."

Differential Scales (or Thurstone-type Scales)

The name of L.L. Thurstone is associated with differential scales which have been developed using consensus scale approach. Under such an approach the selection of

items is made by a panel of judges who evaluate the items in terms of whether they are relevant to the topic area and unambiguous in implication. The detailed procedure is as under:

(a) The researcher gathers a large number of statements, usually twenty or more, that express various points of view toward a group, institution, idea, or practice (i.e., statements belonging to the topicarea).

(b) These statements are then submitted to a panel of judges, each of whom arranges them in eleven groups or piles ranging from one extreme to another in position. Each of the judges is requested to place generally in the first pile the statements which he thinks are most unfavourable to the issue, in the second pile to place those statements which he thinks are next most unfavourable and he goes on doing so in this manner till in the eleventh pile he puts the statements which he considers to be the most favourable.

(c) This sorting by each judge yields a composite position for each of the items. In case of marked disagreement between the judges in assigning a position to an item, that item isdiscarded.

(d) For items that are retained, each is given its median scale value between one and eleven as established by the panel. In other words, the scale value of any one statement is computed as the 'median' position to which it is assigned by the group ofjudges.

(e) A final selection of statements is then made. For this purpose a sample of statements, whose median scores are spread evenly from one extreme to the other is taken. The statements so selected, constitute the final scale to be administered to respondents. The position of each statement on the scale is the same as determined by thejudges.

After developing the scale as stated above, the respondents are asked during the administration of the scale to check the statements with which they agree. The median value of the statements that they check is worked out and this establishes their score or quantifies their opinion. It may be noted that in the actual instrument the statements are arranged in random order of scale value. If the values are valid and if the opinionnaire deals with only one attitude dimension, the typical respondent will choose one or several contiguous items (in terms of scale values) to reflect his views.

However, at times divergence may occur when a statement appears to tap a different attitude dimension.

The Thurstone method has been widely used for developing differential scales which are utilised to measure attitudes towards varied issues like war, religion, etc. Such scales are considered most appropriate and reliable when used for measuring a single attitude. But an important deterrent to their use is the cost and effort required to develop them. Another weakness of such scales is that the values assigned to various statements by the judges may reflect their own attitudes. The method is not completely objective; it involves ultimately subjective decision process. Critics of this method also opine that some other scale designs give more information about the respondent's attitude in comparison to differentialscales.

8.2 Scale ConstructionTechniques

In social science studies, while measuring attitudes of the people we generally follow the technique of preparing the opinionnaire* (or attitude scale) in such a way that the score of the individual responses assigns him a place on a scale. Under this approach, the respondent expresses his agreement or disagreement with a number of statements relevant to the issue. While developing such statements, the researcher must note the following twopoints:

8.2.1 That the statements must elicit responses which are psychologically related to the attitude beingmeasured;

8.2.2 That the statements need be such that they discriminate not merely between extremes of attitude but also among individuals who differslightly.

Researchers must as well be aware that inferring attitude from what has been recorded in opinionnaires has several limitations. People may conceal their attitudes and express socially acceptable opinions. They may not really know how they feel about a social issue. People may be unaware of their attitude about an abstract situation; until confronted with a real situation, they may be unable to predict their reaction. Even behaviour itself is at times not a true indication of attitude. For instance, when politicians kiss babies, their behaviour may not be a true expression of affection toward infants. Thus, there is no sure method of measuring attitude; we only try to measure the expressed opinion and then draw inferences from it about people's

real feelings or attitudes.

With all these limitations in mind, psychologists and sociologists have developed several scale construction techniques for the purpose. The researcher should know these techniques so as to develop an appropriate scale for his own study. Some of the important approaches, along with the corresponding scales developed under each approach to measure attitude are as follow

*An information form that attempts to measure the attitude or belief of an individual is known asopinionnaire.

2.4 Table :Different Scales for Measuring Attitudes of People

	Name of the scale construction approach	*Name of the scale developed*
1.	Arbitrary approach	Arbitrary scales
2.	Consensus scale approach	Differential scales (such as Thurstone Differential scale)
3.	Item analysis approach	Summated scales (such as Likert Scale)
4.	Cumulative scale approach	Cumulative scales (such as Guttman's Scalogram)
5.	Factor analysis approach	Factor scales (such as Osgood's Semantic Differential, Multi-dimensional Scaling, etc.)

A brief description of each of the above listed scales will be helpful.

Arbitrary Scales

Arbitrary scales are developed on *ad hoc* basis and are designed largely through the researcher's own subjective selection of items. The researcher first collects few statements or items which he believes are unambiguous and appropriate to a given topic. Some of these are selected for inclusion in the measuring instrument and then people are asked to check in a list the statements with which theyagree.

The chief merit of such scales is that they can be developed very easily, quickly and

with relatively less expense. They can also be designed to be highly specific and adequate. Because of these benefits, such scales are widely used inpractice.

At the same time there are some limitations of these scales. The most important one is that we do not have objective evidence that such scales measure the concepts for which they have been developed. We have simply to rely on researcher's insight and competence.

Conclusion: So there in a nutshell you have it. Measurement always involves some sort of scale, and the observations linked to the measurements can be noted as a simple difference of name and thus a simple classification. One step up in complexity is the ordinal scale which implies the there is an order to the object or process, and one thing can be said to be not just different, but greater or lesser than another. The next up in cmplexity, the interval scale is the most frequently used for measurement and rests on the certainty of equal intervals between sequential points on the scale. Finally there are ratio scales, which are exactly like interval scales with the addition of a zeropoint.

8.4 Keywords

Nominal scale : A **Nominal Scale** is a measurement **scale**, in which numbers serve as "tags" or "labels" only, to identify or classify an object

Ordinal Scale : An **ordinal scale** is a **scale** (of measurement) that uses labels to classify cases (measurements) into ordered classes

Likert scale: A **Likert scale** but more commonly pronounced is a psychometricscale commonly involved in research that employs questionnaires.

Thurston scale: In psychology and sociology, the **Thurstone scale** was the first formal technique to measure an attitude. It was developed by Louis Leon **Thurstone** in 1828, as a **means** of measuring attitudes towardsreligion

Measurement of Variables,

8.5 Self assessmentQuestions

1.List out the classification of scales ?

2.What is nominal scale and its Limitations ?

3.What do you mean by ordinal scale and its limitations ?

4.What do you mean by Likert scale and its limitations ?

5. What do you mean by Thurston scale and its limitations ?

8.6 References

1.A..L. Edwards and K.C. Kenney, "A comparison of the Thurstone and Likert techniques of attitude scale construction", *Journal of Applied Psychology*, 30, 72–83, 1846.

2.John W. Best and James V. Kahn, "Research in Education", 5 ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 1886, p.183.

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5.Pauline V. Young, *Scientific Social Surveys and Research,* p.247.

Lesson Writer:

K. N. Lokesh Kumar

Lesson 9

Data Collection

OBJECTIVES

. To understand different methods of data collection

. To acquire the knowledge of data collection Instruments

STRUCTURE

9.1 Data collection methods

COLLECTION OF PRIMARYDATA

We collect primary data during the course of doing experiments in an experimental research but in case we do research of the descriptive type and perform surveys, whether sample surveys or census surveys, then we can obtain primary data either through observation or through direct communication with respondents in one form or another or through personal interviews.* This, in other words, means

An experiment refers to an investigation in which a factor or variable under test is isolated and its effect(s) measured. In an experiment the investigator measures the effects of an experiment which he conducts intentionally. Survey refers to the method of securing information concerning a phenomena under study from all or a selected number of respondents of the concerned universe. In a survey, the investigator examines those phenomena which exist in the universe independent of his action. The difference between an experiment and a survey can be depicted as under that there are several methods of collecting primary data, particularly in

surveys and descriptive researches. Important ones are:

(i) observation method,

(ii) interview method,

(iii) throughquestionnaires,

(iv) through schedules, and

(v) other methods which include

(a) warranty cards;

(b) distributoraudits;

(c)pantryaudits;

(d)consumerpanels;

(e)usingmechanicaldevices;

(f) through projective techniques;

(g) depth interviews, and

(h) content analysis.

We briefly take up each methodseparately.

Observation Method

There are several merits of the participant type of observation: (i) The researcher is enabled to record the natural behaviour of the group. (ii) The researcher can even gather information which could not easily be obtained if he observes in a disinterested fashion.

(iii) The researcher can even verify the truth of statements made by informants in the context of a questionnaire or a schedule. But there are also certain demerits of this type of observation viz., the observer may lose the objectivity to the extent he participates emotionally; the problem of observation-control is not solved; and it may narrow-down the researcher's range of experience.

Sometimes we talk of *controlled* and *uncontrolled observation.* If the observation takes place in the natural setting, it may be termed as uncontrolled observation, but when observation takes place according to definite pre-arranged plans, involving

experimental procedure, the same is then termed controlled observation. In non-controlled observation, no attempt is made to use precision instruments. The major aim of this type of observation is to get a spontaneous picture of life and persons. It has a tendency to supply naturalness and completeness of behaviour, allowing sufficient time for observing it. But in controlled observation, we use mechanical (or precision) instruments as aids to accuracy and standardisation. Such observation has a tendency to supply formalised data upon which generalisations can be built with some degree of assurance. The main pitfall of non-controlled observation is that of subjective interpretation. There is also the danger of having the feeling that we know more about the observed phenomena than we actually do. Generally, controlled observation takes place in various experiments that are carried out in a laboratory or under controlled conditions, whereas uncontrolled observation is resorted to in case of exploratoryresearches.

Interview Method

The interview method of collecting data involves presentation of oral-verbal stimuli and reply in terms of oral-verbal responses. This method can be used through personal interviews and, if possible, through telephone interviews.

(a) Personal interviews: Personal interview method requires a person known as the interviewer asking questions generally in a face-to-face contact to the other person or persons. (At times the interviewee may also ask certain questions and the interviewer responds to these, but usually the interviewer initiates the interview and collects the information.) This sort of interview may be in the form of direct personal investigation or it may be indirect oral investigation. In the case ofdirect personal investigation the interviewer has to collect the information personally from the sources concerned. He has to be on the spot and has to meet people from whom data have to be collected. This method is particularly suitable for intensive investigations. But in certain cases it may not be possible or worthwhile to contact directly the persons concerned or on account of the extensive scope of enquiry, the direct personal investigation technique may not be used. In such cases an indirect oral examination can be conducted under which the interviewer has to cross-examine other persons who are supposed to have knowledge about the problem under investigation and the information, obtained is recorded. Most of the commissions and committees appointed by government to carry on investigations make use of thismethod.

The method of collecting information through personal interviews is usually carried out in a structured way. As such we call the interviews as *structured interviews.* Such interviews involve the use of a set of predetermined questions and of highly standardised techniques of recording. Thus, the interviewer in a structured interview follows a rigid procedure laid down, asking questions in a form and order prescribed. As against it, the *unstructured interviews* are characterised by a flexibility of approach to questioning. Unstructured interviews do not follow a system of pre-determined questions and standardised techniques of recording information. In a non-structured interview, the interviewer is allowed much greater freedom to ask, in case of need, supplementary questions or at times he may omit certain questions if the situation so requires. He may even change the sequence of questions. He has relatively greater freedom while recording the responses to include some aspects and exclude others. But this sort of flexibility results in lack of comparability of one interview with another and the analysis of unstructured responses becomes much more difficult and time-consuming than that of the structured responses obtained in case of structured interviews. Unstructured interviews also demand deep knowledge and greater skill on the part of the interviewer. Unstructured interview, however, happens to be the central technique of collecting information in case of exploratory or formulative research studies. But in case of descriptive studies, we quite often use the technique of structured interview because of its being more economical, providing a safe basis for generalisation and requiring relatively lesser skill on the part of the interviewer.

We may as well talk about focussed interview, clinical interview and the non-directive interview. *Focussed interview* is meant to focus attention on the given experience of the respondent and its effects. Under it the interviewer has the freedom to decide the manner and sequence in which the questions would be asked and has also the freedom to explore reasons and motives. The main task of the interviewer in case of a focussed interview is to confine the respondent to a discussion of issues with which he seeks conversance. Such interviews are used generally in the development of hypotheses and constitute a major type of unstructured interviews. The *clinical interview* is concerned with broad underlying feelings or motivations or with the course of individual's life experience. The method of eliciting information under it is generally left to the interviewer's discretion. In case of *non-directive interview*, the

interviewer's function is simply to encourage the respondent to talk about the given topic with a bare minimum of direct questioning. The interviewer often acts as a catalyst to a comprehensive expression of the respondents' feelings and beliefs and of the frame of reference within which such feelings and beliefs take on personal significance.

Despite the variations in interview-techniques, the major advantages and weaknesses of personal interviews can be enumerated in a general way. The chief merits of the interview method are as follows:

(i) More information and that too in greater depth can beobtained.

(ii) Interviewer by his own skill can overcome the resistance, if any, of the respondents; the interview method can be made to yield an almost perfect sample of the generalpopulation.

(iii) There is greater flexibility under this method as the opportunity to restructure questions is always there, specially in case of unstructuredinterviews.

(iv) Observation method can as well be applied to recording verbal answers to various questions.

(v) Personal information can as well be obtained easily under thismethod.

(vi) Samples can be controlled more effectively as there arises no difficulty of the missing returns; non-response generally remains verylow.

(vii) The interviewer can usually control which person(s) will answer the questions. This is not possible in mailed questionnaire approach. If so desired, group discussions may also beheld.

(viii) The interviewer may catch the informant off-guard and thus may secure the most spontaneous reactions than would be the case if mailed questionnaire isused.

(ix) The language of the interview can be adopted to the ability or educational level of the person interviewed and as such misinterpretations concerning questions can be avoided.

(x) The interviewer can collect supplementary information about the respondent's personal characteristics and environment which is often of great value in

interpretingresults.

But there are also certain weaknesses of the interview method. Among the important weaknesses, mention may be made of the following:

(i) It is a very expensive method, specially when large and widely spread geographical sample istaken.

(ii) There remains the possibility of the bias of interviewer as well as that of the respondent; there also remains the headache of supervision and control of interviewers

(iii) Certain types of respondents such as important officials or executives or people in high income groups may not be easily approachable under this method and to that extent the data may proveinadequate.

(iv) This method is relatively more-time-consuming, specially when the sample is large and re-calls upon the respondents arenecessary.

(v) The presence of the interviewer on the spot may over-stimulate the respondent, sometimes even to the extent that he may give imaginary information just to make the interviewinteresting.

(vi) Under the interview method the organisation required for selecting, training and supervising the field-staff is more complex with formidableproblems.

(vii) Interviewing at times may also introduce systematicerrors.

(viii) Effective interview presupposes proper rapport with respondents that would facilitate free and frank responses. This is often a very difficultrequirement.

9.2 Guidelines for Questionnaire

COLLECTION OF DATA THROUGH QUESTIONNAIRES

This method of data collection is quite popular, particularly in case of big enquiries. It is being adopted by private individuals, research workers, private and public organisations and even by governments. In this method a questionnaire is sent (usually by post) to the persons concerned with a request to answer the questions and return the questionnaire. A questionnaire consists of a number of questions printed or typed in a definite order on a form or set of forms. The questionnaire is mailed to respondents who are expected to read and understand the questions and write down

the reply in the space meant for the purpose in the questionnaire itself. The respondents have to answer the questions on their own.

The method of collecting data by mailing the questionnaires to respondents is most extensively employed in various economic and business surveys. The merits claimed on behalf of this method are as follows:

1. There is low cost even when the universe is large and is widely spreadgeographically.
2. It is free from the bias of the interviewer; answers are in respondents' ownwords.
3. Respondents have adequate time to give well thought outanswers.
4. Respondents, who are not easily approachable, can also be reachedconveniently.
5 Large samples can be made use of and thus the results can be made more dependable and reliable.

The main demerits of this system can also be listed here:

1. Low rate of return of the duly filled in questionnaires; bias due to no-response is oftenindeterminate.
2. It can be used only when respondents are educated andcooperating.
3. The control over questionnaire may be lost once it issent.
4. There is inbuilt inflexibility because of the difficulty of amending the approach once questionnaires have beendespatched.
5. There is also the possibility of ambiguous replies or omission of replies altogether to certain questions; interpretation of omissions isdifficult.
6. It is difficult to know whether willing respondents are trulyrepresentative.
7. This method is likely to be the slowest ofall.

Before using this method, it is always advisable to conduct 'pilot study' (Pilot Survey) for testing the questionnaires. In a big enquiry the significance of pilot survey is felt very much. Pilot survey is infact the replica and rehearsal of the main survey.

Such a survey, being conducted by experts, brings to the light the weaknesses (if any) of the questionnaires and also of the survey techniques. From the experience gained in this way, improvement can be effected.

Main aspects of a questionnaire: Quite often questionnaire is considered as the heart of a survey operation. Hence it should be very carefully constructed. If it is not properly set up, then the survey is bound to fail. This fact requires us to study the main aspects of a questionnaire viz., the general form, question sequence and question formulation and wording. Researcher should note the following with regard to these three main aspects of a questionnaire:

1. General form: So far as the general form of a questionnaire is concerned, it can either be structured or unstructured questionnaire. Structured questionnaires are those questionnaires in which there are definite, concrete and pre-determined questions. The questions are presented with exactly the same wording and in the same order to all respondents. Resort is taken to this sort of standardisation to ensure that all respondents reply to the same set of questions. The form of the question may be either closed (i.e., of the type 'yes' or 'no') or open (i.e., inviting free response) but should be stated in advance and not constructed during questioning. Structured questionnaires may alsohave fixed alternative questions in which responses of the informants are limited to the stated alternatives. Thus a highly structured questionnaire is one in which all questions and answers are specified and comments in the respondent's own words are held to the minimum. When these characteristics are not present in a questionnaire, it can be termed as unstructured or non-structured questionnaire. More specifically, we can say that in an unstructured questionnaire, the interviewer is provided with a general guide on the type of information to be obtained, but the exact question formulation is largely his own responsibility and the replies are to be taken down in the respondent's own words to the extent possible; in some situations tape recorders may be used to achieve thisgoal.

Structured questionnaires are simple to administer and relatively inexpensive to analyse. The provision of alternative replies, at times, helps to understand the meaning of the question clearly. But such questionnaires have limitations too. For instance, wide range of data and that too in respondent's own words cannot be obtained with structured questionnaires. They are usually considered inappropriate in investigations where the aim happens to be to probe for attitudes and reasons for

certain actions or feelings. They are equally not suitable when a problem is being first explored and working hypotheses sought. In such situations, unstructured questionnaires may be used effectively. Then on the basis of the results obtained in pretest (testing before final use) operations from the use of unstructured questionnaires, one can construct a structured questionnaire for use in the mainstudy.

2. Question sequence: In order to make the questionnaire effective and to ensure quality to the replies received, a researcher should pay attention to the question-sequence in preparing the questionnaire. A proper sequence of questions reduces considerably the chances of individual questions being misunderstood. The question-sequence must be clear and smoothly-moving, meaning thereby that the relation of one question to another should be readily apparent to the respondent, with questions that are easiest to answer being put in the beginning. The first few questions are particularly important because they are likely to influence the attitude of the respondent and in seeking his desired cooperation. The opening questions should be such as to arouse human interest. The following type of questions should generally be avoided as opening questions in a questionnaire:

1. questions that put too great a strain on the memory or intellect of therespondent;
2. questions of a personalcharacter;
3. questions related to personal wealth, etc.

Following the opening questions, we should have questions that are really vital to the research problem and a connecting thread should run through successive questions. Ideally, the question-sequence should conform to the respondent's way of thinking.

Knowing what information is desired, the researcher can rearrange the order of the questions (this is possible in case of unstructured questionnaire) to fit the discussion in each particular case. But in a structured questionnaire the best that can be done is to determine the question-sequence with the help of a Pilot Survey which is likely to produce good rapport with most respondents. Relatively difficult questions must be relegated towards the end so that even if the respondent decides not to answer such questions, considerable information would have already been obtained.

Thus, question- sequence should usually go from the general to the more specific and the researcher must always remember that the answer to a given question is a function not only of the question itself, but of all previous questions as well. For instance, if one question deals with the price usually paid for coffee and the next with reason for preferring that particular brand, the answer to this latter question may be couched largely in terms of price-differences.

Question formulation and wording: With regard to this aspect of questionnaire, the researcher should note that each question must be very clear for any sort of misunderstanding can do irreparable harm to a survey. Question should also be impartial in order not to give a biased picture of the true state of affairs. Questions should be constructed with a view to their forming a logical part of a well thought out tabulation plan. In general, all questions should meet the following standards—(a) should be easily understood; (b) should be simple i.e., should convey only one thought at a time; (c) should be concrete and should conform as much as possible to the respondent's way of thinking. (For instance, instead of asking. "How many razor blades do you use annually?" The more realistic question would be to ask, "How many razor blades did you use lastweek?"

Concerning the form of questions, we can talk about two principal forms, viz., multiple choice question and the open-end question. In the former the respondent selects one of the alternative possible answers put to him, whereas in the latter he has to supply the answer in his own words. The question with only two possible answers (usually 'Yes' or 'No') can be taken as a special case of the multiple choice question, or can be named as a 'closed question.' There are some advantages and disadvantages of each possible form of question. Multiple choice or closed questions have the advantages of easy handling, simple to answer, quick and relatively inexpensive to analyse. They are most amenable to statistical analysis. Sometimes, the provision of alternative replies helps to make clear the meaning of the question. But the main drawback of fixed alternative questions is that of "putting answers in people's mouths" i.e., they may force a statement of opinion on an issue about which the respondent does not infact have any opinion. They are not appropriate when the issue under consideration happens to be a complex one and also when the interest of the researcher is in the exploration of a process. In such situations, open-ended questions which are designed to permit a free response from the respondent rather than one

limited to certain stated alternatives are considered appropriate. Such questions give the respondent considerable latitude in phrasing a reply. Gettingtherepliesinrespondent'sownwordsis,thus,themajoradvantageofopen- ended questions. But one should not forget that, from an analytical point of view, open-ended questions are more difficult to handle, raising problems of interpretation, comparability and interviewer bias.*

In practice, one rarely comes across a case when one questionnaire relies on one form of questions alone. The various forms complement each other. As such questions of different forms are included in one single questionnaire. For instance, multiple-choice questions constitute the basis of a structured questionnaire, particularly in a mail survey. But even there, various open-ended questions are generally inserted to provide a more complete picture of the respondent's feelings and attitudes.

Researcher must pay proper attention to the wordings of questions since reliable and meaningful returns depend on it to a large extent. Since words are likely to affect responses, they should be properly chosen. Simple words, which are familiar to all respondents should be employed. Words with ambiguous meanings must be avoided. Similarly, danger words, catch-words or words with emotional connotations should be avoided. Caution must also be exercised in the use of phrases which reflect upon the prestige of the respondent. Question wording, in no case, should bias the answer. In fact, question wording and formulation is an art and can only be learnt by practice

Essentials of a good questionnaire: To be successful, questionnaire should be comparatively short and simple i.e., the size of the questionnaire should be kept to the minimum. Questions should proceed in logical sequence moving from easy to more difficult questions. Personal and intimate questions should be left to the end. Technical terms and vague expressions capable of different interpretations should be avoided in a questionnaire. Questions may be dichotomous (yes or no answers), multiple choice (alternative answers listed) or open-ended. The latter type of questions are often difficult to analyse and hence should be avoided in a questionnaire to the extent possible. There should be some control questions in the questionnaire which indicate the reliability of the respondent. For instance, a question designed to determine the consumption of particular material may beasked

Interviewer bias refers to the extent to which an answer is altered in meaning by some

action or attitude on the part of the interviewer. first in terms of financial expenditure and later in terms of weight. The control questions, thus, introduce a cross-check to see whether the information collected is correct or not. Questions affecting the sentiments of respondents should be avoided. Adequate space for answers should be provided in the questionnaire to help editing and tabulation. There should always be provision for indications of uncertainty, e.g., “do not know,” “no preference” and so on. Brief directions with regard to filling up the questionnaire should invariably be given in the questionnaire itself. Finally, the physical appearance of the questionnaire affects the cooperation the researcher receives from the recipients and as such an attractive looking questionnaire, particularly in mail surveys, is a plus point for enlisting cooperation. The quality of the paper, along with its colour, must be good so that it may attract the attention ofrecipients.

9.3 Schedule construction

COLLECTION OF DATA THROUGH SCHEDULES

This method of data collection is very much like the collection of data through questionnaire, with little difference which lies in the fact that schedules (proforma containing a set of questions) are being filled in by the enumerators who are specially appointed for the purpose. These enumerators along with schedules, go to respondents, put to them the questions from the proforma in the order the questions are listed and record the replies in the space meant for the same in the proforma. In certain situations, schedules may be handed over to respondents and enumerators may help them in recording their answers to various questions in the said schedules. Enumerators explain the aims and objects of the investigation and also remove the difficulties which any respondent may feel in understanding the implications of a particular question or the definition or concept of difficultterms.

This method requires the selection of enumerators for filling up schedules or assisting respondents to fill up schedules and as such enumerators should be very carefully selected. The enumerators should be trained to perform their job well and the nature and scope of the investigation should be explained to them thoroughly so that they may well understand the implications of different questions put in the schedule. Enumerators should be intelligent and must possess the capacity of cross-examination in order to find out the truth. Above all, they should be honest, sincere, hardworking

and should have patience and perseverance.

This method of data collection is very useful in extensive enquiries and can lead to fairly reliable results. It is, however, very expensive and is usually adopted in investigations conducted by governmental agencies or by some big organisations. Population census all over the world is conducted through thismethod.

DIFFERENCE BETWEEN QUESTIONNAIRES AND SCHEDULES

Both questionnaire and schedule are popularly used methods of collecting data in research surveys. There is much resemblance in the nature of these two methods and this fact has made many people to remark that from a practical point of view, the two methods can be taken to be the same. But from the technical point of view there is difference between the two. The important points of difference are asunder:

The questionnaire is generally sent through mail to informants to be answered as specified in a covering letter, but otherwise without further assistance from the sender. The schedule is generally filled out by the research worker or the enumerator, who can interpret questions when necessary.

2. To collect data through questionnaire is relatively cheap and economical since we have to spend money only in preparing the questionnaire and in mailing the same to respondents. Here no field staff required. To collect data through schedules is relatively more expensive since considerable amount of money has to be spent in appointing enumerators and in importing training to them. Money is also spent in preparingschedules.

3. Non-response is usually high in case of questionnaire as many people do not respond and many return the questionnaire without answering all questions. Bias due to non-response often remains indeterminate. As against this, non-response is generally very low in case of schedules because these are filled by enumerators who are able to get answers to all questions. But there remains the danger of interviewer bias andcheating.

4. In case of questionnaire, it is not always clear as to who replies, but in case of schedule the identity of respondent isknown.

5. The questionnaire method is likely to be very slow since many respondents do

not return the questionnaire in time despite several reminders, but in case of schedules the information is collected well in time as they are filled in by enumerators.

6. Personal contact is generally not possible in case of the questionnaire method as questionnaires are sent to respondents by post who also in turn return the same by post. But in case of schedules direct personal contact is established with respondents.

7. Questionnaire method can be used only when respondents are literate and cooperative, but in case of schedules the information can be gathered even when the respondents happen to beilliterate.

8. Wider and more representative distribution of sample is possible under the questionnaire method, but in respect of schedules there usually remains the difficulty in sending enumerators over a relatively widerarea.

9. Risk of collecting incomplete and wrong information is relatively more under the questionnaire method, particularly when people are unable to understand questions properly. But in case of schedules, the information collected is generally complete and accurate as enumerators can remove the difficulties, if any, faced by respondents in correctly understanding the questions. As a result, the information collected through schedules is relatively more accurate than that obtained throughquestionnaires.

10. The success of questionnaire method lies more on the quality of the questionnaire itself, but in the case of schedules much depends upon the honesty and competence ofenumerators.

11. In order to attract the attention of respondents, the physical appearance of questionnaire must be quite attractive, but this may not be so in case of schedules as they are to be filled in by enumerators and not byrespondents.

12. Along with schedules, observation method can also be used but such a thing is not possible while collecting data throughquestionnaires.

SOME OTHER METHODS OF DATA COLLECTION

Let us consider some other methods of data collection, particularly used by big business houses in modern times.

1. **Warranty cards:** Warranty cards are usually postal sized cards which are used by dealers of consumer durables to collect information regarding their products. The information sought is printed in the form of questions on the 'warranty cards' which is placed inside the package along with the product with a request to the consumer to fill in the card and post it back to thedealer.

2. **Distributor or store audits:** Distributor or store audits are performed by distributors as well as manufactures through their salesmen at regular intervals. Distributors get the retail stores audited through salesmen and use such information to estimate market size, market share, seasonal purchasing pattern and so on. The data are obtained in such audits not by questioning but by observation. For instance, in case of a grocery store audit, a sample of stores is visited periodically and data are recorded on inventories on hand either by observation or copying from store records. Store audits are invariably panel operations, for the derivation of sales estimates and compilation of sales trends by stores are their principal ' *raison detre*'. The principal advantage of this method is that it offers the most efficient way of evaluating the effect on sales of variations of different techniques of in-storepromotion.

3. **Pantry audits:** Pantry audit technique is used to estimate consumption of the basket of goods at the consumer level. In this type of audit, the investigator collects an inventory of types, quantities and prices of commodities consumed. Thus in pantry audit data are recorded from the examination of consumer's pantry. The usual objective in a pantry audit is to find out what types of consumers buy certain products and certain brands, the assumption being that the contents of the pantry accurately portray consumer's preferences. Quite often, pantry audits are supplemented by direct questioning relating to reasons and circumstances under which particular products were purchased in an attempt to relate these factors to purchasing habits. A pantry audit may or may not be set up as a panel operation, since a single visit is often considered sufficient to yield an accurate picture of consumers' preferences. An important limitation of pantry audit approach is that, at times, it may not be possible to identify consumers' preferences from the audit data alone, particularly when promotion devices produce a marked rise insales.

4. **Consumer panels:** An extension of the pantry audit approach on a regular basis is known as 'consumer panel', where a set of consumers are arranged to come

to an understanding to maintain detailed daily records of their consumption and the sameis made available to investigator on demands. In other words, a consumer panel is essentially a sample of consumers who are interviewed repeatedly over a period of time. Mostly consume panels are of two types viz., the transitory consumer panel and the continuing consumer panel. *A transitory consumer panel* is set up to measure the effect of a particular phenomenon. Usually such a panel is conducted on a before-and-after-basis. Initial interviews are conducted before the phenomenon takes place to record the attitude of the consumer. A second set of interviews is carried out after the phenomenon has taken place to find out the consequent changes that might have occurred in the consumer's attitude. It is a favourite tool of advertising and of social research. A *continuing consumer panel* is often set up for an indefinite period with a view to collect data on a particular aspect of consumer behaviour over time, generally at periodic intervals or may be meant to serve as a general purpose panel for researchers on a variety ofsubjects.

5. **Use of mechanical devices:** The use of mechanical devices has been widely made to collect information by way of indirect means. Eye camera, Pupilometric camera, Psychogalvanometer, Motion picture camera and Audiometer are the principal devices so far developed and commonly used by modern big business houses, mostly in the developed world for the purpose of collecting the requiredinformation.

Eye cameras are designed to record the focus of eyes of a respondent on a specific portion of a sketch or diagram or written material. Such an information is useful in designing advertising material. Pupilometric cameras record dilation of the pupil as a result of a visual stimulus. The extent of dilation shows the degree of interest aroused by the stimulus. Psychogalvanometer is used for measuring the extent of body excitement as a result of the visual stimulus. Motion picture cameras can be used to record movement of body of a buyer while deciding to buy a consumer good from a shop or big store. Influence of packaging or the information given on the label would stimulate a buyer to perform certain physical movements which can easily be recorded by a hidden motion picture camera in the shop's four walls. Audiometers are used by some TV concerns to find out the type of programmes as well as stations preferred by people. A device is fitted in the television instrument

itself to record these changes. Such data may be used to find out the market share of competing televisionstations.

6. **Projective techniques:** Projective techniques (or what are sometimes called as indirect interviewing techniques) for the collection of data have been developed by psychologists to use projections of respondents for inferring about underlying motives, urges, or intentions which are such that the respondent either resists to reveal them or is unable to figure out himself. In projective techniques the respondent in supplying information tends unconsciously to project his own attitudes or feelings on the subject under study. Projective techniques play an important role in motivational researches or in attitudesurveys.

The use of these techniques requires intensive specialised training. In such techniques, the individual's responses to the stimulus-situation are not taken at their face value. The stimuli may arouse many different kinds of reactions. The nature of the stimuli and the way in which they are presented under these techniques do not clearly indicate the way in which theresponseistobeinterpreted. The stimulusmaybeaphotograph, apicture, an inkblot and so on. Responses to these stimuli are interpreted as indicating the individual's own view, his personality structure, his needs, tensions, etc. in the context of some pre-established psychological conceptualisation of what the individual's responses to the stimulus mean. We may now briefly deal with the important projective techniques.

9.4 SECONDARY DATA

Secondary data means data that are already available i.e., they refer to the data which have already been collected and analysed by someone else. When the researcher utilises secondary data, then he has to look into various sources from where he can obtain them. In this case he is certainly not confronted with the problems that are usually associated with the collection of original data. Secondary data may either be published data or unpublished data. Usually published data are available in: (a) various publications of the central, state are local governments; (b) various publications of foreign governments or of internationalbodiesandtheirsubsidiaryorganisations;(c)technicalandtradejournals;

(d) books, magazines and newspapers; (e) reports and publications of various associations connected with business and industry, banks, stock exchanges, etc.; (f)

reports prepared by research scholars, universities, economists, etc. in different fields; and (g) public records and statistics, historical documents, and other sources of published information. The sources of unpublished data are many; they may be found in diaries, letters, unpublished biographies and autobiographies and also may be available with scholars and research workers, trade associations, labour bureaus and other public/ private individuals andorganisations.

Researcher must be very careful in using secondary data. He must make a minute scrutiny because it is just possible that the secondary data may be unsuitable or may be inadequate in the context of the problem which the researcher wants to study. In this connection Dr. A.L. Bowley very aptly observes that it is never safe to take published statistics at their face value without knowing their meaning and limitations and it is always necessary to criticise arguments that can be based on them.

By way of caution, the researcher, before using secondary data, must see that they possess following characteristics:

1. **Reliability of data:** The reliability can be tested by finding out such things about the said data:

   (a) Who collected the data? (b) What were the sources of data? (c) Were they collected by using proper methods (d) At what time were they collected?(e) Was there any bias of thecompiler?

   (t) What level of accuracy was desired? Was it achieved ?

2. **Suitability of data:** The data that are suitable for one enquiry may not necessarily be found suitable in another enquiry. Hence, if the available data are found to be unsuitable, they should not be used by the researcher. In this context, the researcher must very carefully scrutinise the definition of various terms and units of collection used at the time of collecting the data from the primary source originally. Similarly, the object, scope and nature of the original enquiry must also be studied. If the researcher finds differences in these, the data will remain unsuitable for the present enquiry and should not beused.

3. **Adequacy of data:** If the level of accuracy achieved in data is found inadequate for the purpose of the present enquiry, they will be considered as inadequate and should not be used by the researcher. The data will also be considered inadequate, if they are related to an area which may be either narrower or wider than

the area of the presentenquiry.

From all this we can say that it is very risky to use the already available data. The already available data should be used by the researcher only when he finds them reliable, suitable and adequate. But he should not blindly discard the use of such data if they are readily available from authentic sources and are also suitable and adequate for in that case it will not be economical to spend time and energy in field surveys for collecting information. At times, there may be wealth of usable information in the already available data which must be used by an intelligent researcher but with dueprecaution.

SELECTION OF APPROPRIATE METHOD FOR DATA COLLECTION

Thus, there are various methods of data collection. As such the researcher must judiciously select the method/methods for his own study, keeping in view the following factors:

1. **Nature, scope and object of enquiry:** This constitutes the most important factor affecting the choice of a particular method. The method selected should be such that it suits the type of enquiry that is to be conducted by the researcher. This factor is also important in deciding whether the data already available (secondary data) are to be used or the data not yet available (primary data) are to becollected.

2. **Availability of funds:** Availability of funds for the research project determines to a large extent the method to be used for the collection of data. When funds at the disposal of the researcher are very limited, he will have to select a comparatively cheaper method which may not be as efficient and effective as some other costly method. Finance, in fact, is a big constraint in practice and the researcher has to act within thislimitation.

Time factor: Availability of time has also to be taken into account in deciding a particular method of data collection. Some methods take relatively more time, whereas with others the data can be collected in a comparatively shorter duration. The

3. time at the disposal of the researcher, thus, affects the selection of the method by which the data are to becollected.

4. **Precision required:** Precision required is yet another important factor to be considered at the time of selecting the method of collection ofdata.

But one must always remember that each method of data collection has its uses and none is superior in all situations. For instance, telephone interview method may be considered appropriate (assuming telephone population) if funds are restricted, time is also restricted and the data is to be collected in respect of few items with or without a certain degree of precision. In case funds permit and more information is desired, personal interview method may be said to be relatively better. In case time is ample, funds are limited and much information is to be gathered with no precision, then mail- questionnaire method can be regarded more reasonable. When funds are ample, time is also ample and much information with no precision is to be collected, then either personal interview or the mail-questionnaire or the joint use of these two methods may be taken as an appropriate method of collecting data. Where a wide geographic area is to be covered, the use of mail-questionnaires supplemented by personal interviews will yield more reliable results per rupee spent than either method alone. The secondary data may be used in case the researcher finds them reliable, adequate and appropriate for his research. While studying motivating influences in market researches or studying people's attitudes in psychological/social surveys, we can resort to the use of one or more of the projective techniques stated earlier. Such techniques are of immense value in case the reason is obtainable from the respondent who knows the reason but does not want to admit it or the reason relates to some underlying psychological attitude and the respondent is not aware of it. But when the respondent knows the reason and can tell the same if asked, than a non-projectivequestionnaire, using direct questions, may yield satisfactory results even in case of attitude surveys. Since projective techniques are as yet in an early stage of development and with the validity of many of them remaining an open question, it is usually considered better to rely on the straight forward statistical methods with only supplementary use of projective techniques. Nevertheless, in pre-testing and in searching for hypotheses they can be highlyvaluable.

Thus, the most desirable approach with regard to the selection of the method depends on the nature of the particular problem and on the time and resources (money and personnel) available along with the desired degree of accuracy. But, over and above all this, much depends upon the ability and experience of the researcher. Dr. A.L. Bowley's remark in this context is very appropriate when he says that "in collection of statistical data common sense is the chief requisite and experience the

chief teacher."

CASE STUDY METHOD

Meaning: The case study method is a very popular form of qualitative analysis and involves a careful and complete observation of a social unit, be that unit a person, a family, an institution, a cultural group or even the entire community. It is a method of study in depth rather than breadth. The case study places more emphasis on the full analysis of a limited number of events or conditions and their interrelations. The case study deals with the processes that take place and their interrelationship. Thus, case study is essentially an intensive investigation of the particular unit under consideration. The object of the case study method is to locate the factors that account for the behaviour- patterns of the given unit as an integrated totality.

According to H. Odum, "The case study method is a technique by which individual factor whether it be an institution or just an episode in the life of an individual or a group is analysed in its relationship to any other in the group." [5] Thus, a fairly exhaustive study of a person (as to what he does and has done, what he thinks he does and had done and what he expects to do and says he ought to do) or group is called a life or case history. Burgess has used the words "the social microscope" for the case study method." [6] Pauline

V. Young describes case study as "a comprehensive study of a social unit be that unit a person, a group, a social institution, a district or a community." [7]In brief, we can say that case study method is a form of qualitative analysis where in careful and complete observation of an individual or a situation or an institution is done; efforts are made to study each and every aspect of the concerning unit in minute details and then from case data generalisations and inferences aredrawn.

Characteristics: The important characteristics of the case study method are as under:

1. Under this method the researcher can take one single social unit or more of such units for his study purpose; he may even take a situation to study the same comprehensively.
2. Here the selected unit is studied intensively i.e., it is studied in minute details. Generally, the study extends over a long period of time to ascertain the natural history of the unit so as to obtain enough information for drawing correct inferences.

3. In the context of this method we make complete study of the social unit covering all facets. Through this method we try to understand the complex of factors that are operative within a social unit as an integratedtotality.

4 Under this method the approach happens to be qualitative and not quantitative. Mere quantitative information is not collected. Every possible effort is made to collect information concerning all aspects of life. As such, case study deepens our perception and gives us a clear insight into life. For instance, under this method we not only study how many crimes a man has done but shall peep into the factors that forced him to commit crimes when we are making a case study of a man as a criminal. The objective of the study may be to suggest ways to reform the criminal.

5. In respect of the case study method an effort is made to know the mutual inter-relationship of causalfactors.

6. Under case study method the behaviour pattern of the concerning unit is studied directly and not by an indirect and abstractapproach.

7. Case study method results in fruitful hypotheses along with the data which may be helpful in testing them, and thus it enables the generalised knowledge to get richer and richer. In its absence, generalised social science may gethandicapped.

Evolution and scope: The case study method is a widely used systematic field research technique in sociology these days. The credit for introducing this method to the field of social investigation goes to Frederic Le Play who used it as a hand-maiden to statistics in his studies of family budgets. Herbert Spencer was the first to use case material in his comparative study of different cultures. Dr. William Healy resorted to this method in his study of juvenile delinquency, and considered it as a better method over and above the mere use of statistical data. Similarly, anthropologists, historians, novelists and dramatists have used this method concerning problems pertaining to their areas of interests. Even management experts use case study methods for getting clues to several management problems. In brief, case study method is being used in several disciplines. Not only this, its use is increasing day by day.

Assumptions: The case study method is based on several assumptions. The important assumptions may be listed as follows:

(i) The assumption of uniformity in the basic human nature in spite of the fact that

human behaviour may vary according tosituations.

(ii) The assumption of studying the natural history of the unitconcerned.

(iii) The assumption of comprehensive study of the unitconcerned.

Major phases involved: Major phases involved in case study are as follows:

(i) Recognition and determination of the status of the phenomenon to be investigated or the unit ofattention.

(ii) Collection of data, examination and history of the givenphenomenon.

(iii) Diagnosis and identification of causal factors as a basis for remedial or developmentaltreatment.

(iv) Application of remedial measures i.e., treatment and therapy (this phase is often characterised as casework).

(v) Follow-up programme to determine effectiveness of the treatmentapplied.

Advantages: There are several advantages of the case study method that follow from the various characteristics outlined above. Mention may be made here of the important advantages.

(i) Being an exhaustive study of a social unit, the case study method enables us to understand fully the behaviour pattern of the concerned unit. In the words of Charles Horton Cooley, "case study deepens our perception and gives us a clearer insight into life…. It gets at behaviour directly and not by an indirect and abstractapproach."

(ii) Through case study a researcher can obtain a real and enlightened record of personal experiences which would reveal man's inner strivings, tensions and motivations that drive him to action along with the forces that direct him to adopt a certain pattern of behaviour.

(iii) This method enables the researcher to trace out the natural history of the social unit and its relationship with the social factors and the forces involved in its surroundingenvironment.

(iv) It helps in formulating relevant hypotheses along with the data which may be helpful in testing them. Case studies, thus, enable the generalised knowledge to get richer and richer.

(v) The method facilitates intensive study of social units which is generally not possible if we use either the observation method or the method of collecting information through schedules. This is the reason why case study method is being frequently used, particularly in socialresearches.

(vi) Information collected under the case study method helps a lot to the researcher in the task of constructing the appropriate questionnaire or schedule for the said task requires thorough knowledge of the concerninguniverse.

(vii) The researcher can use one or more of the several research methods under the case study method depending upon the prevalent circumstances. In other words, the use of different methods such as depth interviews, questionnaires, documents, study reports of individuals, letters, and the like is possible under case studymethod.

(viii) Case study method has proved beneficial in determining the nature of units to be studied along with the nature of the universe. This is the reason why at times the case study method is alternatively known as "mode of organisingdata".

(ix) This method is a means to well understand the past of a social unit because of its emphasis of historical analysis. Besides, it is also a technique to suggest measures for improvement in the context of the present environment of the concerned socialunits.

(x) Case studies constitute the perfect type of sociological material as they represent a real record of personal experiences which very often escape the attention of most of the skilled researchers using othertechniques.

(xi) Case study method enhances the experience of the researcher and this in turn increases his analysing ability andskill.

(xii) This method makes possible the study of social changes. On account of the minute study of the different facets of a social unit, the researcher can well understand the social change then and now. This also facilitates the drawing of inferences and helps in maintaining the continuity of the research process. In fact, it may be considered the gateway to and at the same time the final destination of abstractknowledge.

(xiii) Case study techniques are indispensable for therapeutic and administrative

purposes. They are also of immense value in taking decisions regarding several management problems. Case data are quite useful for diagnosis, therapy and other practical caseproblems.

Limitations: Important limitations of the case study method may as well be highlighted.

(i) Case situations are seldom comparable and as such the information gathered in case studies is often not comparable. Since the subject under case study tells history in his own words, logical concepts and units of scientific classification have to be read into it or out of it by theinvestigator.

(ii) Read Bain does not consider the case data as significant scientific data since they do not provide knowledge of the "impersonal, universal, non-ethical, non-practical, repetitive aspects

of phenomena." [8] Real information is often not collected because the subjectivity of the researcher does enter in the collection of information in a case study.

(iii) The danger of false generalisation is always there in view of the fact that no set rules are followed in collection of the information and only few units arestudied.

(iv) It consumes more time and requires lot of expenditure. More time is needed under case study method since one studies the natural history cycles of social units and that toominutely.

(v) The case data are often vitiated because the subject, according to Read Bain, may write what he thinks the investigator wants; and the greater the rapport, the more subjective the whole processis.

(vi) Case study method is based on several assumptions which may not be very realistic at times, and as such the usefulness of case data is always subject to doubt.

(vii) Case study method can be used only in a limited sphere., it is not possible to use it in case of a big society. Sampling is also not possible under a case study method.

(viii) Response of the investigator is an important limitation of the case study method. Heoftenthinksthathehasfullknowledgeoftheunitandcanhimselfanswer about it. In case the same is not true, then consequences follow. In fact, this is more the fault of the researcher rather than that of the case method.

Conclusion: Despite the above stated limitations, we find that case studies are being undertaken in several disciplines, particularly in sociology, as a tool of scientific research in view of the several advantages indicated earlier. Most of the limitations can be removed if researchers are always conscious of these and are well trained in the modern methods of collecting case data and in the scientific techniques of assembling, classifying and processing the same. Besides, case studies, in modern times, can be conducted in such a manner that the data are amenable to quantification and statistical treatment. Possibly, this is also the reason why case studies are becoming popular day byday.

9.5 Keyword

Primary data : Primary data is data that is collected by a researcher from first-hand sources, using methods like surveys, interviews, or experiments

Secondary data : **Secondary data** refers to **data** that is collected by someone other than the user. Common sources of **secondary data** for social science include censuses, information collected by government departments, organizational records and **data** that was originally collected for other research purposes.

Data Collection Methods: **Data collection** is **defined** as the "process of **gathering** and measuring information on variables of interest, in an established systematic fashion that enables one to answer queries, stated research questions, test hypotheses, and evaluate outcomes."

Observation : **Observation Method**. The **observation method** involves human or mechanical **observation** of what people actually do or what events take place during a buying or consumption situation. " Information is collected by **observing** process at work."

Questionaire: A **questionnaire** is a research instrument consisting of a series of questions for the purpose of gathering information from respondents. **Questionnaires** can be thought of as a kind of written interview. ... Often a **questionnaire** uses both open and closed questions to collect data.

9.6 Self assessmentQuestions

1.What do you mean by data collection?

2.How to measure the variables?

3.What do you understand by observation method ?

4.How many methods are there for collecting data?

5.What do you mean by primary and secondary data ?

6.What are the different methods of data collection ?

9.7 Further References

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Lesson Writer:

K. N. Lokesh Kumar.

LESSON-10

MULTIVARIATE ANALYSIS

Objectives

After studying the unit you should be able to

- Understand the concept of multivariate analysis
- Know the use of multiple regression in research
- Understand the applications of cluster analysis
- To analyze the steps in conjoint analysis
- To know about the objectives of discriminant analysis

Structure

10.1 Introduction to Multivariate Analysis

In this chapter we shall discuss measures of association between more than two variables Multivariate analysis is a set of statistical techniques used for analysis of data that contain more than one variable. ... It's the same in your data. The only way to solve the complex problems and realize the full potential is by analyzing all variables and dimensions of the data by using multivariateanalysis.

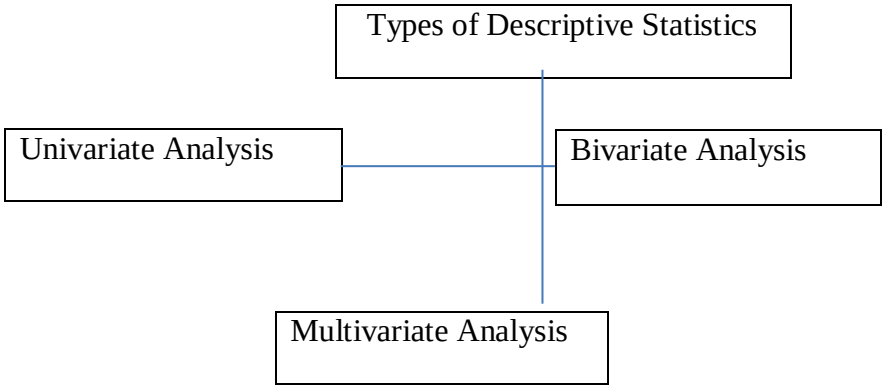
Multivariate statistical tools have been applied with increasing frequency of research problems. Now a day's more complex problems are addressed by considering multiple independent and multiple dependent variables

1.1.(A) Meaning of multivariate analysis

The score on each test is one variable, Xi, and there are several, k, of such scores for each object, represented as X1, X2 …Xk. Most of the research studies involve more than two variables in which situation analysis is desired of the association between one (at times many) criterion variable and several independent variables, or we may be required to study the association between variables having no dependency relationships. All such analyses are termed as multivariate analyses or multivariate techniques. In brief, techniques that take account of the various relationships among variables are termed multivariate analyses or multivariate techniques.

1.1.(B) Types of descriptive statistics

Descriptive statistics is used to describe the attributes of a system. A typical procedures to first identify the attributes present, and then rate these attributes. Magnitude estimation can be used to correlate each of the attributes relative contribution to the final system. One way to achieve this is to use preset or agreed upon conditions or terminologies. Descriptive analysis is of three types:



1.1. (C)Examples of multivariate

A doctor has collected data on cholesterol, blood pressure, and weight. He/she also collected data on the eating habits of the subjects (e.g., how many ounces of red meat, fish, dairy products, and chocolate consumed per week).

Essentially, multivariateanalysis is a tool to find patterns and relationships between several variables simultaneously. It lets us predict the effect a change in one variable will have on other variables.

10.2 Nature of Multivariate Analysis

1. Empirical and deal with the reality: Multivariate techniques are largely empirical and deal with the reality; they possess the ability toanalyze complex data. Accordingly in most of the applied and behavioral researches, we generallyresort to multivariate analysis techniques for realistic results.

2. It helps in decision making: Besides being a tool for analyzing thedata, multivariate techniques also help in various types of decision-making. For example, take thecase of college entrance examination wherein a number of tests are administered to candidates, andthe candidates scoring high total marks based on many subjects are admitted. This system, thoughapparently fair, may at times be biased in favor of some subjects with the larger standard deviations.Multivariate techniques may be appropriately used in such situations for developing norms as to whoshould be admitted in college.

3. It concern relationships between different test results: We may also cite an example from medical field. Many medicalexaminations such as blood pressure and cholesterol tests are administered to patients. Each of theresults of such examinations has significance of its own, but it is also important to consider relationshipsbetween different test results or results of the same tests at different occasions in order to drawproper diagnostic conclusions and to determine an appropriate therapy.

4.Best strategy of data analysis: Multivariate techniques canassist us in such a situation. In view of all this, we can state that "if the researcher is interested inmaking probability statements on the basis of sampled multiple measurements, then the best strategyof data analysis is to use some suitable multivariate statistical technique." The basic objective underlying multivariate techniques is to represent a collection of massivedata in a simplified way.

5. Real data into a simplified: In other words, multivariate techniques transform a mass of observationsinto a smaller number of composite scores in such a way that they may reflect as much informationas possible contained in the raw data obtained concerning a research study. Thus, the main contributionof these techniques is in arranging a large amount of complex information involved in the real datainto a simplified visible form.

6. Conclusion: Mathematically, multivariate techniques consist in "forming a linearcomposite vector in a vector subspace, which can be represented in terms of projection of a vectoronto certain specified subspaces."For better appreciation and understanding of multivariate techniques, one must be familiar withfundamental concepts of linear algebra, vector spaces, orthogonal and oblique projections and univariateanalysis.

Even then before applying multivariate techniques for meaningful results, one must considerthe nature and structure of the data and the real aim of the analysis. We should also not forget thatmultivariate techniques do involve several complex mathematical computations and as such can beutilized largely with the availability of computer facility.

10.3 Classification of Multivariate Techniques

(a) **Interdependence methods.** Today, there exist a great variety of multivariate techniques which can be conveniently classified intotwo broad categories viz., dependence methods and interdependence methods. This sort ofclassification depends upon the question: Are some of the involved variables dependent upon others?If the answer is 'yes', we have dependence methods; but in case the answer is 'no', we haveinterdependence methods.

(b) **Dependence method:** Two more questions are relevant for understanding the nature of multivariatetechniques. Firstly, in case some variables are dependent, the question is how many variables aredependent? The other question is, whether the data are metric or non-metric? This means whether the data are quantitative, collected on interval or ratio scale, or whether the data are qualitative, collected on nominal or ordinal scale.

10.4 Introduction to multiple regression analysis

Multiple regression analysis explains the logical extension of two variable regression analysis multiple regression analysis uses two or more than two independent variables to evaluate the value of a dependent variable. Is a powerful technique used for predicting the unknown value of a variable from the known value of two or more variables- also called the predictorsmultiple regression is an extension of simple linear regression.

It is used when we want to predict the value of a variable based on the value of two or more other variables. The variable we want to predict is called the dependent variable (or sometimes, the outcome, target or criterion variable). Multicollinearity occurs when two independent variables are highly correlated with each other.

For example, let's say you included both height and arm length as independent variables in a multiple regression with vertical leap as the dependent variable.This analysis is adopted when the researcher has one dependentvariable which is presumed to be a function of two or more independent variables. The objective ofthis analysis is to make a prediction about the dependent variable based on its covariance with all theconcerned independent variables.

When there are two or more than two independent variables, the analysis concerning relationship is known as multiple correlations and the equation describing such relationship as the multiple regression equation. We here explain multiple correlation and regression taking only two independent variables and one dependent variable.

1.4.1 Use of multiple regression in research

Multiple regression we can used for solving a variety of problems. Some of them are listed below

i. **Forecasting:** forecasting about profit, growth of sales, and demand or market share of a certain company in a selected time.
ii. **Analysis about:**availability of raw materials at lowest cost, absence of competition, availability of natural resources and skilled man power.
iii. **Marketing mix analysis:** by analyzing the relationship between elements in thee marketing mix and market share or sales.
iv. **Quota determination:** involves using territory size, last period sales, competitor strength and related variables to determine sales quotas or objectives.

10.5 Steps in multiple regression

1. State the research hypothesis

2. State the null hypothesis

3. Gather the data

4. Assess each variable separately

5. Assess the relationship of each independent variable one at a time with the dependent variable

6. Assess the relationships between all of the independent variables with each other

7. Calculate the repression equation from the data

8. Accept or reject the null hypothesis

9. Reject or accept the research hypothesis

10. Explain the practical implications of the findings

10.6 Introduction to Cluster Analysis

Cluster analysis consists of methods of classifying variables into clusters. Technically, a cluster consists of variables that correlate highly with one another and have comparatively low correlations with variables in other clusters. The basic objective of cluster analysis is to determine how many mutually and exhaustive groups or clusters, based on the similarities of profiles among entities, really exist in the population and then to state the composition of such groups. Various groups to be determined in cluster analysis are not predefined as happens to be the case in discriminant analysis.

1.6.1 Stepsincluster analysis: contains the following steps to be performed:

(I) First of all, if some variables have a negative sum of correlations in the correlation matrix, one must reflect variables so as to obtain a maximum sum of positive correlations for the matrix as a whole.

(II) The second step consists in finding out the highest correlation in the correlation matrix and the two variables involved (i.e., having the highest correlation in the matrix) form the nucleus of the first cluster.

(III) Then one looks for those variables that correlate highly with the said two variables and includes them in the cluster, this is how the first cluster is formed.

(IV)To obtain the nucleus of the second cluster, we find two variables that correlate highly but have low correlations with members of the first cluster. Variables that correlate highly with the said two variables are then found. Such variables along the said two variables thus constitute the second cluster.

(V) One proceeds on similar lines to search for a third cluster and so on. From the above description we find that clustering methods in general are judgmental and aredevoid of statistical inferences. For problems concerning large number of variables, various cut-andtrymethods have been proposed for locating clusters.

McQuitty has specially developed a number ofrather elaborate computational routines for that purpose.In spite of the above stated limitation, cluster analysis has been found useful in context of marketresearch studies. Through the use of this technique we can make segments of market of a producton the basis of several characteristics of the customers such as personality, socio-economicconsiderations, psychological factors, purchasing habits and like ones.

1.6.2 Examples of Clustering Applications

• **Marketing:** Help marketers discover distinct groups in their customer bases, and then use this knowledge to develop targeted marketing programs

• **Land use:** Identification of areas of similar land use in an earth observation database

• **Insurance:** Identifying groups of motor insurance policy holders with a high average claim cost

• **City-planning:** Identifying groups of houses according to their house type, value, and geographical location

• **Earth-quake studies:** Observed earth quake epicenters should be clustered along continent Faults

1.6.3 What Is Good Clustering?

• A good clustering method will produce high quality clusters with high intra-class similarity low Inter-class similarity

• The quality of a clustering result depends on both the similarity measure used by the method and its implementation.

• The quality of a clustering method is also measured by its ability to discover some or all of the hidden patterns.

1.6.4Measure the Quality of Clustering:

• Dissimilarity/Similarity metric: Similarity is expressed in terms of a distance function, which is typically metric: d(i, j)

• There is a separate quality function that measures the goodness of a cluster.

• The definitions of distance functions are usually very different for interval-scaled, Boolean, categorical, and ordinal variables.

• Weights should be associated with different variables based onapplications and data semantics.

• It is hard to define □similar enough□or □good enough□the answer is typically highly subjective.

10.7 Introduction to Conjoint Analyses:

□Factors and their values are defined by the researcher in advance

□The various combinations of the factor values yield fictive products that are being ranked by the interviewed persons

□With Conjoint Analysis it is possible to derive metric partial utilities from the ranking results

□The summation of these partial utilities therefore results in metric total utilities, independent variables: object attributes

□Dependent variable: Preferences of the interviewed person for the fictive products

□The utility structure of a number of persons can be computed through aggregation of the single results

1.7.1 Examples of conjoint analysis

□***Example:*** *Attitudes towards dishwashing products*

1. Clean: glass/dishes clean

2. Shiny: glass/dishes shiny

3. Smell: Non-perfumed/lemon fresh/intensive lemon fresh

4. Quantity: small/medium/x-large

5. Packaging: loose in box/tab in plastic/tab in dissolving plastic

6. Design: single/multi-colored/multi-colored + ball.

11.8 Introduction to Discriminant Analysis (DA):

Discriminant Analysis (DA) is a technique for analyzing data when the criterion or dependent variable is categorical and the predictor or independent variables are interval in nature. DA undertakes the same task as multiple linear regressions by predicting an outcome. However, multiple linear regressions is limited to cases where the dependent variable on the Y axis is an interval variable so that the combination of predictors will, through the regression equation, produce estimated mean population numerical Y values for given values of weighted combinations of X values.

But many interesting variables are categorical, such as political party voting intention, migrant/non-migrant status, making a profit or not, holding a particular credit card, owning, renting or paying a mortgage for a house, employed/unemployed, satisfied versus dissatisfied employees, which customers are likely to buy a product or not buy, what distinguishes Stellar Bean clients from Gloria Beans clients, whether a person is a credit risk or not, etc.

1.8.1 Objectives Discriminant Analysis

 Development of discriminant functions

 Examination of whether significant differences exist among the groups, in terms of the predictor variables

 Determination of which predictor variables contribute to most of the intergroup differences

 Evaluation of the accuracy of classification

1.8.2 Discriminate analysis linear equation

DA involves the determination of a linear equation like regression that will predict which group the case belongs to. The form of the equation or function is:

D= v1 X1+ v2 X2+ v3X3+ ... + viXi + a

Where D = discriminate function

v = the discriminant coefficient or weight for that variable

X = respondent's score for that variable 2

a = a constant

i = the number of predictor variables

This function is similar to a regression equation or function. The v's are unstandardized discriminate coefficients analogous to the b's in the regression equation. These v's maximize the distance between the means of the criterion (dependent) variable. Standardized discriminate coefficients can also be used like beta weight in regression.

Good predictors tend to have large weights. What you want this function to do is maximize the distance between the categories, i.e. come up with an equation that has strong discriminatory power between groups. After using an existing set of data to calculate the discriminant function and classify cases, any new cases can then be classified. The number of discriminant functions is one less the number of groups. There is only one function for the basic two group discriminant analysis.

1.8.3 Assumptions of discriminant analysis

 The observations are a random sample;

 Each predictor variable is normally distributed;

 Each of the allocations for the dependent categories in the initial classification are correctly classified;

 There must be at least two groups or categories, with each case belonging to only one group so that the groups are mutually exclusive and collectively exhaustive (all cases can be placed in a group);

 Each group or category must be well defined, clearly differentiated from any other group(s) and natural. Putting a median split on an attitude scale is not a natural way to form groups. Partitioning quantitative variables is only justifiable if there are easily identifiable gaps at the points of division;

 For instance, three groups taking three available levels of amounts of housing loan;

 The groups or categories should be defined before collecting the data;

 The attribute(s) used to separate the groups should discriminate quite clearly between the

groups so that group or category overlap is clearly non-existent or minimal;

 Group sizes of the dependent should not be grossly different and should be at least five times the number of independent variables.

1.8.4 Applications of discriminant analysis

 Agriculture extension research: Adoption behavior

 Market research: Market segmentation

 Financial research: Default behavior

 Human resources: High performers

10.9 Key Words

Descriptive statistics: Is used to describe the attributes of a system, a typical procedure to first identify the attributes present, and then rate these attributes.

Multiple regression analysis:Explains the logical extension of two variable regression analysis multiple regression analysis uses two or more than two independent variables to evaluate the value of a dependent variable.

Discriminant Analysis: Is a technique for analyzing data when the criterion or dependent variable is categorical and the predictor or independent variables are interval in nature.

10.10 Self-Assessment Questions:

1. Explain about nature of multivariate analysis
2. What do you mean by multivariate techniques? Explain their use in research
3. Write about the significance of multiple regression in research
4. Describe the various steps in cluster analysis
5. What do you mean by conjoint analysis? Explain its examples in detail
6. What are the assumptions of discriminant analysis
7. Write a short notes on:

(i) Cluster analysis (ii) Multiple regression analysis (iii) Conjoint analysis

10.10 Further Readings

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Lesson Writer:

Ch. Venkateswarlu

LESSON-11

FACTOR ANALYSIS and its METHODS

Objectives

After studying the unit you should be able to

- To know the various methods of factor analysis
- Understand the concept of multidimensional scaling (MDS)

Structure

11.1Introduction to Factor analysis

Factor analysis attempts to represent a set of observed variables *X1, X2 …. Xn* in terms of a number of 'common' factors plus a factor which is unique to each variable the common factors (sometimes called latent variables) are hypothetical variables which explain why a number of variables are correlated with each other -- it is because they have one or more factors *in common*.

Concrete physical example may help. Say we measured the size of various parts of the

body of a random sample of humans: for example, such things as height, leg, arm, finger, foot and toe lengths and head, chest, waist, arm and leg circumferences, the distance between eyes, etc. We'd expect that many of the measurements would be

correlated, and we'd say that the explanation for these correlations is that there is a common underlying factor of body size. It is this kind of common factor that we are looking for with factor analysis, although in psychology the factors may be less tangible than body size.

To carry the body measurement example further, we probably wouldn't expect body size to explain all of the variability of the measurements: for example, there might be a lankiness factor, which would explain some of the variability of the circumference measures and limb lengths, and perhaps another factor for head size which would have some independence from body size (what factors emerge is very dependent on what variables are measured).

Even with a number of common factors such as body size, lankiness and head size, we still wouldn't expect to account for all of the variability in the measures (or explain all of the correlations), so the factor analysis model includes a unique factor for each variable which accounts for the variability of that variable which is not due to any of the common factors. Why carry out factor analyses? If we can summarize a multitude of measurements with a smaller number of factors without losing too much information, we have achieved some economy of description, which is one of the goals of scientific investigation.

It is also possible that factor analysis will allow us to test theories involving variables which are hard to measure directly. Finally, at a more prosaic level, factor analysis can help us establish that sets of questionnaire items (observed variables) are in fact all measuring the same underlying factor (perhaps with varying reliability) and so can be combined to form a more reliable measure of that factor.

There are a number of different varieties of factor analysis: the discussion here is limited to principal axis factor analysis and factor solutions in which the common factors are uncorrelated with each other. It is also assumed that the observed variables are standardized (mean zero, standard deviation of one) and that the factor analysis is based on the correlation matrix of the observed variables

Factor analysis is by far the most often used multivariate technique of research studies, specially pertaining to social and behavioral sciences. It is a technique applicable when there is a systematic interdependence among a set of observed or manifest variables and the researcher is interested in finding out something more

fundamental or latent which creates this commonality. For instance, we might have data, say, about an individual's income, education, occupation and dwelling area and want to infer from these some factor (such as social class) which summarizes the commonality of all the said four variables.

The technique used for such purpose is generally described as factor analysis. Factor analysis, thus, seeks to resolve a large set of measured variables in terms of relatively few categories, known as factors. This technique allows the researcher to group variables into factors (based on correlation between variables) and the factors so derived may be treated as new variables (often termed as latent variables) and their value derived by summing the values of the original variables which have been grouped into the factor. The meaning and name of such new variable is subjectively determined by the researcher.

Since the factors happen to be linear combinations of data, the coordinates of each observation or variable is measured to obtain what are called factor loadings. Such factor loadings represent the correlation between the particular variable and the factor, and are usually place in a matrix of correlations between the variable and the factors. The mathematical basis of factor analysis concerns a data matrix (also termed as score matrix), symbolized as S. The matrix contains the scores of N persons of k measures. Thus a is the score of person on measure a, is the score of person on measure a, and kN, is the score of person N on measure k.

11.2 Important Methods of Factor Analysis

There are several methods of factor analysis, but they do not necessarily give same results. As such factor analysis is not a single unique method but a set of techniques. Important methods of factor analysis are:

(i) The centroid method;

(ii) The principal components method;

(ii) The maximum likelihood method.

Before we describe these different methods of factor analysis, it seems appropriate that some basic terms relating to factor analysis be well understood.

1. **Factor:** A factor is an underlying dimension that account for several observed variables. There can be one or more factors, depending upon the nature of the study and the number of variables involved in it.

2. **Factor-loadings:** Factor-loadings are those values which explain how closely the variables are related to each one of the factors discovered. They are also known as factor-variable correlations. In fact, factor-loadings work as key to understanding what the factors mean. It is the absolute size (rather than the signs, plus or minus) of the loading that is important in the interpretation of a factor.

3. **Communality (h2):** Communality, symbolized as h2, shows how much of each variable is accounted for by the underlying factor taken together. A high value of communality means that not much of the variable is left over after whatever the factors represent is taken into consideration.

   It is worked out in respect of each variable as under:

   h2 of the ith variable = (ith factor loading of factor A)2

   + (ith factor loading of factor B)2 + …

4. **Eigen value (or latent root):** When we take the sum of squared values of factor loadings relating to a factor, then such sum is referred to as Eigen Value or latent root. Eigen value indicates the relative importance of each factor in accounting for the particular set of variables being analyzed.

5. **Total sum of squares:** When Eigen values of all factors are totaled, the resulting value is termed as the total sum of squares. This value, when divided by the number of variables (involved in a study), results in an index that shows how the particular solution accounts for what all the variables taken together represent.

If the variables are all very different from each other, this index will be low. If they fall into one or more highly redundant groups, and if the extracted factors account for all the groups, the index will then approach unity.

6. **Rotation:** Rotation, in the context of factor analysis, is something like staining a microscope slide. Just as different stains on it reveal different structures in the tissue, different rotations reveal different structures in the data. Though different rotations give results that appear to be entirely different, but from a statistical point of view, all results are taken as equal, none superior or inferior to others.

However, from the standpoint of making sense of the results of factor analysis, one must select the right rotation. If the factors are independent orthogonal rotation is done and if the factors are correlated, an oblique rotation is made. Communality for each variables will remain undisturbed regardless of rotation but the Eigen values will change as result of rotation.

7. **Factor scores:** Factor score represents the degree to which each respondent gets high scores on the group of items that load high on each factor. Factor scores can help explain what the factors mean. With such scores, several other multivariate analyses can be performed. We can now take up the important methods of factor analysis.

Factor analysis is a technique that is used to reduce a large number of variables into fewer numbers of factors. This technique extracts maximum common variance from all variables and puts them into a common score. As an index of all variables, we can use this score for further analysis. Factor analysis is part of general linear model (GLM) and this method also assumes several assumptions: there is linear relationship, there is no multi collinearity, it includes relevant variables into analysis, and there is true correlation between variables and factors. Several methods are available, but principle component analysis is used most commonly.

11.3 Various Types of factoring:

There are different types of methods used to extract the factor from the data set:

1. **Principal component analysis:** This is the most common method used by researchers. PCA starts extracting the maximum variance and puts them into the first factor. After that, it removes that variance explained by the first factors and then starts extracting maximum variance for the second factor. This process goes to the last factor.

2. **Common factor analysis:** The second most preferred method by researchers, it extracts the common variance and puts them into factors. This method does not include the unique variance of all variables. This method is used in SEM.

3. **Image factoring:** This method is based on correlation matrix. OLS Regression method is used to predict the factor in image factoring.

4. **Maximum likelihood method:** This method also works on correlation metric but it uses maximum likelihood method to factor.

5. **Exploratory factor analysis:** Assumes that any indicator or variable may be associated with any factor. This is the most common factor analysis used by researchers and it is not based on any prior theory.

6. **Confirmatory factor analysis (CFA):** Used to determine the factor and factor loading of measured variables, and to confirm what is expected on the basic or pre-established theory. CFA assumes that each factor is associated with a specified subset of measured variables. It commonly uses two approaches:

7. The traditional method: Traditional factor method is based on principle factor analysis method rather than common factor analysis. Traditional method allows the researcher to know more about insight factor loading.

8.The SEM approach: CFA is an alternative approach of factor analysis which can be done in SEM. In SEM, we will remove all straight arrows from the latent variable, and add only that arrow which has to observe the variable representing the covariance between every pair of latents. We will also leave the straight arrows error free and disturbance terms to their respective variables.

If standardized error term in SEM is less than the absolute value two, then it is assumed good for that factor, and if it is more than two, it means that there is still some unexplained variance which can be explained by factor. Chi-square and a number of other goodness-of-fit indexes are used to test how well the model fits.

9. **Other methods of factor analysis:** Alfa factoring outweighs least squares. Weight square is another regression based method which is used for factoring.

11.4 Criteria for determining the number of factors: According to the Kaiser Criterion, Eigen values is a good criteria for determining a factor. If Eigen values is greater than one, we should consider that a factor and if Eigen values is less than one, then we should not consider that a factor. According to the variance extraction rule, it should be more than 0.7. If variance is less than 0.7, then we should not consider that a factor.

11.5 Rotation method: Rotation method makes it more reliable to understand the output. Eigenvalues do not affect the rotation method, but the rotation method affects

the Eigenvalues or percentage of variance extracted. There are a number of rotation methods available: (1) No rotation method, (2) Varimax rotation method, (3) Quartimax rotation method, (4) Direct oblimin rotation method, and (5) Promax rotation method. Each of these can be easily selected in SPSS, and we can compare our variance explained by those particular methods.

2.5.1 Rotation method and its Assumptions:

1.**No outlier:** Assume that there are no outliers in data.

2.**Adequate sample size:** The case must be greater than the factor.

3.**No perfect multicollinearity:** Factor analysis is an interdependency technique. There should not be perfect multicollinearity between the variables.

4.**Homoscedasticity:** Since factor analysis is a linear function of measured variables, it does not require homoscedasticity between the variables.

5.**Linearity:** Factor analysis is also based on linearity assumption. Non-linear variables can also be used. After transfer, however, it changes into linear variable.

6.Interval Data: Interval data are assumed.

11.6 Introduction to Multidimensional scaling (MDS)

Multi-dimensional scaling (MDS) is a statistical technique that allows researchers to find and explore underlying themes, or dimensions, in order to explain similarities or dissimilarities (i.e. distances) between investigated datasets.

Multidimensional Scaling (MDS) is a class of procedures for representing perceptions and preferences of respondents spatially by means of visual display. Multidimensional scaling are used for: To determine the number and nature of dimensions consumers use to perceive different brands.

Multidimensional scaling (MDS) is relatively more complicated scaling device, but with this sort of scaling one can scale objects, individuals or both with a minimum of information. Multidimensional scaling (or MDS) can be characterized as a set of procedures for portraying perceptual or affective dimensions of substantive interest. It “provides useful methodology for portraying subjective judgments of diverse kinds.”7 MDS is used when all the variables (whether metric or non-metric) in

a study are to be analyzed simultaneously and all such variables happen to be independent.

The underlying assumption in MDS is that people (respondents) "perceive a set of objects as being more or less similar to one another on a number of dimensions (usually uncorrelated with one another) instead of only one."8 Through MDS techniques one can represent geometrically the locations and interrelationships among a set of points.

In fact, these techniques attempt to locate the points, given the information about a set of interpoint distances, in space of one or more dimensions such as to best summaries the information contained in the inter point distances. The distances in the solution space then optimally reflect the distances contained in the input data. For instance, if objects, say *X* and *Y*, are thought of by the respondent as being most similar as compared to all other possible pairs of objects, MDS techniques will position objects *X* and *Y* in such a way that the distance between them in multidimensional space is shorter than that between any two other objects.

Two approaches, viz., the metric approach and the non-metric approach, are usually talked about in the context of MDS, while attempting to construct a space containing *m* points such that $m(m-1)/2$ interpoint distances reflect the input data. The *metric approach to MDS* treats the input data as interval scale data and solves applying statistical methods for the additive constant* which minimizes the dimensionality of the solution space. This approach utilises all the information in the data in obtaining a solution.

The data (i.e., the metric similarities of the objects) are often obtained on a bipolar similarity scale on which pairs of objects are rated one at a time. If the data reflect exact distances between real objects in an *r*-dimensional space, their solution will reproduce the set of interposing distances. But as the true and real data are rarely available, we require random and systematic procedures for obtaining a solution.

Generally, the judged similarities among a set of objects are statistically transformed into distances by placing those objects in a multidimensional space of some dimensionality. The *non-metric approach* first gathers the non-metric similarities by asking respondents to rank order all possible pairs that can be obtained

from a set of objects. Such non-metric data is then transformed into some arbitrary metric space and then the solution is obtained by reducing the

dimensionality.

In other words, this non-metric approach seeks "a representation of points in a space of minimum dimensionality such that the rank order of the interposing distances in the solution space maximally corresponds to that of the data. This is achieved by requiring only that the distances in the solution be monotone with the input data."9 The non-metric approach has come into prominence during the sixties with the coming into existence of high speed computers to generate metric solutions for ordinal input data.

The significance of MDS lies in the fact that it enables the researcher to study "the perceptual structure of a set of stimuli and the cognitive processes underlying the development of this structure. Psychologists, for example, employ multidimensional scaling techniques in an effort to scale psychophysical stimuli and to determine appropriate labels for the dimensions along which these stimuli vary."10 The MDS techniques, in fact, do away with the need in the data collection process to specify the attribute(s) along which the several brands, say of a particular product, may be compared as ultimately the MDS analysis itself reveals such attribute(s) that presumably underlie the expressed relative similarities among objects.

Thus, MDS is an important tool in attitude measurement and the techniques falling under MDS promise "a great advance from a series of unidimensional measurements (e.g., a distribution of intensities of feeling towards single attribute such as color, taste or a preference ranking with indeterminate intervals), to a perceptual mapping in multidimensional space of objects company images, advertisement brands, etc."

In spite of all the merits stated above, the MDS is not widely used because of the computation complications involved under it. Many of its methods are quite laborious in terms of both the collection of data and the subsequent analyses. However, some progress has been achieved (due to the pioneering efforts of Paul Green and his associates) during the last few years in the use of non-metric MDS in the context of market research problems.

The techniques have been specifically applied in "finding out the perceptual dimensions, and the spacing of stimuli along these dimensions, that people, use in making judgments about the relative similarity of pairs of Stimuli."11 But, "in the long run, the worth of MDS will be determined by the extent to which it advances the behavioral sciences."

11.7 Key Words

Factor: A factor is an underlying dimension that account for several observed variables.

Factor-loadings: Factor-loadings are those values which explain how closely the variables are related to each one of the factors discovered.

Eigen value (or latent root): When we take the sum of squared values of factor loadings relating to a factor, then such sum is referred to as Eigen Value or latent root.

Multi-dimensional scaling (MDS): is a statistical technique that allows researchers to find and explore underlying themes, or dimensions, in order to explain similarities or dissimilarities (i.e. distances) between investigated datasets.

11.8Self-Assessment Questions:

1. Write about various methods of factor analysis
2. Describe the role of multidimensional scaling in research
3. What is the significance of Rotation method and its Assumptions
4. Write a short notes on:

   (i) Factor loading (ii) SEM approach (iii) Eigen value (iv) Factor scores

11.9FurtherReadings

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Lesson Writer:

Ch. Venkateswarlu

LESSON-12

ROLE OF COMPUTERS and STATISTICAL PAKAGES IN RESEARCH

Objectives

After studying the unit you should be able to

- To analyze the role of computers in research
- Explain the use of statistical packages in data analysis

Structure

12.1 Computers Used in Research

Computers have always assisted in solving problems faced by humankind since the time of its invention. The word "Computer" means "something which computes". Today it is being used in every walk of life. There are five main characteristics to the computer; Speed, Accuracy, Automation, Diligence and Storage. Computers are indispensible throughout the research process. The role of computer becomes more when the research is on a large scale.

The collected data can be stored on the computer for immediate use or as a backup in auxiliary storage devices. During data analysis, the computer helps in the mathematical part i.e. calculation of the various statistical methods. There are various software available for calculation purposes like MS-Excel, SPSS, NCSS-PASS, STATA, and Sysat are being popularly used for research data analysis. They can also be used to calculate the sample size of the proposed study, hypothesis testing and calculating the power of the study. Computers are not only useful for statistical analysis, but also to monitor the accuracy and completeness of the collected data.

Computers used in research have the ability to analyze data in ways and at speeds not possible with the human eye. They are able to analyze percentages of materials present in a variety of compounds from soil samples to chemicals and even the air you breathe. Using a computer to perform the statistical analysis has several advantages, from increased accuracy and speed to the versatility and ability to handle large amounts of data.

Informative graphics can also be produced easily, and data can be manipulated easily in terms of mathematical operations and transformations. Problem solving is an age old activity. The development of electronic devices, specially the computers, has given added impetus to this activity. Problems which could not be solved earlier due to sheer amount of computations involved can now are tackled with the aid of computers accurately and rapidly. Computer is certainly one of the most versatile and ingenious developments of the modern technological age.

Today people use computers in almost every walk of life. No longer are they just big boxes with flashing lights whose sole purpose is to do arithmetic at high speed but they make use of studies in philosophy, psychology, mathematics and linguistics to produce output that mimics the human mind. The sophistication in computer technology has reached the stage that it will not be longer before it is impossible to tell whether you are talking to man or machine. Indeed, the advancement in computers is astonishing.

To the researcher, the use of computer to analyses complex data has made complicated research designs practical. Electronic computers have by now become an indispensable part of research students in the physical and behavioral sciences as well as in the humanities. The research student, in this age of computer technology, must be exposed to the methods and use of computers.

A basic understanding of the manner in which a computer works helps a person to appreciate the utility of this powerful tool. Keeping all this in view, the present chapter introduces the basics of computers, especially it. Answers questions like: What is a computer? How does it function? How does one communicate with it? How does it help in analyzing data?

12.2 The Computer and Computer Technology

If you were actually doing a research study, you would by now have reached a stage where you haveeither extracted or collected the required information. The next step is what to do with this information.How do you find the answers to your research questions? How do you make sense of the informationcollected?

How do you prove or disprove your hypothesis if you had one? How should the informationbe analyzed to achieve the objectives of your study? To answer these questions you need to subject yourdata to a number of procedures that constitute the core of data processing

A computer, as the name indicates, is nothing but a device that computes. In this sense, any device, however crude or sophisticated, that enables one to carry out mathematical manipulations becomes a computer. But what has made this term conspicuous today and, what we normally imply when we speak of computers, are electronically operating machines which are used to carry out computations.

In brief, computer is a machine capable of receiving, storing, manipulating and yielding information such as numbers, words, and pictures. The computer can be a digital computer or it can be a analogue computer. A *digital computer* is one which operates essentially by counting (using information, including letters and symbols, in coded form) whereas *the analogue computer* operates by measuring rather than counting.

Digital computer handles information as strings of binary numbers i.e., zeros and ones, with the help of counting process but analogue computer converts varying quantities such as temperature and pressure into corresponding electrical voltages and then performs specified functions on the given signals.

Thus, analogue computers are used for certain specialized engineering and scientific applications. Most computers are digital, so much so that the word computer is generally accepted as being synonymous with the term ‘digital computer’. *Computer technology* has undergone a significant change over a period of four decades.

The present day microcomputer is far more powerful and costs very little, compared to the world’s first electronic computer viz. Electronic Numerical Integrator and Calculator (ENIAC) completed in 1946. The microcomputer works many times

faster, is thousands of times more reliable and has a large memory. The advances in computer technology are usually talked in terms of 'generations'.

Today we have the fourth generation computer in service and efforts are being made to develop the fifth generation computer, which is expected to be ready by 1990. *The first generation computer* started in 1945 contained 18000 small bottle-sized valves which constituted its central processing unit (CPU). This machine did not have any facility for storing programs and the instructions had to be fed into it by a readjustment of switches and wires.

The second generation computer found the way for development with the invention of the transistor in 1947. The transistor replaced the valve in all electronic devices and made them much smaller and more reliable. Such computers appeared in the market in the early sixties. *The third generation computer* followed the invention of integrated circuit (IC) in 1959. Such machines, with their CPU and main store made of IC chips, appeared in the market in the second half of the sixties.

The fourth generation computers owe their birth to the advent of microprocessor—the king of chips—in 1972. The use of microprocessor as CPU in a computer has made real the dream of 'computer for the masses'. This device has enabled the development of microcomputers, personal computers, portable computers and the like. *The fifth generation computer,* which is presently in the developing stage, may use new switch (such as the High Electron Mobility Transistor) instead of the present one and it may herald the era of superconducting computer. It is said that fifth generation computer will be 50 times or so more faster than the present day superfast machines. So far as input devices in computers are concerned, the card or tape-based data entry system has almost been replaced by direct entry devices, such as Visual Display Unit (VDU) which consist of a TV-like screen and a typewriter-like key board which is used for feeding data into the computer.

Regarding output devices, the tele printer has been substituted by various types of low-cost high speed printers. VDU is also used as an output device. For storing data, the magnetic tapes and discs *(*i) First generation computers were those produced between 1945–60 such as IBM 650, IBM 701. (ii) Second generation computers were those produced between 1960–65 such as IBM 1401 Honeywell 40.

12.3 Introduction tocomputerapplications

At present, computers are widely used for varied purposes. Educational, commercial, industrial, administrative, transport, medical, social financial and several other organizations are increasingly depending upon the help of computers to some degree or the other. Even if our work does not involve the use of computers in our everyday work, as individuals, we are affected by them. “The motorists, the air passenger, hospital patients and those working in large departmental stores, are some of the people for whom computers process information.

Everyone who pays for electricity or telephone has their bills processed by computers. Many people who are working in major organizations and receive monthly salary have their salary slips prepared by computers. Thus, it is difficult to find anyone who in some way or the other does not have some information concerning them processed by computer”.

“Computers can be used by just about anyone: doctors, policemen, pilots, scientists, engineers and recently even house-wives. Computers are used not only in numeric applications but also in nonnumeric applications such as proving theorems, playing chess, preparing menu, matrimonial matchmaking and so on. Without computers we might not have achieved a number of things. For example, man could not have landed on the moon nor could he have launched satellites. We might not have built 100 storied buildings or high speed trains and planes.”

12.4 Computers and Researchers

Performing calculations almost at the speed of light, the computer has become one of the most useful research tools in modern times. Computers are ideally suited for data analysis concerning large research projects. Researchers are essentially concerned with huge storage of data, their faster retrieval when required and processing of data with the aid of various techniques. In all these operations, computers are of great help. Their use, apart expediting the research work, has reduced human drudgery and added to the quality of research activity. constitute an indispensable part of their research equipment.

The computers can perform many statistical calculations easily and quickly. Computation of means, standard deviations, correlation coefficients, ‘t’ tests, analysis of variance, analysis of covariance, multiple regression, factor analysis and various

nonparametric analyses are just a few of the programs and subprograms that are available at almost all computer centers.

Similarly, canned programs for linear programming, multivariate analysis, monte carlo simulation etc. are also available in the market. In brief, software packages are readily available for the various simple and complicated analytical and quantitative techniques of which researchers generally make use of. The only work a researcher has to do is to feed in the data he/she gathered after loading the operating system and particular software package on the computer. The output, or to say the result, will be ready within seconds or minutes depending upon the quantum of work.

Techniques involving trial and error process are quite frequently employed in research methodology. This involves lot of calculations and work of repetitive nature. Computer is best suited for such techniques, thus reducing the drudgery of researchers on the one hand and producing the final result rapidly on the other. Thus different scenarios are made available to researchers by computers in no time which otherwise might have taken days or even months.

The storage facility which the computers provide is of immense help to a researcher for he can make use of stored up data whenever he requires doing so. Thus, computers do facilitate the research work. Innumerable data can be processed and analyzed with greater ease and speed. Moreover, the results obtained are generally correct and reliable. Not only this, even the design, pictorial graphing and report are being developed with the help of computers.

Hence, researchers should be given computer education and be trained in the line so that they can use computers for their research work. Researchers interested in developing skills in computer data analysis, while consulting the computer centers and reading the relevant literature must be aware of the following steps:

(i) Data organization and coding;

(ii) Storing the data in the computer;

(iii) Selection of appropriate statistical measures/techniques;

(iv) Selection of appropriate software package;

(v) Execution of the computer program.

A brief mention about each of the above steps is appropriate and can be stated as under:

First of all, researcher must pay attention toward data organization and coding prior to the input stage of data analysis. If data are not properly organized, the researcher may face difficulty while analyzing their meaning later on. For this purpose the data must be coded. Categorical data need to be given a number to represent them.

For instance, regarding sex, we may give number 1 for male and 2 for female; regarding occupation, numbers 1, 2, and 3 may represent Farmer, Service and Professional respectively. The researcher may as well code interval or ratio data. For instance, I.Q. Level with marks 120 and above may be given number 1, 90–119 number 2, 60–89 number 3, 30–59 number 4 and 29 and below number 5. Similarly, the income data classified in class intervals such as Rs. 4000 and above, Rs. 3000–3999, Rs. 2000–2999 and below Rs. 2000 may respectively be represented or coded as 1, 2, 3 and 4.

The coded data are to be put in coding forms (most systems call for a maximum of 80 columns per line in such forms) at the appropriate space meant for each variable. Once the researcher knows how many spaces each variable will occupy, the variables can be assigned to their column numbers (from 1 to 80). If more than 80 spaces are required for each subject, then two or more lines will need to be assigned.

The first few columns are generally devoted for subject identity number. Remaining columns are used for variables. When large number of variables are used in a study, separating the variables with spaces make the data easier to comprehend and easier for use with other programs. Once the data is coded, it is ready to be stored in the computer. Input devices may be used for the purpose. After this, the researcher must decide the appropriate statistical measure(s) he will use to analyze the data.

He will also have to select the appropriate program to be used. Most researchers prefer one of the canned programs easily available but others may manage to develop it with the help

of some specialized agency. Finally, the computer may be operated to execute instructions. The above description indicates clearly the usefulness of computers to researchers in data analysis.

These procedures are the same whether your study is quantitative or qualitative, but what you do within each procedure is different.

For both types of study you need to visualize how you are going to present your findings to your readership in light of its background and the purpose of the study. You need to decide what type of analysis would be appropriate for the readers of your report. It is in light of the purpose of your study and your impression about the level of understanding of your readership that you decide the type of analysis you should undertake.

For example, there is no point in doing a sophisticated statistical analysis if your readers are not familiar with statistical procedures. In quantitative research the main emphasis in data analysis is to decide how you are going to analyze information obtained in response to each question that you asked of your respondents.

In qualitative research the focus is on what should be the basis of analysis of the information obtained; that is, is it contents, discourse, narrative or event analysis? Because of the different techniques used in processing data in quantitative and qualitative research

Researchers, using computers, can carry on their task at faster speed and with greater reliability. The developments now taking place in computer technology will further enhance and facilitate the use of computers for researchers. Programming knowledge would no longer remain an obstacle in the use of a computer. In spite of all this sophistication we should not forget that basically computers are machines that only compute, they do not think. The human brain remains supreme and will continue to be so for all times. As such, researchers should be fully aware about the following limitations of computer-based analysis:

1. Computerized analysis requires setting up of an elaborate system of monitoring, collection and feeding of data. All these require time, effort and money. Hence, computer based analysis may not prove economical in case of small projects.

2. Various items of detail which are not being specifically fed to computer may get lost sight.

3. The computer does not think; it can only execute the instructions of a thinking person. If poor data or faulty programs are introduced into the computer, the data analysis would not be worthwhile. The expression “garbage in, garbage out” describes this limitation very well

12.5 Introduction to Statistical Packages

Statistical packages are collections of software designed to aid in statistical analysis and data exploration. ... Third, statistical packages are more likely to produce correct results than are hand-coded routines. You can use a range of software packages to analyse data - from Access or Excel to dedicated packages, such as SPSS, Stata and R for statistical analysis of quantitative data, Nvivo for qualitative (textual and audio-visual) data analysis (QDA), or ArcGIS for analyzing geospatial data.

The role of statistics in research is sometimes exaggerated. Statistics have a role only when you have collected the required information, adhering to the requirements of each operational step of the research process.

Once data is collected you encounter two questions in a way, the answer to the first question forms the basis for the second. Statistics can play a very important role in answering your research questions in such a manner that you are able to quantify, measure, place a level of confidence on the findings, make an assessment of the contribution each variable has made in bringing out change, measure the association and relationship between various variables, and help predict what is likely to happen in the light of current trends.

From individual responses, particularly if there are many, it becomes extremely difficult to understand the patterns in the data, so it is important for the data to be summarized. Some simple statistical measures such as percentages, means, standard deviations and coefficients of correlation can reduce the volume of data, making it easier to understand. In computing summary measures, certain information is lost and therefore misinterpretation is possible. Hence, caution is required when interpreting data.

Statistics play a vital role in understanding the relationship between variables, particularly when there are more than two. With experience, it is easy to ‘read’ the

relationship between two variables from at able, but not to quantify this relationship. Statistics help you to ascertain the strength of a relationship. They confirm or contradict what you read from a piece of information, and provide an indication of the strength of the relationship and the level of confidence that can be placed in findings.

When there are more than two variables, statistics are also helpful in understanding the interdependence between themand their contribution to a phenomenon or event. Indirectly, knowledge of statistics helps you at each step of the research process. Knowledge of the problems associated with data analysis, the types of statistical test that can be applied to certain types of variable, and the calculation of summary statistics in relation to the measurement scale used plays an important role in a research endeavor. However, you can also carry out a perfectly valid study without using any statistical procedures. This depends upon the objectives of your study.

12.6 The top statistical tools you need to make your data shine

Statistical analysis is very important for all the research or experiments that involve statistics as a research methodology. The vast majority of social sciences and many important researches in natural science and engineering employ statistical analysis. It is also a very useful tool to bring out the approximate solutions to a highly complex or unknown in its true form. In social sciences the statistical analysis is at its heart of the research. Unfortunately, statistical analysis can intentionally or unintentionally used to reach a faulty conclusion. Statistics is just a tool and not a substitute for in-depth analysis and reasoning.

1. SPSS (IBM): SPSS, (Statistical Package for the Social Sciences) is perhaps the most widely used statistics software package within human behavior research.(Statistical Package for the Social Sciences) is perhaps the most widely used statistics software package within human behavior research. SPSS offers the ability to easily compile descriptive statistics, parametric and non-parametric analyses, as well as graphical depictions of results through the graphical user interface (GUI). It also includes the option to create scripts to automate analysis, or to carry out more advanced statistical processing.

2. R (R Foundation for Statistical Computing): R is a free statistical software package that is widely used across both human behavior research and in other fields. Toolboxes (essentially plugins) are available for a great range of applications, which

can simplify various aspects of data processing. While R is very powerful software, it also has a steep learning curve, requiring a certain degree of coding. It does however come with an active community engaged in building and improving R and the associated plugins, which ensures that help is never too far away.

3.MATLAB (The Math works):Mat Lab is an analytical platform and programming language that is widely used by engineers and scientists. As with R, the learning path is steep, and you will be required to create your own code at some point. A plentiful amount of toolboxes are also available to help answer your research questions (such as EEGLab for analyzing EEG data). While Mat Lab can be difficult to use for novices, it offers a massive amount of flexibility in terms of what you want to do – as long as you can code it (or at least operate the toolbox you require).

4. Microsoft Excel: While not a cutting-edge solution for statistical analysis, MS Excel does offer a wide variety of tools for data visualization and simple statistics. It's simple to generate summary metrics and customizable graphics and figures, making it a usable tool for many who want to see the basics of their data. As many individuals and companies both own and know how to use Excel, it also makes it an accessible option for those looking to get started with statistics.

5.SAS: is a statistical analysis platform that offers options to use either the GUI, or to create scripts for more advanced analyses. It is a premium solution that is widely used in business, healthcare, and human behavior research alike. It's possible to carry out advanced analyses and produce publication-worthy graphs and charts, although the coding can also be a difficult adjustment for those not used to this approach.

6. Graph Pad Prism: is premium software primarily used within statistics related to biology, but offers a range of capabilities that can be used across various fields. Similar to SPSS, scripting options are available to automate analyses, or carry out more complex statistical calculations, but the majority of the work can be completed through the GUI.

7.The Minitab software: offers a range of both basic and fairly advanced statistical tools for data analysis. Similar to Graph Pad Prism, commands can be executed through both the GUI and scripted commands, making it accessible to novices as well as users looking to carry out more complex analyses.

There are a range of different software tools available, and each offers something slightly different to the user – what you choose will depend on a range of factors, including your research question, knowledge of statistics, and experience of coding.

These factors could mean that you are at the cutting-edge of data analysis, but as with any research, the quality of the data obtained is reliant upon the quality of the study execution. It's therefore important to keep in mind that while you might have advanced statistical software (and the knowledge to use it) available to you, the results won't mean much if they weren't collected in a valid way.We've put together a guide to experimental design, helping you carry out quality research so that the results you collect can be relied on.

12.7 Key Words

Statistical packages: These are collections of software designed to aid in statistical analysis and data exploration. Statistical packages are more likely to produce correct results than are hand-coded routines.

SPSS (IBM): SPSS, (Statistical Package for the Social Sciences) is perhaps the most widely used statistics software package within human behavior research.

R (R Foundation for Statistical Computing): R is a free statistical software package that is widely used across both human behavior research and in other fields.

SAS: is a statistical analysis platform that offers options to use either the GUI, or to create scripts for more advanced analyses. It is a premium solution that is widely used in business, healthcare, and human behavior research alike.

12.8 Self-Assessment Questions:

1. Describe the role of computers in research
2. Write about various statistical packages used in data analysis
3. What is the significance of statistical packages in data analysis
4. Write a short notes on:

   (i) SPSS (ii) R Programing (iii) SAS

12.9 Further Readings

1. C.R. Kothari "Research Methodology methods and techniques" new age publishers second edition, 2007.

2. Prof. M.V. Kulakarni "Research Methodology" Everest publishing house
3. Davies, Máire Messenger and Nick Mosdel. *Practical Research Methods for Media and Cultural Studies* (New Delhi: Rawat Publications, 2007), 78.
4. Ahuja, Ram. *Research Methods* (New Delhi: Rawat Publications, 2010), 315.
5. Robert Ferber, (ed.), Handbook of Marketing Research, p. 2–471.
6. See, Eleanor W. Willemsen, Understanding Statistical Reasoning, p. 167–168

Lesson Writer:

Ch. Venkateswarlu

LESSON-13

INTERPRETATION OF DATA

Objectives

- After studying the unit you should be able to
- Understand the concept of interpretation
- Knowthe significance of interpretation
- To analyze the steps in data interpretation
- Learn about Precautions in Interpretation

Structure

13.1Meaning of Interpretation

Interpretation states to the task of portrayal inferences from the collected facts after an analytical and/or experimental study. In detail, it is a search for broader meaning of research findings. The task of interpretation has two major aspects viz.,

- The determination to found continuity in research through linking the results of a given study with those of another and
- Theformation 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.

13.2 Why Interpretation?

Interpretation is vital for the simple reason that the usefulness and utility of research findings lie in proper interpretation. It is being considered a basic component of research process because of the following reasons:

(i) To understand the abstract: It is through interpretation that the researcher can well understand the abstract principle that works beneath his findings. Through this he can link up his findings with those of other studies, having the same abstract principle, and thereby can predict about the concrete world of events. Fresh inquiries can test these predictions later on. This way the continuity in research can be maintained.

(ii) Helps in further research: Proper interpretation leads to the establishment of explanatory concepts that can serve as a guide for future research studies; it opens new avenues of intellectual adventure and stimulates the quest for more knowledge.

(iii) It indicates the significance of research: The Researcher can better appreciate only through interpretation why his findings are what they are and can make others to understand the real significance of his research findings.

(iv)Transition from exploratory to experimental research: The interpretation of the findings of exploratory research study often results into hypotheses

for experimental research and as such interpretation is involved in the transition from exploratory to experimental research. Since an exploratory study does not have a hypothesis to start with, the findings of such a study have to be interpreted on a post-factum basis in which case the interpretation is technically described as 'post factum' interpretation.

13.3 Steps in data Interpretation

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) Generalization: The Researcher must give rational explanations of the relations which he has found and he must interpret the lines of relationship in terms of the essential 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 information during the study, the researcher 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) Avoid false generalization: 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.

13.4 Precautions in Interpretation

Any should always remember that even if the data are properly collected and analyzed, 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 (a) the data are appropriate, trustworthy and adequate for drawing inferences; (b) the data reflect good homogeneity; and that (c) 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/or 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. Another major pitfall is the tendency to affirm that definite relationships exist on the basis of confirmation of particular hypotheses.

In fact, the positive test results accepting the hypothesis must be interpreted as "being in accord" with the hypothesis, rather than as "confirming the validity of the hypothesis". The researcher must remain vigilant about all such things so that false generalization may not take place. He should be well equipped with and must know the correct use of statistical measures for drawing inferences concerning his study.

(iii) He 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) He 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." He must pay special attention to this aspect while engaged in the task of interpretation.

13.5 Key Words

Interpretation: States to the task of portrayal inferences from the collected facts after an analytical and/or experimental study.

Generalization: The Researcher must give rational explanations of the relations which he has found and he must interpret the lines of relationship in terms of the essential processes and must try to find out the thread of uniformity.

13.6 Self-Assessment Questions

1. What is the meaning of interpretation?
2. Why Interpretation?
3. Explain essential steps in data interpretation
4. What are the various Precautions in Interpretation

13.7 Further Readings

1. C. William Emory, Business Research Methods, p. 336.
2. Pauline V. Young, Scientific Social Surveys and Research, 4th ed., p. 488.
3. C.R. Kothari "Research Methodology methods and techniques" new age publishers second edition, 2007.
4. Prof. M.V. Kulakarni "Research Methodology" Everest publishing house

Lesson Writer:

Ch. Venkateswarlu

LESSON-14
REPORT WRITING

Objectives

- After studying the unit you should be able to
- Understand the concept of research report
- Know the significance of report writing
- To know the various steps in report writing
- To analyze the different types of reports

Structure

14.1 Layout of the Research Report

Anybody, who is reading the research report, must necessarily be conveyed enough about the study so that he can place it in its general scientific context, judge the adequacy of its methods and thus form an opinion of how seriously the findings are to be taken. For this purpose there is the need of proper layout of the report. The layout of the report means as to what the research report should contain. A comprehensive layout of the research report should comprise (A) Preliminary pages; (B) Main text; and (C) End matter. Let us deal with them separately.

(A) Preliminary Pages

In its preliminary pages the report should carry a title and date, followed by acknowledgements in the form of 'Preface' or 'Foreword'. Then there should be a table of contents followed by list of tables and illustrations so that the decision-maker or anybody interested in reading the report can easily locate the required information in the report.

(B) Main Text

The main text provides the complete outline of the research report along with all details. Title of the research study is repeated at the top of the first page of the main text and then follows the other details on pages numbered consecutively, beginning with the second page. Each main section of the report should begin on a new page. The main text of the report should have the following sections:

(i) Introduction; (ii) Statement of findings and recommendations; (iii) The results; (iv) The implications drawn from the results; and (v) The summary.

(i) Introduction: The purpose of introduction is to introduce the research project to the readers. Itshould contain a clear statement of the objectives of research i.e., enough background should begiven to make clear to the reader why the problem was considered worth investigating. A briefsummary of other relevant research may also be stated so that the present study can be seen in that context. The hypotheses of study, if any, and the definitions of the major concepts employed in the study should be explicitly stated in the introduction of the report.

The methodology adopted in conducting the study must be fully explained. The scientific reader would like to know in detail about such thing: How was the study carried out? What was its basic design? If the study was an experimental one, then what were the experimental manipulations?

If the data were collected by means of questionnaires or interviews, then exactly what questions were asked (The questionnaire or interview schedule is usually given in an appendix)? If measurements were based on observation, then what instructions were given to the observers? Regarding the sample used in the study the reader should be told: Who were the subjects? How many were there? How were they selected?

All these questions are crucial for estimating the probable limits of generalizability of the findings. The statistical analysis adopted must also be clearly stated. In addition to all this, the scope of the study should be stated and the boundary lines be demarcated. The various limitations, under which the research project was completed, must also be narrated.

(ii) Statement of findings and recommendations: After introduction, the research report must contain a statement of findings and recommendations in non-technical language so that it can be easily understood by all concerned. If the findings happen to be extensive, at this point they should be

(iii) Results:A detailed presentation of the findings of the study, with supporting data in the form of tables and charts together with a validation of results, is the next step in writing the main text of the report. This generally comprises the main body of the report, extending over several chapters. The result section of the report should contain statistical summaries and reductions of the data rather than the raw data.

All the results should be presented in logical sequence and splitted into readily identifiable sections. All relevant results must find a place in the report. But how one is to decide about what is relevant is the basic question. Quite often guidance comes primarily from the research problem and from the hypotheses, if any, with which the study was concerned.

But ultimately the researcher must rely on his own judgment in deciding the outline of his report. "Nevertheless, it is still necessary that he states clearly the problem with which he was concerned, the procedure by which he worked on the problem, the conclusions at which he arrived, and the bases for his conclusions."

(iv) Implications of the results: Toward the end of the main text, the researcher should again putdown the results of his research clearly and precisely. He should, state the implications that flowfrom the results of the study, for the general reader is interested in the implications for understanding the human behavior. Such implications may have three aspects as stated below:

(a) A statement of the inferences drawn from the present study which may be expected to apply in similar circumstances.

(b) The conditions of the present study which may limit the extent of legitimate generalizations of the inferences drawn from the study.

(c) The relevant questions that still remain unanswered or new questions raised by the study along with suggestions for the kind of research that would provide answers for them. It is considered a good practice to finish the report with a short conclusion which summarizes and recapitulates the main points of the study.

The conclusion drawn from the study should be clearlyrelated to the hypotheses that were stated in the introductory section. At the same time, a forecast of the probable future of the subject and an indication of the kind of research which needs to be done in that particular field is useful and desirable.

(v) Summary: It has become customary to conclude the research report with a very brief summary, resting in brief the research problem, the methodology, the major findings and the major conclusions drawn from the research results.

(C) End Matter

At the end of the report, appendices should be enlisted in respect of all technical data such as questionnaires, sample information, mathematical derivations and the like ones. Bibliography of sources consulted should also be given. Index (an alphabetical listing of names, places and topics along with the numbers of the pages in a book or report on which they are mentioned or discussed) should invariably be given at the end of the report.

The value of index lies in the fact that it works as a guide to the reader for the contents in the report. Each individual case, both the length and the form are largely dictated by the problems at hand. For instance, business firms prefer reports in the letter form, just one or two pages in length. Banks, insurance organisations and financial institutions are generally fond of the short balance-sheet type of tabulation for their annual reports to their customers and shareholders. Mathematicians prefer to write the results of their investigations in the form of algebraic notations. Chemists report their results in symbols and formulae.

14.2 Significance of Report Writing

a. Research report is considered a major component of the research study for the research task remains incomplete till the report has been presented and/or written.
b. As a matter of fact even the most brilliant hypothesis, highly well designed and conducted research study, and the most striking generalizations and findings are of little value unless they are effectively communicated to others.
c. The purpose of research is not well served unless the findings are made known to others. Research results must invariably enter the general store of knowledge.

d. There are people who do not consider writing of report as an integral part of the research process. But the general opinion is in favor of treating the presentation of research results or the writing of report as part and parcel of the research project.
e. Writing of report is the last step in a research study and requires a set of skills somewhat different from those called for in respect of the earlier stages of research. This task should be accomplished by the researcher with utmost care; he may seek the assistance and guidance of experts for the purpose.

14.3 Different Steps in Writing Report

Research reports are the product of slow, painstaking, accurate inductive work. The usual steps involved in writing report are: (a) logical analysis of the subject-matter; (b) preparation of the final outline; (c) preparation of the rough draft; (d) rewriting and polishing; (c) preparation of the final bibliography; and (f) writing the final draft. Though all these steps are self-explanatory, yet a brief mention of each one of these will be appropriate for better understanding.

(a) Logical analysis of the subject matter: It is the first step which is primarily concerned with the development of a subject. There are two ways in which to develop a subject (a) logically and

(b) chronologically. The logical development is made on the basis of mental connections and associations between the one thing and another by means of analysis. Logical treatment often consists in developing the material from the simple possible to the most complex structures. Chronological development is based on a connection or sequence in time or occurrence. The directions for doing or making something usually follow the chronological order.

(b)Preparation of the final outline: It is the next step in writing the research report "Outlines are the framework upon which long written works are constructed. They are an aid to the logical organization of the material and a reminder of the points to be stressed in the report."3

(c)Preparation of the rough draft: This follows the logical analysis of the subject and the preparationof the final outline. Such a step is of utmost importance for the researcher now sits to write downwhat he has done in the context of his research study. He will write down the procedure adopted by him in collecting the material for his study along with various limitations faced by him, the technique of analysis

adopted by him, the broad findings and generalizations and the various suggestions he wants to offer regarding the problem concerned.

(d)Rewriting and polishing of the rough draft: This step happens to be most difficult part of all formal writing. Usually this step requires more time than the writing of the rough draft. The careful revision makes the difference between a mediocre and a good piece of writing. While rewriting and polishing, one should check the report for weaknesses in logical development or presentation.

The researcher should also "see whether or not the material, as it is presented, has unity and cohesion; does the report stand upright and firm and exhibit a definite pattern, like a marble arch? Or does it resemble an old wall of moldering cement and loose brick." In addition the researcher should give due attention to the fact that in his rough draft he has been consistent or not. He should check the mechanics of writing—grammar, spelling and usage.

(e)Preparation of the final bibliography: Next in order comes the task of the preparation of the final bibliography. The bibliography, which is generally appended to the research report, is a list of books in some way pertinent to the research which has been done.

3 Elliott S.M. Gatner and Francesco Cordasco, Research and Report Writing, p. 37.4 Ibid., p. 50.

It should contain all those works which the researcher has consulted. The bibliography should be arranged alphabetically and may be divided into two parts; the first part may contain the names of books and pamphlets, and the second part may contain the names of magazine and newspaper articles. Generally, this pattern of bibliography is considered convenient and satisfactory from the point of view of reader, though it is not the only way of presenting bibliography. The entries in bibliography should be made adopting the following order:

For books and pamphlets the order may be as under:

1. Name of author, last name first.

2. Title, underlined to indicate italics.

3. Place, publisher, and date of publication.

4. Number of volumes.

Example

Kothari, C.R., Quantitative Techniques, New Delhi, Vikas Publishing House Pvt. Ltd., 1978.

For magazines and newspapers the order may be as under:

1. Name of the author, last name first.

2. Title of article, in quotation marks.

3. Name of periodical, underlined to indicate italics.

4. The volume or volume and number.

5. The date of the issue.

6. The pagination.

Example

Robert V. Roosa, "Coping with Short-term International Money Flows", The Banker, London, September, 1971, p. 995.

The above examples are just the samples for bibliography entries and may be used, but one should also remember that they are not the only acceptable forms. The only thing important is that, whatever method one selects, it must remain consistent.

(f)Writing the final draft: This constitutes the last step. The final draft should be written in a concise and objective style and in simple language, avoiding vague expressions such as "it seems", "there may be", and the like ones. While writing the final draft, the researcher must avoid abstract terminology and technical jargon. Illustrations and examples based on common experiences must be incorporated in the final draft as they happen to be most effective in communicating the research findings to others.

A research report should not be dull, but must enthuse people and maintain interest and must show originality. It must be remembered that every report should be an attempt to solve some intellectual problem and must contribute to the solution of a problem and must add to the knowledge of both the researcher and the reader.

14.4Types of Report

Literatures usually write long reports presenting the critical analysis of some writer or period or the like with a liberal use of quotations from the works of the author under discussion. In the field of education and psychology, the favorite form is the report on the results of experimentation accompanied by the detailed statistical tabulations. Clinical psychologists and social pathologists frequently find it necessary to make use of the case-history form.

News items in the daily papers are also forms of report writing. They represent firsthand on-the scene accounts of the events described or compilations of interviews with persons who were on the scene. In such reports the first paragraph usually contains the important information in detail and the succeeding paragraphs contain material which is progressively less and less important. Book-reviews which analyze the content of the book and report on the author's intentions, his success or failure in achieving his aims, his language, his style, scholarship, bias or his point of view.

Such reviews also happen to be a kind of short report. The reports prepared by governmental bureaus, special commissions, and similar other organisations are generally very comprehensive reports on the issues involved.

Such reports are usually considered as important research products. Similarly, Ph.D. theses and dissertations are also a form of report-writing, usually completed by students in academic institutions. The above narration throws light on the fact that the results of a research investigation can be presented in a number of ways viz., a technical report, a popular report, an article, a monograph or at times even in the form of oral presentation. Which method(s) of presentation to be used in a particular study depends on the circumstances under which the study arose and the nature of the results

A technical report is used whenever a full written report of the study is required whether for recordkeeping or for public dissemination. A popular report is used if the research results have policy implications. We give below a few details about the said two types of reports:

(A) Technical Report

In the technical report the main emphasis is on (i) the methods employed, (it) assumptions made in the course of the study, (iii) the detailed presentation of the

findings including their limitations and supporting data. A general outline of a technical report can be as follows:

1. Summary of results: A brief review of the main findings just in two or three pages.

2. Nature of the study: Description of the general objectives of study, formulation of the problem in operational terms, the working hypothesis, the type of analysis and data required, etc.

3. Methods employed: Specific methods used in the study and their limitations. For instance, in sampling studies we should give details of sample design viz., sample size, sample selection, etc.

4. Data: Discussion of data collected their sources, characteristics and limitations. If secondary data are used, their suitability to the problem at hand be fully assessed. In case of a survey, the manner in which data were collected should be fully described.

5. Analysis of data and presentation of findings: The analysis of data and presentation of the findings of the study with supporting data in the form of tables and charts be fully narrated. This, in fact, happens to be the main body of the report usually extending over several chapters.

6. Conclusions: A detailed summary of the findings and the policy implications drawn from the results be explained.

7. Bibliography: Bibliography of various sources consulted be prepared and attached.

8. Technical appendices: Appendices be given for all technical matters relating to questionnaire, mathematical derivations, elaboration on particular technique of analysis and the like ones.

9. Index: Index must be prepared and be given invariably in the report at the end.The order presented above only gives a general idea of the nature of a technical report; the order of presentation may not necessarily be the same in all the technical reports.

This, in other words, means that the presentation may vary in different reports; even the different sections outlined above will not always be the same, nor will all these sections appear in any particular report. It should, however, be remembered that even in a technical report, simple presentation and ready availability of the findings

remain an important consideration and as such the liberal use of charts and diagrams is considered desirable.

(B) Popular Report

The popular report is one which gives emphasis on simplicity and attractiveness. The simplification should be sought through clear writing, minimization of technical, particularly mathematical, details and liberal use of charts and diagrams. Attractive layout along with large print, many subheadings, even an occasional cartoon now and then is another characteristic feature of the popular report. Besides, in such a report emphasis is given on practical aspects and policy implications. We give below a general outline of a popular report.

1. The findings and their implications: Emphasis in the report is given on the findings of most practical interest and on the implications of these findings.

2. Recommendations for action: Recommendations for action on the basis of the findings of the study is made in this section of the report.

3. Objective of the study: A general review of how the problem arise is presented along with the specific objectives of the project under study.

4. Methods employed: A brief and non-technical description of the methods and techniques used ,including a short review of the data on which the study is based, is given in this part of the report.

5. Results: This section constitutes the main body of the report wherein the results of the study are presented in clear and non-technical terms with liberal use of all sorts of illustrations such as charts, diagrams and the like ones.

6. Technical appendices: More detailed information on methods used, forms, etc. is presented in the form of appendices. But the appendices are often not detailed if the report is entirely meant for general public there can be several variations of the form in which a popular report can be prepared. The only important thing about such a report is that it gives emphasis on simplicity and policy implications from the operational point of view, avoiding the technical details of all sorts to the extent possible.

Type # 1. Formal or Informal Reports:

Formal reports are carefully structured; they stress objectivity and organization, contain much detail, and are written in a style that tends to eliminate such elements as personal pronouns. Informal reports are usually short messages with natural, casual use of language. The internal memorandum can generally be described as an informal report.

Type # 2. Short or Long Reports:

This is a confusing classification. A one-page memorandum is obviously short, and a twenty page report is clearly long. But where is the dividing line? Bear in mind that as a report becomes longer (or what you determine as long), it takes on more characteristics of formal reports.

Type # 3. Informational or Analytical Reports:

Informational reports (annual reports, monthly financial reports, and reports on personnel absenteeism) carry objective information from one area of an organization to another. Analytical reports (scientific research, feasibility reports, and real-estate appraisals) present attempts to solve problems.

Type # 4. Proposal Report:

The proposal is a variation of problem-solving reports. A proposal is a document prepared to describe how one organization can meet the needs of another. Most governmental agencies advertise their needs by issuing “requests for proposal” or RFPs. The RFP specifies a need and potential suppliers prepare proposal reports telling how they can meet that need.

Type # 5. Vertical or Lateral Reports:

This classification refers to the direction a report travels. Reports that more upward or downward the hierarchy are referred to as vertical reports; such reports contribute to anagement control. Lateral reports, on the other hand, assist in coordination in the organization. A report traveling between units of the same organization level (production and finance departments) is lateral.

Type # 6. Internal or External Reports:

Internal reports travel within the organization. External reports, such as annual reports of companies, are prepared for distribution outside the organization.

Type # 7. Periodic Reports:

Periodic reports are issued on regularly scheduled dates. They are generally upward directed and serve management control. Preprinted forms and computer-generated data contribute to uniformity of periodic reports.

Type # 8. Functional Reports:

This classification includes accounting reports, marketing reports, financial reports, and a variety of other reports that take their designation from the ultimate use of the report. Almost all reports could be included in most of these categories. And a single report could be included in several classifications. Although authorities have not agreed on a universal report classification, these report categories are in common use and provide a nomenclature for the study (and use) of reports. Reports are also classified on the basis of their format. As you read the classification structure described below, bear in mind that it overlaps with the classification pattern described above.

i. Preprinted Form:

Basically for **"fill in the blank"** reports, most are relatively short (five or fewer pages) and deal with routine information, mainly numerical information. Use this format when it is requested by the person authorizing the report.

ii. Letter:

Common for reports of five or fewer pages that are directed to outsiders, these reports include all the normal parts of a letter, but they may also have headings, footnotes, tables, and figures. Personal pronouns are used in this type of report.

iii. Memo:

Common for short (fewer than ten pages) informal reports distributed within an organization. The memo format of "Date," "To," "From," and "Subject" is used. Like longer reports, they often have internal headings and sometimes have visual aids. Memos exceeding ten pages are sometimes referred to as memo reports to distinguish them from shorter ones.

iv. Manuscript:

Common for reports that run from a few pages to several hundred pages and require a formal approach, as their length increases, reports in manuscript format require more elements before and after the text of the report. Now that we have surveyed the different types of reports and become familiar with the nomenclature, let us move on to the actual process of writing the report.

14.5 Key Points

Results: A detailed presentation of the findings of the study, with supporting data in the form of tables and charts together with a validation.

Memo: Common for short (fewer than ten pages) informal reports distributed within anorganization

Formal reports: are carefully structured; they stress objectivity and organization, contain much detail, and are written in a style that tends to eliminate such elements as personal pronouns. **Informal reports**: are usually short messages with natural, casual use of language. The internal memorandum can generally be described as an informal report.

14.6 Self-Assessment Questions

1. Describe the layout of the research report
2. Explain the significance of report writing
3. What are the various steps in writing research report
4. Explain different types of report

14.7 Further Readings

1. C. William Emory, Business Research Methods, p. 336.
2. Pauline V. Young, Scientific Social Surveys and Research, 4th ed., p. 488.
3. Robert Ferber, (ed.), Handbook of Marketing Research, p. 2–471.
4. See, Eleanor W. Willemsen, Understanding Statistical Reasoning, p. 167–168
5. C.R. Kothari “Research Methodology methods and techniques” new age publishers second edition, 2007.
6. Prof. M.V. Kulakarni “Research Methodology” Everest publishing house

Lesson Writer:

Ch. Venkateswarlu

LESSON-15

REPORT PRESENTATION

OBJECTIVES:

- After studying the lesson you should be able to
- Understand the concept of report presentation
- Know the significance of report presentation
- To analyze the stages in report presentation
- Learn about factors affecting report presentation

STRUCTURE:

15.1 Introduction to Report Presentation

A presentation is a commitment by the presenter to help the audience do something, to solve a problem. The motivating thing to communication is that in a presentation occurrence of commitment by the presenter and judgment by the audience is simultaneous. The presenter advocates and audience evaluates to render a verdict

In terms of content and structure, presentations and speeches have a virtuous deal in common with formal reports many of them are oral version of a written document. Presentation is a process through which you present some things, some opinions, some designs, some products, some information, some reports, some

findings, etc. to certain individuals or a group of individuals, with a definite purpose and a clear goal in your mind.

The aim is to put the point across audience in a manner, which best serves the company's purpose and that of audience. Therefore, the basic idea is that you should be an effective presenter for which you need to possess the required skills to understand the detailsinvolved in the act of presentation.

15.2 Essential Characteristics of Report Presentation

i. Objective

Start by being clear about your goals, was your report designed primarily to pass along information-perhaps to bring your audience up-to-date or make them aware of some business issues? Or was it intended as a call to action? What specific response do you want from your audience? The answers to those questions will help shape your presentation. Write down your objective. Make it as clear and concise as you can. Keep it to a few sentences, at most.

ii. Audience

Know your audiences thoroughly, check for anything that can affect how they're likely to respond. Find out also what they may be expecting from your report. You'll have to address in your presentation whatever expectations or preconceived notions your audience may have.

iii. Your road map

your best bet is to begin by mapping out the logic underlying the presentation, especially when dealing with extensive and detailed material. Think of this as your road map. It'll help you stay focused on the key elements of your report—the main ideas and messages, the conclusions, and recommendations. List those points from your report that best support your key messages. You don't want to get bogged down in more detail than you'll need in your presentation, so be ruthless in cutting out what you don't need. Remember: you are not presenting the report; you're creating a presentation based on the report.

iv. Structure your talk

When you're dealing with a lengthy report that later will become an oral presentation, it helps to break the material into several distinct parts, based on the structure you've

defined in your road map. That way, you can address each main idea as an entity, before moving on to the next idea. That'll help your listeners better comprehend and remember each key idea. Pay attention here to transitions; these should provide a natural link from one idea or section to another. Your transitions can also serve both as a summary of each section and a glimpse of what's coming nextwith a well-thought-out outline, building the body of your presentation should not pose a great challenge. You should now be able to move on logically, step-by-step, to your conclusion.

v. Create a strong opener.

It's essential that you begin any presentation with a strong opener. It's even more essential when your audience thinks it's about to sit through what could be a long, tedious exposition. You can quickly dispel any such notion with an opener that immediately grabs everyone's attention. So plan your opening comments carefully. Find something in the report—a statement, a claim, a conclusion—that's likely to have a particular impact on this audience.

That may require no more than going straight to the report's key conclusion, and stating it as concisely as you can. You may want to think of an elevator speech. Imagine you've got 10 seconds to make your pitch. What would you say? Once you've got the opener down cold, you can move on smoothly to the body of your presentation.

vi. Keep those visuals lean and mean.

Chances are your report contains lots of detailed data. Be on the alert to include only the most essential data in your visuals. As you create your visuals, keep in mind the fundamental rules. Use only at-a-glance visuals that support your key messages. As much as possible, avoid visuals crowded with lots of data, charts, and graphs that add nothing of real value.

Here again, you'll need to be somewhat ruthless in cutting out all but the most essential material. Remember, your report was compiled as a report. Your job now is to create a successful presentation. That means you'll need everything in the presenter's toolkit, including practicing your non-verbal communication skills as well—like maintaining eye focus and using your voice and gestures to good effect.

15.3Elements of report presentation

1.Be prepared

Being prepared is by far the most important element. How many times do you practice your speech? As a general rule, you should spend about 30 hours of preparation and rehearsal time for every hour you will be speaking. Use a tape recorder or videotape yourself. This will help you to get an accurate picture of how you speak.

2.Give of Yourself

Use personal examples and stories in your speech whenever possible. Make sure your stories help to emphasize or support your point. The stories must match your message. Use examples from your personal and professional life to make your point. In either case be willing to give of yourself by sharing some of yourself with the audience.

3.Stay Relaxed

To stay relaxed you should be prepared. Also, focus on your message and not the audience. Use gestures, including walking patterns. Practice the opening of your speech and plan exactly how you will say it. The audience will judge you in the first 30 seconds they see you.

4.Use Natural Humor

Don't try to be a standup comedian. Use natural humor by poking fun at yourself and something you said or did. Be sure NOT to make fun of anyone in the audience. People will laugh with you when you poke fun at yourself but don't overdo it.

5.Plan Your Body & Hand Positions

During the practice of your speech look for occasions where you can use a gesture, establish three positions where you will stand and practice not only how to move to them but where in your speech do you move. Pick three positions, one on center stage, one to your right, and one to your left. Do not hide behind the lectern. When you do move maintain eye contact with the audience.

6.Pay attention to all details

Make sure you have the right location (school, hotel, room & time). Make sure you know how to get to where you are speaking. Ask how large an audience you will be speaking to. Make sure you bring all your visual aids and plenty of handouts. Arrive early so you can check out where you will be speaking and make any last minute adjustments.

It is very important that you pay attention to even the smallest details. You can never over plan. Remember, "He who fails to plan is planning for failure"

15.4 Factors Affecting Report Presentation

Following factors affect the effectiveness of the presentation:

1) **Audience Analysis**

If the speaker has analyzed the audience in a proper way before presentation, his presentation will be more effective. On the other hand, poor or improper audience analysis leads to ineffective presentation. The style of the presentation is largely dependent upon the type and size of the audience. If audience is large, presentation should be more formal whereas informal presentation can work in small audience.

2) **Communication Environment**

Communication environment affects the effectiveness of the presentations. Much of the audience notices the physical things surrounding the speaker, the stage, lighting arrangement, background, etc. Proper arrangement of these things can enhance the impact of the presentation. If there is noise in the surrounding environment, it detracts the audience from listening and consequently leaves unhealthy messages.

3) **Personal Appearance**

Personal appearance of the speaker has great impact on the audience. Well dressed up person can deliver good presentation. Therefore, the speaker should wear neat and clean clothes and take time to check his appearance just before starting presentation.

4) **Use of Visuals**

Visuals can enhance the professional image of the presentation. Different research studies demonstrate that presenters using latest visual techniques are perceived as better prepared, more persuasive, more credible and more interesting than speakers who do not use visuals. But visuals work only if the technology on which they depend works well. Therefore, presenter should check the equipment in advance before presenting.

5) **Opening and Closing of Presentation**

The beginning and closing of a presentation are the positions of emphasis. Those presenters who can open the presentation with interesting remarks which are likely to create more interest and enthusiasm for listening the presentation. On the other hand, presenters with poor opening are likely to leave the audience bored. Similarly, the ending of the presentation has profound impact on the audience. Endings, with vivid and positive pictures are more likely to have profound impact on the audience.

6) **Organization of Presentation**

Clarity in presentation is essential that comes with proper organization of the information. Organizing the information in a proper manner can make the message more understandable, keep the audience happy and boost the image of the speaker. Proper organization of presentation enhances the effectiveness of the presentation. On the other hand, improper organization of the presentation will not influence the audience. Improper organization of presentation is reflected as follows:

i) Taking a long time to get to the point.
ii) Inclusion of irrelevant material.
iii) Leaving out necessary information.
iv) Mixing up of ideas.

To overcome these problems, presentation can be organized in one of the five standard patterns:

i) **Chronological:** It starts with past, moves to the present and ends by looking ahead.
ii) **Problem-Causes-Solution**

It explains the symptoms of the problem, identifies its causes and suggests the remedial measures.

iii) **Excluding Alternatives**

It shows the symptoms of the problem, suggests possible solutions, explains the reasons why these don't work and ends the discussion with a solution that will work.

iv) **Pros-Cons:** It explains the advantages and disadvantages of problem(s).

v) **1-2-3:** It discusses three aspects of a topic: introduction, body and conclusion.

7) **Language and Words:** The quality of presentation is affected by the language and words. To make the audience understand the message, the speaker has to talk in the language known to the audience. To enhance the impact of presentation, he should choose the catchy words that appeal to the heart and emotions of the audience. If the language spoken by presentation is different from audience's language, and words used are stereotyped, it is likely to have least impact on the audience.

8) **Quality of Voice:** Quality of voice of the presenter affects the effectiveness of the presentation. Voice modulation is likely to have greater impact upon the audience whereas monotonous voice will bore the audience.

9) **Body Language:** The effectiveness of the presentation is also affected by the body language of the speaker. A speaker having eye contact with audience is likely to impress more than a speaker reading out the handouts. A speaker who looked more at the audience is judged as better informed, more experienced, more honest and friendliest than a speaker who delivers the speech with less eye contact. With eye contact members of audience feel that speaker is talking to them.

Similarly, confidently moving speakers are likely to have more impact than nervous speakers. To calm one's nervousness, one should be well-prepared, take several deep breaths, relax one's muscles, pause and look at the audience and use body energy in strong gestures and movement.

10) **Answering Questions:** The effectiveness of presentation is also affected by

presenter's skill in handling questions asked at the end of presentation. A speaker who answers the audience's questions and handles hostile questions with tact is likely to influence the audience more. On the other hand, a speaker who answers rudely will leave negative impact upon the audience.

15.5 Techniques of Report Presentation

1. Use visual aids

Using pictures in your presentations instead of words can double the chances of meeting your objectives.

2. Keep it short and sweet

There is an old adage that said – "No one ever complained of a presentation being too short." Nothing kills a presentation more than going on too long.There are some college professors who will penalize a short presentation (most lecturers see no problem in droning on), but for most people a shorter presentation is better. Keep your presentation to less than 22 minutes if you can.

3. Use the rule of three

A simple technique is that people tend to only remember three things. Work out what the three messages that you want your audience to take away and structure your presentation around them. Use a maximum of three points on a slide.

4. Rehearse

Practice makes for perfect performance. Many experts say that rehearsal is the biggest single thing that you can do to improve your performance. Perform your presentation out loud at least four times. One of these should be in front of a real scary audience. Family, friends or colleagues. Even the dog is better than nothing.

5. Tell stories

All presentations are a type of theatre. Tell stories and anecdotes to help illustrate points. It all helps to make your presentation more effective and memorable.

6. Lose the bullet points – don't put your speaker notes up on the screen

Bullet points are the kiss of death for most presentations. Most people use bullet points as a form of speaker notes. To make your presentation more effective put your speaker notes in your notes and not up on the screen.

7. Video yourself

Set up a video camera and video yourself presenting. You will see all sorts of mistakes that you are making, from how you are standing, if you are jangling keys, to how well your presentation is structured.

8. Know what slide is coming next

You should always know when presenting which slide is coming up next. It sounds very powerful when you say "On the next slide you will see.", rather than a period of confusion when the next slide appears.

9. Have a back-up plan

Murphy's Law normally applies during a presentation. Technology not working, power cuts, projector blowing a bulb, spilling coffee on your front, not enough power leads, no loudspeakers, presentation displays strangely on the laptop – all of these are things that have happened in presentations that I have given.

Have a back-up plan. Take with you the following items – a printed out set of slides – (you can hold these up to the audience if you need to), a CD or data stick of your presentation, a laptop with your slides on it. Just in case it goes wrong.

10. Check out the presentation room

Arrive early and check out the presentation room. If you can make sure that you see your slides loaded onto the PC and working on the screen. Work out where you will need to stand.Do you agree or disagree with any of these effective presentation techniques? Have you have any experiences like this? Add it in to the comments box below.

15.6 Stages of Report Presentation

1. Determine the purpose of your presentation and identify your own objectives.
2. Know your audience and what it knows.
3. Define your topic.
4. Arrange your material in a way that makes sense for your objectives.
5. Compose your presentation.
6. Create visual aids.

7. Practice your presentation (don't forget to time it!)
8. Make necessary adjustments.
9. Analyze the room where you'll be giving your presentation (set-up, sight lines, equipment, etc.).
10. Practice again.

15.7 Guidelines for Report Presentation

- Summarize your research succinctly: stating your thesis, argument, purpose, and research methods.
- Present the evidence that supports your thesis.
- Point out any conclusions you have reached.
- Explain the larger significance of your research for your field.

15.8 Key Points

Body Language: The conscious and unconscious use of the body to communicate messages to others. Body language is a type of non-verbal communication and differs from speech in that the message is holistic. During a presentation, the eyes, hands & arms, face and body posture is typically used to convey body language.

Chronemics: The study of how humans use time to convey messages. For example, during a presentation, a speaker may pause at certain points in order to convey a change in topic to the audience.

Intonation: Intonation is the rise and fall of the pitch of the voice over a stretch of speech

Kinesics: The study of body language.

Pitch: The perceptual correlate of frequency. Pitch is how humans perceive the frequency of speech and how it increases or decreases. It is a subjective measure.

15.9 Self-Assessment Questions

1. What are the essential characteristics of report presentation?
2. Explain various elements of report presentation
3. What are the various factors affecting report presentation
4. What are the techniques of report presentation?

5. Describe the stages of report presentation

6. Explain various guidelines for report presentation

15.10 Further Readings

1. Pauline V. Young, Scientific Social Surveys and Research, 4th ed., p. 488.
2. Robert Ferber, (ed.), Handbook of Marketing Research, p. 2–471.
3. C.R. Kothari "Research Methodology methods and techniques" new age publishers second edition, 2007.

Lesson Writer:

Ch. Venkateswarlu