JEPPIAAR
ENGINEERING COLLEGE

DEPARTMENT OF MANAGEMENT STUDIES

I YEAR / II SEMESTER

MB25C08: BUSINESS RESEARCH METHODS

STUDY MATERIAL – NOTES

Faculty In charge

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Regulation 2025

JEPPIAAR ENGINEERING COLLEGE

DEPARTMENT OF MANAGEMENT STUDIES

VISION

To build Jeppiaar Engineering College as an institution of academic excellence in technology and management education, leading to become a world class university..

MISSION

- To excel in teaching and learning, research and innovation by promoting the principles of scientific analysis and creative thinking.
- To participate in the production, development and dissemination of knowledge and interact with national and international communities.
- To equip students with values, ethics and life skills needed to enrich their lives and enable them to contribute for the progress of society.
- To prepare students for higher studies and lifelong learning, enrich them with the practical skills necessary to excel as future professionals and entrepreneurs for the benefit of Nation's economy.

PROGRAMMEEDUCATIONALOBJECTIVES(PEOS):

MBA programme curriculum is designed to prepare the post graduate students

- To have a thorough understanding of the core aspects of the business.
- To provide the learners with the management tools to identify, analyze and create business opportunities as well as solve business problems.
- To prepare them to have a holistic approach towards management functions.
- To inspire and make them practice ethical standards in business.

PROGRAMMEOUTCOMES(POS)

On successful completion of the programme,

1. Ability to apply the business acumen gained in practice.
2. Ability to understand and solve managerial issues.
3. Ability to communicate and negotiate effectively, to achieve organizational and individual goals.
4. Ability to understand one's own ability to set achievable targets and complete them.
5. Ability to fulfill social outreach
6. Ability to take up challenging assignments

COURSE OUTCOMES (COs)

1. Students will understand and appreciate scientific inquiry
2. Students would know to write research proposals
3. The students would be able to undertake a systematic outlook towards business situations for the purpose of objective decision making, and the method of conducting scientific inquiry to solve organizational problems
4. Students would be able to analyze data and find solutions to the problems.
5. Students could prepare research reports

BA4205 BUSINESS RESEARCH METHODS

UNIT I INTRODUCTION 9

Business Research – Definition and Significance – the research process – Types of Research – Exploratory and causal Research – Theoretical and empirical Research – Cross – Sectional and time – series Research – Research questions / Problems – Research objectives – Research hypotheses – characteristics – Research in an evolutionary perspective – the role of theory in research.

UNIT II RESEARCH DESIGN AND MEASUREMENT 9

Research design – Definition – types of research design – exploratory and causal research design – Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and scaling – Different scales – Construction of instrument – Validity and Reliability of instrument.

UNIT III DATA COLLECTION 9

Types of data – Primary Vs Secondary data – Methods of primary data collection – Survey Vs Observation – Experiments – Construction of questionnaire and instrument – Validation of questionnaire – Sampling plan – Sample size – determinants optimal sample size – sampling techniques – Probability Vs Non–probability sampling methods.

UNIT IV DATA PREPARATION AND ANALYSIS 9

Data Preparation – editing – Coding –Data entry – Validity of data – Qualitative Vs Quantitative data analyses – Bivariate and Multivariate statistical techniques – Factor analysis – Discriminant analysis – cluster analysis – multiple regression and correlation – multidimensional scaling – Application of statistical software for data analysis.

UNIT V REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH 9

Research report – Different types – Contents of report – need of executive summary – chapterization – contents of chapter – report writing – the role of audience – readability – comprehension – tone – final proof – report format – title of the report – ethics in research – ethical behaviour of research – subjectivity and objectivity in research.

TEXT BOOKS

1. Donald R. Cooper, Pamela S. Schindler and J K Sharma, Business Research methods, 11th Edition, Tata McGraw Hill, New Delhi, 2012.
2. Alan Bryman and Emma Bell, Business Research methods, 3rd Edition, Oxford University Press, New Delhi, 2011.
3. Uma Sekaran and Roger Bougie, Research methods for Business, 5th Edition, Wiley India, New Delhi, 2012.
4. William G Zikmund, Barry J Babin, Jon C.Carr, AtanuAdhikari,Mitch Griffin, Business Research methods, A South Asian Perspective, 8th Edition, Cengage Learning, New Delhi, 2012.
5. Panneerselvam. R, Research Methodology, 2nd Edition, PHI Learning, 2014

UNIT I

UNIT I INTRODUCTION

Business Research – Definition and Significance – the research process – Types of Research – Exploratory and causal Research – Theoretical and empirical Research – Cross – Sectional and time – series Research – Research questions / Problems – Research objectives – Research hypotheses – characteristics – Research in an evolutionary perspective – the role of theory in research.

CO-PO AND BLOOMS TAXONOMY

Lecture No	Concept	CO	PO	Blooms Taxonomy
1	Business Research – Definition and Significance	CO1	1,2,6	K1, K2
2	The research process	CO1	1,2,6	K2,K3
3	Types of Research Exploratory and causal Research – Theoretical and empirical Research	CO1	1,2,6	K2, K3
4	Types of Research – Cross –Sectional and time – series Research	CO1	1,2,6	K2, K3
5	Research questions / Problems	CO1	1,2,6	K3.K4,K5,K6
6	Research objectives	CO1	1,2,6	K3.K4,K5,K6
7	Research hypotheses – characteristics	CO1	1,2,6	K3.K4,K5,K6
8	Research in an evolutionary perspective	CO1	1,2,6	K2
9	The role of theory in research	CO1	1,2,6	K2

LECTURE NO ONE

Business Research – Definition:

The Advanced Learner's Dictionary of Current English lays down the meaning of research as "a careful investigation or inquiry especially through search for new facts in any branch of knowledge." Redman and Mory define research as a "systematized effort to gain new knowledge."

Features of Research:

- It means the discovery of new knowledge
- Is essentially an investigation
- Is related with the solution of a problem
- It is based on observation or experimental evidences.
- It demands accurate observation or experimentation.
- In research, the researchers try to find out answers for unsolved questions
- It should be carefully recorded and reported

Purpose / Aims / Objectives of Research

1. To find out the truth which is hidden and which has not been discovered so far.
2. Aims at advancing systematic knowledge and formulating basic theories about the forces influencing the relation between groups as well as those acting on personality development and is adjustment with individuals.
3. Try to improve tools of analysis or to test these against the complex human behaviour and institutions.
4. To understand social life and thereby to gain a greater measure of control over social behaviour.
5. To provide an educational program in the accumulated knowledge of group dynamics, in skills of research, in techniques of training leaders and in social action.

Criteria of Good Research:

Whatever may be the types of research works and studies, one thing that is important is that they all meet on the common ground of scientific method employed by them. One expects scientific research to satisfy the following criteria:

1. The purpose of the research should be clearly defined and common concepts be used.
2. 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.
3. The procedural design of the research should be carefully planned to yield results that are as objective as possible.
4. The researcher should report with complete frankness, flaws in procedural design and estimate their effects upon the findings.
5. 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.

6. 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.
7. Greater confidence in research is warranted if the researcher is experienced, has a good reputation in research and is a person of integrity.

Qualities of a good research

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.

Motivation in research:

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

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

However, this is not an exhaustive list of factors motivating people to undertake research studies. Many more factors such as directives of government, employment conditions, curiosity about new things, desire to understand causal relationships, social thinking and awakening, and the like may as well motivate (or at times compel) people to perform research operations.

Limitations of Research

- It is based on sample & sampling research lacks the complete accuracy.
- Long time is required in the research procedures.
- Difficult to evaluate the economic benefits derived from the research.
- Trained personnel and a lot of time are required for research.
- Lack of adequate knowledge of research.
- Conclusions in research are based upon data collected. Therefore when the data collected are not valid or adequate, the conclusion will not be conclusive or appropriate.

- Research results in theory
- Activities in a society are influenced by various internal and external factors Small organizations cannot afford to have research on various issues. Many people in society depend on customs, traditions, routines and practices for taking decision; instead of going for research.
- Research is usually based on sample studies. But in many cases samples are not true representatives. Therefore the research reports based on these samples may not be accurate.

Significance of research:

(a) To those students who are to write a master's or Ph.D. thesis, research may mean careerism or a way to attain a high position in the social structure;

(b) To professionals in research methodology, research may mean a source of livelihood;

(c) To philosophers and thinkers, research may mean the outlet for new ideas and insights;

(d) To literary men and women, research may mean the development of new styles and creative work;

(e) To analysts and intellectuals, research may mean the generalisations of new theories.

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

PROBLEMS ENCOUNTERED BY RESEARCHER IN INDIA:

- The lack of a scientific training in the methodology of research
- Insufficient interaction between the university research departments on the side and business establishments, governments department, and research institution on the other side.
- The business unit do not have confidence that the information supplied by them to researchers will be misused and so such they are often reluctant in supplying the needed information to researchers.
- Research studies overlapping one another are undertaken quite often for want of adequate information.
- There does not exist a code of conduct for researcher
- The difficult of adequate and timely secretarial assistance.
- Library management and functioning is not satisfactory at many place.
- There is also the problem that many of our libraries are not able to get copies of old and new Acts/ rules, reports and other government publications in time.
- There is also the difficulty of timely availability of published data.
- There may at times take place the problem of conceptualization.

HALLMARKS OF SCIENTIFIC RESEARCH

Purposiveness

- Research must be started with a definite, clear aim, objective and purpose.
- Research findings must be beneficial for organization.

- For example an increase in employee commitment will be beneficial for Organization.It will translate into less turnover, less absenteeism, and increased performance levels

Rigor

- Rigor connotes carefulness during research.
- It also refers to degree of exactitude in research investigations.
- Chosen sample should be true representative of whole organization.
- Method adopted for collecting data should be appropriate.
- Research process should be free from personal and emotional biases.

Testability

- Testability refers that hypothesis must be testable.
- Hypotheses are tentative yet testable statements.
- They are derived from theory or theory based.
- It must be able to testify by applying certain statistical tests experimentally.

Replicability

- Results should be supported again and again when the same type of research is repeated in other similar circumstances.
- Replicability will gain confidence in the scientific nature of our research.
- Replicability brings exactitude and accuracy in research findings.

Precision and Confidence

- Precision refers to the closeness of the findings to reality.
- Precision reflects the degree of accuracy of the results .
- We ensures that our findings are close to reality.
- So that we can place reliance or confidence in the results.
- In social sciences confidence level is 95%.

Objectivity

- The conclusions drawn from information should be objective.
- The findings should be based on the facts .
- The more objective the interpretation of the data, the more scientific the research investigation becomes.

Generalizability

- Generalizability refers to the scope of applicability of the research findings in one organizational setting to other settings.
- The wider the range of applicability of the solutions generated by research, the more useful the research is to the users.

Parsimony

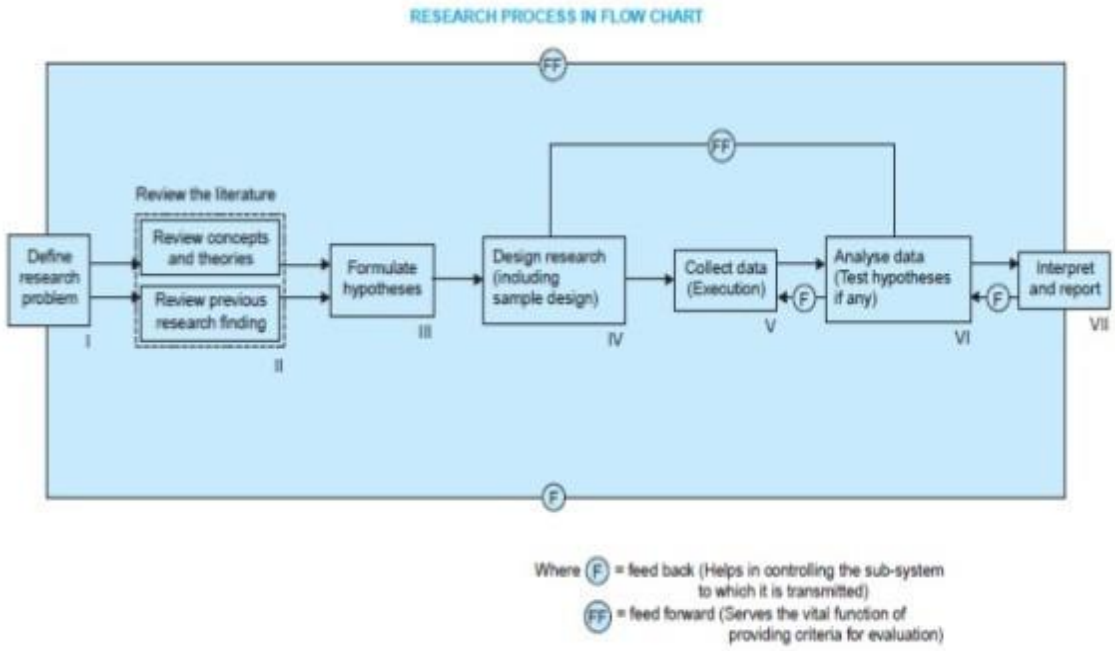
- Parsimony refers to simplicity in explaining the phenomena or problems that occur.
- It is Level of understanding in generating solutions for the problems.
- Economy in research models is achieved when we can build a lesser number of variables.
- Those variables would explain the variance far more efficiently than a complex set of variables.

LECTURE NO TWO

RESEARCH PROCESS:

Research process consists of a series of steps or actions required for effectively conducting research. The following are the steps that provide useful procedural guidelines regarding the conduct of research:

Research Process Flow Chart



1. Identifying, Evaluating and Formulating the Research Problems-:

After creating interest in a research work, a researcher has to think about formulating the problem related to his research work. Choosing a correct problem for study is the most important step in the entire research process. After selecting the problem, the researcher has to formulate the problem.

2. Extensive Literature Survey:-

Before formulating the research it is desirable that researcher examines all available literature, both conceptual and empirical. The conceptual literature is one which deals with concepts and theories. Empirical literature is that which contains studies made earlier and so it consists of many facts and figures observed in the earlier studies.

3. Writing a Primary Synopsis:-

After formulating the problems a brief summary of it should be written down. A research worker has to write a synopsis of the topic selected for research work mentioning the summary of what is going to be done under his research.

4. Indentifying and Labeling Variables: -

In any research the problem under study deals with relation between variables. The variables whose change has affected the other variable, is called independent variable. Therefore there is a cause and effect relation between the variables. The research problem

must be formulated in such a manner that it highlights the nature, extent and implications of relation existing between the variables. It is only through this process of establishing the effective relation between variables that meaningful conclusions are derived from the study.

5. Setting Up Of Hypothesis:

Specification of working hypothesis is a basic step in the research process. A hypothesis is a tentative conclusion logically drawn. The research work is conducted to test the truth of this hypothesis.

6. Preparing the Research Design:-

A research design is a plan that specifies the sources and types of information relevant to the research problem. It is a strategy which approach will be used for gathering and analyzing the data. It includes the time and cost budgets since most studies are done under these two constraints. A research design provides a rational approach to research enabling one to decide in advance what to do, how to do, in investigating the subjects.

7. Determining the Sample Design:-

A sample design is a definite plan determined before any data are actually collected for obtaining a sample from a given universe. Sample design refers to the technique or the procedure which the researcher would adopt in selecting some sampling units from the universe for drawing inferences about the universe. If the proper procedure is followed to select the sample, definitely the sample will give all dependable information.

8. Collecting of Data: -

There are several ways of collecting the appropriate data. Some of the methods of collecting primary data are (1) Observation method. (2) Direct personal interview method. (3) Telephone interview method. (4) Questionnaire method. (5) Schedule method. A choice of one of these methods.

9. Execution of the Project: -

The researcher has to see that the project is executed in a systematic manner and in time. He should make necessary preparations for successful conduct of the project.

10. Processing, Analysis and Interpretation of Data by Statistical Methods: -

The processing of data consists of classification, tabulation and coding. By classification and tabulation the unwieldy data can be condense into few manageable and purposeful groups and tables so that further analysis becomes simple. Coding converts the data into symbols and small figures so that the data can be dealt with in an easy manner. Editing improves the quality of the data since it is at this stage that data which is irrelevant can be dropped. Analysis and interpretation of data results in observation, analysis, conclusion, induction and deduction. For this various statistical measures are computed.

11. Testing of Hypothesis: -

Depending upon the nature of data and conclusions to be arrived one or two of these tests can be applied. Testing of hypothesis will results in either accepting or rejecting the hypothesis. Testing of hypothesis may prove or disprove a theory and a theory facilitates formulating of a further hypothesis. Testing of hypothesis will result in contribution to existing theory or the generation of a new theory.

12. Preparation of the Report or Thesis:-

A report is a detailed description of what has been done and how it has been done with respect to a particular area or topic. The report should contain the preliminary section, the main body and the end matter. The preliminary section contains only titles, data, acknowledgement foreword and table of contents. The important section of a report is its main body. It carries introduction, methodology, and statements of findings, conclusions and recommendations. The end matter includes appendix, literature selected and bibliography. The appendix includes letters, questions or other tools used. Bibliography is the list of books, journals. Reports, bulletins etc. used for reference.

LECTURE NO THREE

TYPES OF RESEARCH:

There are different types of research. The basic ones are as follows.

- **Applied research** : is also known as decisional research, use existing knowledge as an aid to the solution of some given problem or set of problems. An attempt to find a solution to an immediate problem encountered by a firm, an industry, a business organisation, or the society is known as applied research. Researchers engaged in such researches aim at drawing certain conclusions confronting a concrete social or business problem.
- **Fundamental research**, frequently called basic or pure research, seeks to extend the boundaries of knowledge in a given area with no necessary immediate application to existing problems. Researches relating to pure mathematics or concerning some natural phenomenon are examples
- **Futuristic research**: Futures research is the systematic study of possible future conditions. It includes analysis of how those conditions might change as a result of the implementation of policies and actions, and the consequences of these policies and actions.
- **Descriptive research** includes surveys and fact-finding enquiries of different kinds. It tries to discover answers to the questions who, what, when and sometimes how. Here the researcher attempts to describe or define a subject, often by creating a profile of a group of problems,people, or events. The major purpose of descriptive research is description of the state of affairs as it exists at present The term 'ex post facto research' is quite often used for descriptive research studies in social sciences and business research.
- **Explanatory research**: Explanatory research goes beyond description and attempts to explain the reasons for the phenomenon that the descriptive research only observed. The research would use theories or at least hypothesis to account for the forces that caused a certain phenomenon to occur.
- **Predictive research**: If we can provide a plausible explanation for an event after it has occurred, it is desirable to be able to predict when and in what situations the event will occur. This research is just as rooted in theory as explanation. This research calls for a high order of inference making. In business research, prediction is found in studies conducted to evaluate specific courses of action or to forecast current and future values.
- **Analytical research**: The researcher has to use facts or information already available, and analyse these to make a critical evaluation of the material.
- **Quantitative research**: Quantitative research is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity

LECTURE NO FOUR

- **Cross-Sectional Design**
  A cross-sectional design is used for research that collects data on relevant variables one time only from a variety of people, subjects, or phenomena.A cross-sectional designs provides a snapshot of the variables included in the study, at one particular point in time.
- **Longitudinal:** A longitudinal design collects data over long periods of time. Measurements are taken on each variable over two or more distinct time periods. This allows the researcher to measure change in variables over time.
- **Fundamental:** Mainly concerns generalizations and formulation of a theory. In other words, "Gathering knowledge for knowledge's sake is termed 'pure' or 'basic' research" (Young in Kothari, 1988). Researches relating to pure mathematics or concerning some natural phenomenon are instances of Fundamental Research. Likewise, studies focusing on human behaviour also fall under the category of fundamental research.
- **Quantitative:** Quantitative research relates to aspects that can be quantified or can be expressed in terms of quantity. It involves the measurement of quantity or amount. Various available statistical and econometric methods are adopted for analysis in such research. Which includes correlation, regressions and time series analysis etc,.
- **Qualitative:** Qualitative research is concerned with qualitative phenomena, or more specifically, the aspects related to or involving quality or kind. For example, an important type of qualitative research is 'Motivation Research', which investigates into the reasons for certain human behaviour. The main aim of this type of research is discovering the underlying motives and desires of human beings by using in-depth interviews. The other techniques employed in such research are story completion tests, sentence completion tests, word association tests, and other similar projective methods. Qualitative research is particularly significant in the context of behavioural sciences, which aim at discovering the underlying motives of human behaviour.
- **Conceptual :**The research related to some abstract idea or theory is known as Conceptual Research. Generally, philosophers and thinkers use it for developing new concepts or for reinterpreting the existing ones.
- **Empirical:** Empirical Research, relies on the observation or experience with hardly any regard for theory and system. Such research is data based, which often comes up with conclusions that can be verified through experiments or observation. Empirical research is also known as experimental type of research, in which it is important to first collect the facts and their sources, and actively take steps to stimulate the production of desired information.
- **Time Series**

A Time Series research collects data on the same variable at regular intervals in the form of aggregate measures of a population. Time series designs are useful for:

- establishing a baseline measure
- describing changes over time
- keeping track of trends
- forecasting future (short term) trends

- **Historical research** is research involving analysis of events that occurred in the remote or recent past. Historical research can show patterns that occurred in the past and over time which can help us to see where we came from and what kinds of solutions we have used in the past. Understanding this can add perspective on how we examine current events and educational practices.

LECTURE NO FIVE

RESEARCH PROBLEMS

Refers to some difficulty which a researcher experiences in the context either a theoretical or practical situation and wants to obtain solution for the same

Characteristics of a Good Research Problem:

- **Clarity:** The problem should be clearly and concisely stated, leaving no room for ambiguity.
- **Significance:** The problem should address an important issue or contribute to the existing body of knowledge.
- **Feasibility:** The problem should be researchable within the available resources and time constraints.
- **Specificity:** The problem should be focused and well-defined, avoiding vague or overly broad statements.
- **Relevance:** The problem should be relevant to the researcher's field of study and have potential implications for practice or policy.

Types of Research Problems:

- **Theoretical:** These problems focus on advancing our understanding of fundamental concepts and theories.
- **Applied:** These problems seek to solve practical problems or address real-world challenges.
- **Descriptive:** These problems aim to describe a phenomenon or explore its characteristics.
- **Relational:** These problems investigate the relationships between different variables or phenomena.

Identifying Research Problems:

- **Literature Review:** Examining existing research can reveal gaps in knowledge or areas where further investigation is needed.
- **Observations:** Observing real-world situations or phenomena can spark ideas for research problems.
- **Discussions:** Talking to experts, colleagues, or community members can help identify relevant research problems.
- **Personal Experiences:** Reflecting on personal experiences or challenges can lead to the identification of research problems.

Formulating Research Problems:

- **Start with a broad area of interest:** Identify a general topic that you are passionate about or that is relevant to your field.
- **Narrow down the focus:** Refine your area of interest into a more specific and manageable research problem.
- **State the problem clearly:** Express the research problem in a concise and unambiguous statement.
- **Consider the scope:** Determine the boundaries of your research problem and what aspects you will focus on.

Evaluating Research Problems:

- **Is the problem clear and well-defined?**
- **Is the problem significant and relevant?**
- **Is the problem feasible to research?**
- **Is the problem original and novel?**
- **Does the problem align with your interests and expertise?**

By carefully considering these factors, researchers can identify and formulate research problems that are both meaningful and researchable, ultimately contributing to the advancement of knowledge and the solution of real-world problems.

Components of a Research Problem

- There must be an individual or a group which has some difficulty or the problem
- There must be some objectives to be attained at.
- There must be alternative means for obtaining the objectives one wishes to attain
- There must remain some doubt in the mind of a researcher with regard to the selection of alternatives
- There must be some environment to which the difficulty pertains

Steps in Research Problem

- Statement of the problem in a general way
- Understanding the nature of the problem
- Surveying the available literature
- Formulating the ideas through discussions
- Finalizing the research problem

LECTURE NO SIX

Research Question

Research questions are the driving force behind any research project. They are the specific questions that a researcher seeks to answer through their study. A well-crafted research question is essential for guiding the research process and ensuring that the study yields meaningful results.

Key Characteristics of a Good Research Question:

- **Clarity:** The question should be clearly and concisely stated, leaving no room for ambiguity.
- **Focus:** The question should be specific and well-defined, avoiding vague or overly broad statements.
- **Complexity:** The question should be complex enough to require investigation and analysis, rather than a simple yes or no answer.
- **Relevance:** The question should be relevant to the research topic and have potential implications for the field of study.
- **Feasibility:** The question should be researchable within the available resources and time constraints.

Types of Research Questions:

- **Descriptive:** These questions aim to describe a phenomenon or explore its characteristics.
- **Comparative:** These questions compare two or more groups or phenomena.
- **Correlational:** These questions investigate the relationships between different variables.
- **Causal:** These questions seek to determine cause-and-effect relationships.

Formulating Research Questions:

- **Start with a broad topic:** Identify a general area of interest or a research problem that you want to address.
- **Narrow down the focus:** Refine your topic into a more specific and manageable research question.
- **Consider the type of research:** Determine whether you will be conducting qualitative or quantitative research, as this will influence the type of research question you formulate.
- **Use question words:** Start your research question with words like "what," "how," "why," "when," or "where."
- **Be specific:** Clearly define the variables or phenomena you are interested in studying.
- **Consider the scope:** Ensure that your research question is feasible to answer within the available resources and time constraints.

Examples of Research Questions:

- **Descriptive:** What are the key characteristics of social media use among adolescents?
- **Comparative:** How does online learning compare to traditional classroom learning in terms of student outcomes?
- **Correlational:** Is there a relationship between social media use and mental health among young adults?
- **Causal:** Does exposure to violent video games increase aggression in children?

Evaluating Research Questions:

- **Is the question clear and focused?**
- **Is the question complex and researchable?**
- **Is the question relevant and significant?**
- **Is the question feasible to answer?**
- **Does the question align with the research topic and objectives?**

By carefully crafting well-defined research questions, researchers can ensure that their studies are focused, meaningful, and contribute to the advancement of knowledge in their respective fields.

LECTURE NO SEVEN

HYPOTHESIS:

"Hypothesis may be defined as a proposition or a set of propositions set forth as an explanation for the occurrence of some specified group of phenomena either asserted merely as a provisional conjecture to guide some investigation in the light of established facts" (Kothari, 1988). A research hypothesis is quite often a predictive statement, which is capable of being tested using scientific methods that involve an independent and some dependent variables. For instance, the following statements may be considered:

i. "Students who take tuitions perform better than the others who do not receive tuitions" or,

ii. "The female students perform as well as the male students".

These two statements are hypotheses that can be objectively verified and tested. Thus, they indicate that a hypothesis states what one is looking for. Besides, it is a proposition that can be put to test in order to examine its validity.

Role of Hypothesis:

- It guides the direction of the study
- It identifies facts that are relevant and those that are not
- It suggests which form of research design is likely to be most appropriate
- It provides a frame work for organising the conclusions that result

Different Types of Hypothesis:

- **Null Hypothesis** – it points out there is no difference between two populations in respect of same property.
- **Alternative Hypothesis-** when we reject the null hypothesis, we accept another hypothesis known as alternate hypothesis.
- **Descriptive Hypothesis** – Describing the characteristics of a variable (may be an object, person, organisation, event, and situation) • Eg. Employment opportunity of commerce graduates is more than the arts students.
- **Relational Hypothesis** – Establishes relationship between two variables. It may be positive, negative or nil relationship. Eg. High income leads to high savings
- **Causal Hypothesis** – The change in one variable leads to change in another variable i.e. Dependent and independent variables, one variable is a cause and the other one is the effect
- **Non-Directional Hypothesis**If the hypothesis simply predicts that there will be a difference between the two groups, then it is a. It is non-directional because it predicts that there will be a difference but does not specify how the groups will differ.
- **Directional Hypothesis** If, however, the hypothesis uses so-called comparison terms, such as "greater,""less,""better," or "worse," then it is a directional hypothesis. It is directional because it predicts that there will be a difference between the two groups and it specifies how the two groups will differ

Characteristics of Hypothesis:

A hypothesis should have the following characteristic features:-

- It should be clear and precise
- It should be capable of being tested
- It should be related to the body of the theory
- It should be related to the available techniques
- It should state relationship between variables
- It should be stated in simple terms
- It should be consistent with most known facts

Source of Hypothesis

Theoretical or conceptual frameworks

- Through a deductive approach these hypotheses are drawn from theoretical or conceptual frameworks for testing them.

Previous research

- Findings of the previous studies may be used for framing the hypotheses for another study.
- For example, in a small sample descriptive study, a researcher found that a number of patients admitted with coronary artery disease had increased body mass index.

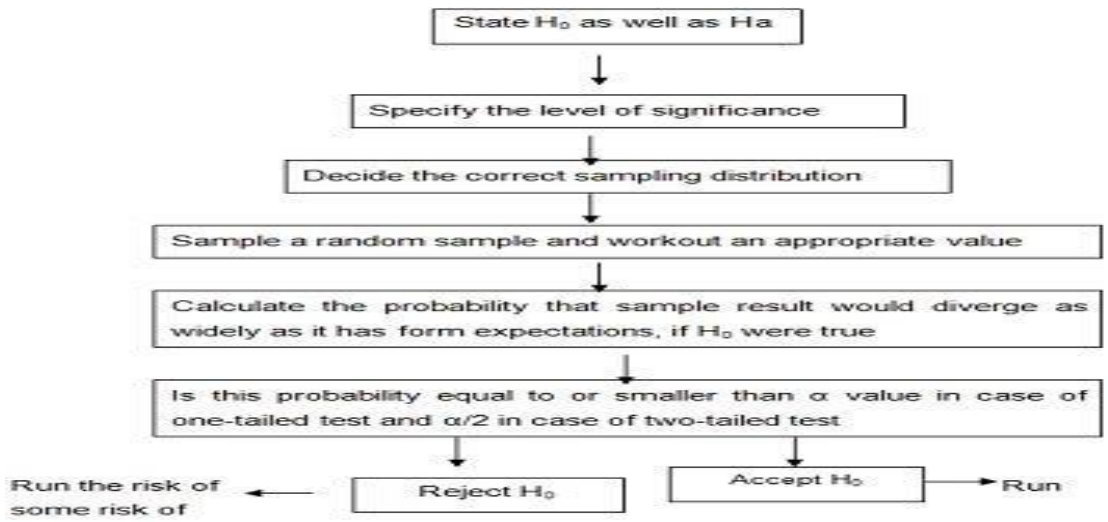
Real-life experiences

- Real-life experiences also contribute in the formulation of hypotheses for research studies.
- For example, Newton had a life-changing experience of the falling of an apple & formulated a hypothesis that earth attracts all the mass towards its centre, through several researchers were conducted before generating a law of central gravity.

Academic literature

- Academic literature is based on formal theories, empirical evidences, experiences, observation, & conceptualizations of academicians.These literatures may serve as good sources for formulating hypotheses for research studies

HYPOTHESIS TESTING:



AStatistical hypothesis Statistical hypothesisis a conjecture about a population parameter. This conjecture may or may not be true.The null hypothesisnull hypothesis, symbolized by H0, is a statistical hypothesis that states that there is no difference between a parameter and a specific value or that there is no difference between two parameters.

The alternative hypothesis alternative hypothesis, symbolized by H1, is a statistical hypothesis that states a specific difference between a parameter and a specific value or states that there is a difference between two parameters.

Testing Procedure:

1. The first step is to state the relevant null and alternative hypotheses. whether the alternative hypothesis can either be accepted or stays undecided as it was before the test.
2. The second step is to consider the statistical assumptions being made about the sample in doing the test; for example, assumptions about the statistical independence or about the form of the distributions of the observations.
3. Decide which test is appropriate, and stating the relevant test statistic.
4. Derive the distribution of the test statistic under the null hypothesis from the assumptions. For example, the test statistics may follow a Student's t distribution or a normal distribution.
5. The distribution of the test statistic partitions the possible values of T into those for which the null-hypothesis is rejected, the so called critical region, and those for which it is not.
6. Compute from the observations the observed value of the test statistic.
7. Decide to either fail to reject the null hypothesis or reject it in favour of the alternative. The decision rule is to reject the null hypothesis H0 if the observed value is in the critical region, and to accept or "fail to reject" the hypothesis otherwise.

Theory and Concept:

Theory is defined as a set of systematically interrelated concepts, definitions and propositions that are advanced to explain and predict a phenomenon. It may also specify causal relationship among variables. A theory is an integrated body of definitions, assumptions, and general propositions covering a given subject matter from which a comprehensive and consistent set of specific and testable principles can be deducted logically. This theory provides a basis for studying consumer behaviour and formulating appropriate marketing strategies.

Requisites (Criteria) of Theory

Theory starts out as ideas. The criteria to be met by the set of ideas are:

- They must be logically consistent.
- They must be interrelated.
- The statements must be exhaustive.
- The propositions should be mutually exclusive.
- They must be capable of being tested through research.

LECTURE NO EIGHT

Research in an evolutionary perspective

An evolutionary perspective in research involves applying the principles of evolutionary biology, particularly natural selection, to understand various phenomena. This approach assumes that many traits and behaviors have evolved over time to enhance survival and reproduction.

Key Concepts:

- **Natural Selection:** The process where traits that improve an organism's chances of survival and reproduction are more likely to be passed on to future generations.
- **Adaptation:** A trait that has evolved to serve a specific function, increasing an organism's fitness in its environment.
- **Evolutionary Psychology:** The study of how human behavior and cognition have evolved over time.

Applications in Research:

- **Human Behavior:** Understanding mate selection, cooperation, aggression, and other social behaviors through an evolutionary lens.
- **Mental Health:** Investigating the evolutionary roots of mental disorders and how they might have served adaptive functions in the past.
- **Culture:** Examining how cultural practices and beliefs evolve and spread, similar to biological traits.
- **Medicine:** Studying the evolution of diseases and antibiotic resistance to develop more effective treatments.

Examples:

- **Mate Selection:** Evolutionary psychology suggests that men and women have different preferences in mates due to their differing reproductive strategies.
- **Fear Response:** The fear response is thought to have evolved to help us avoid dangerous situations.
- **Language:** The capacity for language is considered a uniquely human adaptation that has facilitated complex communication and social interactions.

Criticisms and Considerations:

- **Just-So Stories:** Critics argue that some evolutionary explanations are speculative and lack empirical support.
- **Genetic Determinism:** There is concern that evolutionary perspectives might overemphasize genetic factors while neglecting environmental influences.

Overall, an evolutionary perspective offers a valuable framework for understanding the origins and functions of various traits and behaviors. However, it is essential to apply this approach with caution and consider alternative explanations.

LECTURE NO NINE

Role of Theory in Research

Interaction between theory and research is a continuous process of science leading to consolidation of existing knowledge and additions to it.

1. Theory provides significant guidelines for the empirical research by pointing to areas in which meaningful relationships are likely to be found. Theory narrows down range of facts to be studied. Theory provides the research a definite point of view helping him enquires into relationships between certain variables selected infinite array of variables. A theory provides fruitful hypotheses and new perspectives. It also points to gaps in our knowledge.
2. Theory increases the meaning of the findings of empirical research by helping us to perceive them as special cases of a set of abstract statements of relationships. Research findings will have meaning only when they are put into a theoretical perspective. Theory summarizes relationships amongst variables in a conceptual framework.
3. Proper linkage between theory and research findings provides a more secure ground for prediction about future events.
4. Research findings in theoretical framework provide a secure basis for drawing inferences about consequences in remote areas from the central area to which the findings relate.
5. Theory attests to the truth of research findings.
6. Theory helps in bridging the gaps in knowledge with intuition..

General Principles Regarding the Use of Theory in Research

1. Knowledge of the existing theory in one's area of research is essential for conducting research.

2. Concepts are crucial components of theory and so their clear definitions are essential to the designing of the study.

3. One should view theory as hypothetical proposition and not as conclusive fact.

4. One should pay attention to all odd and puzzling unexpected observations in one's research and enquire into them. They may be a source for new theoretical approaches.

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UNIT VI

UNIT VI INTEGRITY AND TRENDS IN BUSINESS RESEARCH

Research Integrity –Emerging Trends: Digital Surveys, AI in Research, Online Panels, Real-Time Analytics –Case Studies on Ethical Dilemmas in Research.

CO-PO AND BLOOMS TAXONOMY

Lecture No	Concept	CO	PO	PSO	Blooms Taxonomy
1	Research Integrity	CO6	1,2,3,4,5	1,2	K1, K2
2	Emerging Trends: Digital Surveys	CO6	1,2,3,4,5	1,2	K1, K2,K3
3	AI in Research	CO6	1,2,3,4,5	1,2	K1, K2, K3,
4	Online Panels	CO6	1,2,3,4,5	1,2	K1, K2,
5	Real-Time Analytics	CO6	1,2,3,4,5	1,2	K4,K5
6	Case Studies on Ethical Dilemmas in Research	CO6	1,2,3,4,5	1,2	K5 , K5

LECTURE NO ONE

Research Integrity

Research integrity refers to conducting research honestly, responsibly, and ethically. It ensures that research findings are trustworthy, credible, and beneficial to society.

Importance of Research Integrity

- Builds trust in research outcomes
- Ensures accuracy and reliability of data
- Protects the rights and dignity of participants
- Enhances the reputation of researchers and institutions
- Prevents misuse of research results

Core Principles of Research Integrity

1. Honesty
    - Truthful reporting of data, methods, and results
    - No fabrication or falsification
2. Objectivity
    - Avoid bias in data collection and analysis
    - Disclose conflicts of interest
3. Transparency
    - Clearly explain research methods and sources
    - Allow verification and replication
4. Accountability
    - Take responsibility for research decisions
    - Follow institutional and ethical guidelines
5. Respect for Participants
    - Obtain informed consent
    - Ensure privacy and confidentiality

Research Misconduct

Research misconduct violates research integrity and includes:

- Fabrication – Making up data or results
- Falsification – Manipulating data or procedures
- Plagiarism – Using others' work without proper credit

Ethical Practices in Research

- Proper citation and referencing
- Ethical approval from review boards
- Fair authorship and acknowledgment
- Responsible data management and storage

Role of Researchers and Institutions

- Researchers must follow ethical standards
- Institutions should provide training and oversight
- Journals must ensure ethical publication practices

Consequences of Lack of Research Integrity

- Retraction of publications

- Legal and professional penalties
- Loss of public trust
- Damage to academic credibility

Research integrity is the foundation of credible and ethical research. Upholding integrity ensures that research contributes positively to knowledge, policy, and society.

LECTURE TWO

A digital survey is a method of collecting data using electronic platforms such as websites, mobile applications, emails, and social media instead of traditional paper-based questionnaires. Digital surveys allow researchers to design, distribute, collect, and analyze data online, making the research process faster, cost-effective, and more accurate.

Features of Digital Surveys

- Online questionnaire design
- Automated data collection
- Real-time response tracking
- Easy data storage and analysis
- Wide reach across geographic locations

Importance of Digital Surveys

- Saves time and cost
- Reaches large and diverse populations
- Improves response rates
- Reduces data entry errors
- Supports real-time decision-making

Types of Digital Surveys

- Web-based surveys
- Mobile app surveys
- Email surveys
- Social media surveys
- SMS-based surveys

Emerging Trends in Digital Surveys

a) Mobile-First Survey Design
- Surveys optimized for smartphones and tablets
- Short, simple questions for easy navigation
- Higher participation rates

b) AI-Powered Survey Design
- Artificial Intelligence helps create better questions
- Predicts drop-off points
- Improves survey logic and flow

c) Real-Time Analytics
- Instant monitoring of responses
- Live dashboards and alerts
- Enables immediate corrective actions

d) Chatbot-Based Surveys
- Conversational surveys through chat interfaces
- More engaging and interactive

- Reduces respondent fatigue

e) Gamification
- Use of game elements like points, badges, and progress bars
- Increases motivation and completion rates

f) Adaptive and Personalized Surveys
- Questions change based on respondent answers
- Improves relevance and data quality

g) Integration with Social Media
- Surveys conducted through platforms like Instagram, WhatsApp, and Facebook
- Easy sharing and quick feedback

h) Multimedia-Based Questions
- Use of images, videos, and audio
- Helps respondents understand questions better

i) Enhanced Data Security and Privacy
- Strong focus on consent and confidentiality
- Compliance with data protection laws

j) Automated Data Cleaning and Analysis
- Automatic removal of incomplete or inconsistent responses
- Faster data processing

Advantages of Digital Surveys
- Fast and efficient data collection
- Low operational cost
- Easy scalability
- Environment friendly
- High data accuracy

Limitations of Digital Surveys
- Limited access for digitally excluded populations
- Risk of low-quality or dishonest responses
- Privacy and security concerns
- Dependence on internet connectivity

Applications of Digital Surveys
- Academic research
- Market research
- Customer satisfaction studies
- Employee feedback
- Social and public opinion research

Digital surveys have transformed modern research by making data collection faster, smarter, and more flexible. Emerging trends such as AI, real-time analytics, mobile-first design, and gamification are further improving data quality and respondent engagement. However, ethical use and data privacy remain crucial for successful digital survey research.

LECTURE NO THREE

ARTIFICIAL INTELLIGENCE (AI) IN RESEARCH

In 2026, Artificial Intelligence has evolved from a simple data-processing tool into an autonomous research partner. For MBA students and professional researchers, "AI in Research" no longer just refers to "using ChatGPT to summarize a paper"—it describes a fundamental shift in the scientific method known as AI-Driven Discovery.

1. Meaning of Artificial Intelligence in Research

Artificial Intelligence (AI) refers to the use of computer systems capable of performing tasks that normally require human intelligence, such as learning, reasoning, pattern recognition, and decision-making.

In research, AI is used to enhance data collection, analysis, interpretation, and prediction, making the research process faster, more accurate, and more efficient.

Role of AI in the Research Process

AI supports researchers at every stage of the research lifecycle:

1. Problem identification
2. Literature review
3. Research design
4. Data collection
5. Data analysis
6. Interpretation and reporting

Applications of AI in Research

a) Literature Review and Knowledge Discovery

- AI-powered tools scan millions of research papers quickly.
- Helps identify research gaps, trends, and key themes.
- Examples: semantic search, citation mapping, topic modeling.

b) Research Design and Hypothesis Development

- AI analyzes previous studies to suggest variables and relationships.
- Helps in framing research questions and hypotheses.
- Predicts feasible research models.

c) Data Collection

- AI-driven online surveys and chatbots collect data efficiently.
- Uses adaptive questioning (questions change based on responses).
- Integrates data from sensors, social media, and digital platforms.

d) Data Analysis

AI is extensively used in analyzing large and complex datasets.

- Machine Learning detects patterns and trends.
- Natural Language Processing (NLP) analyzes text data (interviews, reviews).
- Image and video analysis for medical and social research.

e) Predictive Analytics

- AI predicts future outcomes based on historical data.
- Used in finance, marketing, healthcare, and policy research.

f) Automation of Repetitive Tasks

- Automatic data cleaning and coding.
- Error detection and anomaly identification.

g) Research Writing and Reporting

- AI assists in grammar checking, summarization, and formatting.
- Helps visualize results using automated charts and dashboards.

Advantages of AI in Research

- ⏱Saves time and cost
- Improves accuracy and consistency
- Handles large and complex datasets
- Reduces human bias
- Enhances innovation and discovery

Challenges and Limitations of AI in Research

- Data bias: AI reflects biases in training data
- Lack of transparency: Black-box decision-making
- Ethical concerns: Privacy, consent, data misuse
- Dependence on quality data
- Skill gap among researchers

Ethical Issues of AI in Research

- Ensuring data privacy and confidentiality
- Avoiding algorithmic bias and discrimination
- Proper acknowledgment of AI-assisted work
- Maintaining human oversight and accountability

Future Scope of AI in Research

- Fully automated research assistants
- AI-generated simulations and models
- Deeper integration with big data and IoT
- Personalized and real-time research insights

Artificial Intelligence is transforming modern research by improving speed, accuracy, and analytical capability. While AI offers immense benefits, ethical use, transparency, and human judgment remain essential to maintain research integrity and credibility.

LECTURE NO FOUR

ONLINE PANELS IN RESEARCH

Online panels are pre-recruited groups of individuals who have agreed to participate in research studies (like surveys or feedback) through the internet.

- These participants join a panel and provide demographic or interest information.
- Researchers then invite them to take part in relevant studies.
- Panel members may receive incentives like points, vouchers, or rewards.

Key idea: An online panel is a ready-made pool of people researchers can use to collect data quickly and repeatedly.

Use of Online Panels in Research

Online panels are popular because they:

✓ Allow fast data collection

✓ Provide access to large and diverse populations

✓ Reduce cost compared to face-to-face or telephone surveys

✓ Support longitudinal research (same people over time)

✓ Enable real-time or frequent feedback

Types of Online Panels

A. General Population Panels

- Represents broad populations (e.g., adults in a country).
- Used for market trends, social research, and public opinion.

B. Specialized Panels

- Focus on specific groups (e.g., gamers, professionals, health patients).
- Useful for niche research needs.

C. Customer or Brand Panels

- Members are users of a brand or product.
- Helps businesses collect feedback and improve offerings.

Online Panels Work in Step by Step

1. Recruitment: Participants sign up via websites or partner platforms.
2. Profiling: Panelists provide demographic and preference information.
3. Survey Invitation: Researchers select eligible panelists and send surveys.
4. Data Collection: Panelists complete surveys online.
5. Incentives: Respondents receive rewards for participation.
6. Analysis: Researchers analyze collected data.

Advantages of Online Panels

⏱Speed

- Surveys are launched and responses collected quickly.

Targeting

- Researchers can filter panelists by age, location, occupation, etc.

Cost-Effective

- Lower cost than traditional surveys.

Repeat Access

- Same participants can be re-contacted for follow-ups or longitudinal studies.

Global Reach

- Panels can include members from different countries.

Limitations and Challenges

✓ Panel Conditioning

Panelists may become “professional respondents,” giving shallow or patterned answers.

✓ Non-Representative Samples

Panels might not fully represent the whole population.

✓ Incentive Bias

Some participants may join just for rewards, not genuine engagement.

✓ Data Quality Concerns

Risk of inattentive or dishonest responses.

Emerging Trends in Online Panels

a) Mobile-First Panels

- Most people now use smartphones.
- Panel platforms are optimized for mobile surveys and interaction.

b) Integration with Big Data

- Panel responses are merged with other data (social media, purchase behavior, online activity).

c) AI and Machine Learning for Sampling

- AI improves panel selection, reducing bias and improving representativeness.
- AI also detects bad data (random or dishonest answers).

d) Passive Data Collection

- Panels now collect data beyond surveys:
  - Location patterns
  - App usage
  - Online behavior

e) Gamification

Researchers add game-like elements:

- Progress bars
- Quizzes
- Rewards

This increases participation and reduces dropout rates.

f) Advanced Panel Management Platforms

Platforms now:

✓ Auto-refresh panel members

✓ Detect inactive users

✓ Track respondent reliability

g) Privacy and Data Security Enhancements

- Compliance with GDPR, CCPA, and global privacy laws.
- Panel platforms focus on transparent consent and data protection.

Important: Ethical use and secure storage of panelist data is now a priority.

h) Multi-Mode Panels

Combining mobile, web, email, and social media surveys for better reach.

Best Practices for Using Online Panels

✓ Carefully define the target population

✓ Use screening questions to ensure relevance

✓ Balance incentives to avoid bias

✓ Monitor data quality (attention, consistency)

✓ Respect privacy and secure consent

✓ Update panelist profiles periodically

Use of Online Panels

Fast turnaround responses
Access to specific demographic or niche groups
Longitudinal tracking over time
Cost-efficient data collection

Online panels are a powerful tool in modern research because they:

- Provide quick, targeted insights
- Support large and diverse samples
- Are cost-effective and scalable
- Can leverage AI and new technologies

LECTURE NO FIVE

REAL-TIME ANALYTICS

Meaning of Real-Time Analytics

Real-time analytics refers to the process of collecting, processing, and analyzing data immediately as it is generated, so that insights and decisions can be made instantly or within seconds/minutes.

Unlike traditional analytics (which analyzes historical data after a delay), real-time analytics provides up-to-the-moment insights.

Example:

Tracking live website visitors and their behavior as it happens.

How Real-Time Analytics Works

Real-time analytics follows these steps:

1. Data Generation
    - Data is produced continuously from sources like:
        - Websites and mobile apps
        - Online surveys
        - Sensors and IoT devices
        - Social media platforms
2. Data Streaming
    - Data is transmitted instantly to analytics systems.
3. Real-Time Processing
    - Tools analyze data immediately using algorithms and rules.
4. Visualization & Alerts
    - Results are shown on live dashboards.
    - Alerts are triggered if certain conditions are met.

Key Components of Real-Time Analytics

a) Data Sources

- Online transactions
- Survey responses
- Clickstream data
- Social media feeds

b) Processing Engine

- Analyzes incoming data instantly.
- Applies filters, rules, and models.

c) Analytics Models

- Descriptive (what is happening now)
- Predictive (what is likely to happen next)

d) Dashboards & Alerts
- Live charts and reports.
- Automatic notifications for important events.

Applications of Real-Time Analytics

a) Research and Surveys
- Monitor survey responses as they come in.
- Detect low response rates or biased samples early.
- Modify questions or targeting instantly.

b) Business and Marketing
- Track customer behavior in real time.
- Measure campaign performance instantly.
- Personalize offers and recommendations.

c) Finance
- Fraud detection in online transactions.
- Stock market monitoring.
- Risk assessment.

d) Healthcare
- Monitoring patient vitals.
- Early detection of medical emergencies.

e) Social Media and Sentiment Analysis
- Tracking trending topics.
- Measuring public opinion live.

Importance of Real-Time Analytics
- ⏱Faster decision-making
- Immediate response to issues
- Improved accuracy and relevance
- Dynamic strategy adjustments
- Competitive advantage

Advantages of Real-Time Analytics

✓ Instant insights
✓ Improved operational efficiency
✓ Better customer experience
✓ Early problem detection
✓ Supports predictive and prescriptive analytics

Challenges and Limitations

a) Data Volume and Speed
- Managing large amounts of fast-moving data is complex.

b) High Cost
- Requires advanced infrastructure and tools.

c) Data Quality Issues
- Errors must be detected immediately.

d) Security and Privacy
- Real-time data often includes sensitive information.

Real-Time Analytics vs Traditional Analytics

Aspect	Real-Time Analytics	Traditional Analytics
Data Processing	Immediate	After data collection
Decision Speed	Instant	Delayed
Use Case	Monitoring & alerts	Reporting & analysis
Data Type	Streaming data	Historical data

Emerging Trends in Real-Time Analytics

- AI-driven real-time insights
- Predictive alerts
- Integration with IoT and Big Data
- Self-updating dashboards
- Automated decision systems

Role of Real-Time Analytics in Research

In modern research, real-time analytics helps to:

- Improve survey management
- Ensure data quality
- Detect sampling errors early
- Support adaptive research designs

Real-time analytics is a powerful approach that transforms raw data into immediate, actionable insights. It plays a crucial role in research, business, healthcare, and digital environments by enabling faster, smarter, and more responsive decision-making.

LECTURE NO SIX

CASE STUDIES ON EMERGING RESEARCH & DIGITAL ANALYTICS TOPICS

Case Study 1: Research Integrity

Title: Data Manipulation in Academic Research

Context:

A postgraduate researcher conducted a study on employee satisfaction in IT companies. Due to low response rates, the researcher altered some survey responses to match the expected hypothesis.

Issue:

- Violation of research integrity
- Data falsification and lack of transparency

Outcome:

- The study was rejected by the university ethics committee
- The researcher faced academic penalties
- The institution strengthened training on research ethics

Learning:

Research integrity is essential for credibility, trust, and ethical scholarship.

Case Study 2: Emerging Trends in Digital Surveys

Title: Mobile-Based Student Feedback Survey

Context:
A university shifted from paper-based feedback forms to mobile-first digital surveys using QR codes.
Emerging Trend Used:
- Mobile-first design
- Real-time dashboards

Outcome:
- Response rate increased by 40%
- Students found surveys easier and faster
- Administrators could view feedback instantly

Learning:
Digital survey trends improve participation, efficiency, and data quality.

Case Study 3: AI in Research
Title: AI-Based Literature Review in Management Research
Context:
A research scholar used AI-powered tools to scan thousands of journal articles for a study on consumer behavior.
AI Applications:
- Automated literature search
- Theme identification using NLP
- Citation mapping

Outcome:
- Literature review time reduced drastically
- Research gaps were identified more accurately
- Improved quality of research framework

Learning:
AI enhances research speed, depth, and analytical accuracy when used ethically.

Case Study 4: Online Panels in Research
Title: Consumer Preference Study Using Online Panels
Context:
A retail company used an online consumer panel of 10,000 registered users to study buying preferences.
Method Used:
- Pre-recruited online panel
- Targeted demographic sampling
- Incentive-based participation

Outcome:
- Data collected within 48 hours
- Cost reduced compared to field surveys
- Enabled follow-up surveys with the same panel

Learning:
Online panels are efficient, scalable, and suitable for longitudinal research.

Case Study 5: Emerging Trends in Online Panels
Title: AI-Enhanced Panel Quality Control
Context:
A research firm noticed low-quality responses from panel members.
Emerging Trend Applied:

- AI-based detection of inattentive respondents
- Automated removal of low-quality panelists

Outcome:

- Improved data reliability
- Reduced survey bias
- Higher client satisfaction

Learning:
AI improves panel management and data quality in online research.

Case Study 6: Real-Time Analytics
Title: Real-Time Survey Monitoring in Market Research
Context:
A market research firm conducted a national brand perception survey using real-time analytics.
Tools Used:

- Live dashboards
- Automated alerts for low response regions

Outcome:

- Researchers adjusted sampling immediately
- Balanced demographic representation achieved
- Faster decision-making for the client

Learning:
Real-time analytics enables dynamic control and immediate corrective action.

Case Study 7: Integration of AI and Real-Time Analytics
Title: Predictive Customer Behavior Analysis
Context:
An e-commerce company analyzed real-time browsing data using AI models.
Technologies Used:

- Machine learning
- Real-time analytics dashboards

Outcome:

- Personalized product recommendations
- Increased sales conversion
- Improved customer experience

Learning:
Combining AI with real-time analytics leads to predictive and actionable insights.

UNIT V

UNIT V REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH
Research report –Types – Contents of report – need for executive summary – chapterization – contents of chapter – report writing – the role of audience – readability – comprehension – tone – final proof – report format – title of the report – ethics in research – Ethics in research – Subjectivity and Objectivity in research.

CO-PO AND BLOOMS TAXONOMY

Lecture No	Concept	CO	PO	PSO	Blooms Taxonomy
1	Research report	CO5	1,2,3,4,5	1,2	K1, K2
2	Different types	CO5	1,2,3,4,5	1,2	K1, K2,K3
3	Contents of report	CO5	1,2,3,4,5	1,2	K1, K2, K3,
4	need of executive summary – chapterization	CO5	1,2,3,4,5	1,2	K1, K2,
5	contents of chapter – report writing	CO5	1,2,3,4,5	1,2	K2,K3,K4
6	the role of audience – readability comprehension – tone – final proof	CO5	1,2,3,4,5	1,2	K2,K3,K4,K5
7	report format title of the report	CO5	1,2,3,4,5	1,2	K1, K2,K3,K4
8	ethics in research – ethical behaviour of research	CO5	1,2,3,4,5	1,2	K2,K3
9	subjectivity and objectivity in research	CO5	1,2,3,4,5	1,2	K2,K3,

LECTURE NO ONE

Data Preparation:

The data, after collection, has to be processed and analysed in accordance with the outline laid down for the purpose at the time of developing the research plan. This is essential for a scientific study and for ensuring that we have all relevant data for making contemplated comparisons and analysis. Technically speaking, processing implies editing, coding, classification and tabulation of collected data so that they are amenable to analysis. The term analysis refers to the computation of certain measures along with searching for patterns of relationship that exist among data-groups. Thus, "in the process of analysis, relationships or differences supporting or conflicting with original or new hypotheses should be subjected to statistical tests of significance to determine with what validity data can be said to indicate any conclusions".

Processing stages

There are four important stages in the processing of data. They are;

1. Editing

As soon as the researcher receives the data, he should screen it for accuracy. Editing is the process of examining the data collected through various methods to detect errors and omissions and correct them for further analysis. Though editing, it is ensured that the collected data are accurate, consistent with other facts gathered, uniformly entered and well arranged so that further analysis is made easier.

Practical guidelines for editing

While editing care has to be taken to see that the data are as accurate and complete as possible.

The following points are to be noted;

1. The editor should familiarize with the copy of instructions given to the interviewers.
2. The original entry, if found incorrect, should not be destroyed or erased. On the other hand, it should be crossed out in such a manner that it is still eligible.
3. Any, modification to the original entry by the editor must be specifically indicated.
4. All completed schedules must bear signature of the editor and the date.
5. Incorrect answer to the questions can be corrected only if the editor is absolutely sure of the answer, otherwise leave it as such.
6. Inconsistent, incomplete or missing answers should not be used.
7. Sere that all numerical answers are converted to same units.

2. Coding

Coding is the process by which r response categories are summarized by numerals or other symbols to carry out subsequent operations of data analysis. This process of assigning numerals or symbols to the responses is called coding. It facilitates efficient analysis of the collected data and helps in reducing several replies to a small number of classes which contain the critical information required for analysis. In general it reduces the huge amount of information collected in to a form that is amenable to analysis.

Steps in coding

1. Study the answers carefully.
2. Develop a coding frame by listing the answers and by aligning codes to each of them.
3. Prepare a coding manual with the detail of variable names, codes and instructions.
4. If the coding manual has already been prepared before the collection of the data, make the required additions for the open ended and partially coded questions.

Coding rules:

1. Give each respondent a code number for identification.

2. Provide code number for each question.
3. All responses including 'don't know', 'no opinion'. Etc is to be coded.
4. Assign additional codes to partially coded questions.

3. Classification

Classification is the process of reducing large mass of data in to homogeneous groups for meaningful analysis. It converts data from complex to understandable and unintelligible to intelligible forms. It divides data in to different groups or classes according to their similarities and dissimilarities. When the data are classified, they give summary of whole information.

Objectives of classification

1. To organize data in to concise, logical and intelligible form.
2. To take the similarities and dissimilarities s between various classes clear.
3. To facilitate comparison between various classes of data.
4. To help the researcher in understanding the significance of various classes of data.
5. To facilitate analysis and formulate generalizations.

Types of classification

A. Classification according to external characteristics

In this classification, data may be classified either on geographical basis or periodical basis.

Classification on geographical basis

In this type of classification, the data that are collected from different places are placed in different classes.

Classification on periodical basis (chronological classification)

In this type of classification, the data belonging to a particular time or period are put under one class. This type of classification is based on period.

B. Classification according to internal characteristics

Data may be classified either according to attributes or according to the magnitude of variables

Classification according to Attributes

In this type data are classified on the basis of some attributes an characteristics.

Simple Classification

If the classification is based on one particular attribute only it is called simple classification. Eg; classification on the basis of sex.

Manifold Classification

If the classification is based on more than one or several attributes it is called manifold or multiple classifications. In this data are classified in several groups.

C. Classification according variables

Here the data are classified to some characteristics that can be measured. Data are classified on the basis of quantitative characteristics such as age, height; weight etc. quantitative variables are grouped in to two:

a) Discrete variable

If the variables can take only exact value, it is called discrete variable.

b) Continuous variable

The variables that can take any numerical value within a specified range are called continuous variable.

Characteristics of an ideal classification

1. Unambiguity- Classification should be unambiguous. The various classes should be defined properly.
2. Stable- it should not change from enquiry to enquiry
3. Flexibility- classification should have the capacity of adjustment to new situations and circumstances.
4. Homogeneity- each class should contain homogenous items.
5. Suitability- it should be suitable to objects of any statistical enquiry.
6. Exhaustiveness- there should be no item which does not find a class.

4. Tabulation

Tabulation is the next step to classification. It is an orderly arrangement of data in rows and columns. It is defined as the "measurement of data in columns and rows". Data presented in tabular form is much easier to read and understand than the data presented in the text the main purpose of tabulation is to prepare the data for final analysis. It is a stage between classification of data and final analysis.

Objectives of Tabulation

1. To clarify the purpose of enquiry
2. To make the significance of data clear.
3. To express the data in least possible space.
4. To enable comparative study.
5. To eliminate unnecessary data
6. To help in further analysis of the data.

Types of Tables

 Simple Table

Here the data are presented only for one variable or characteristic. Any frequency distribution of a single variable is simple table

 Complex table

In complex table, two or more characteristics are shown. If the study is related to more than two variables, it is called multivariate analysis. They may be of the following tables.

(a) One- way table

In this type of table, data of only one characteristic will be shown. It means that when one type of information is secured about different groups or individuals, it can be displayed with the help of one- way table

(b) Two- way table

When mutually related attributes of a phenomenon are to be displayed, two way tables are used. In other words, this table shows two types of characteristics.

(c) Three-way table

It displays three types of attributes. It is used when three inter- related or mutually related attributes or characteristics of a phenomenon are to be displayed,.

(d) Manifold tables

When information about different mutually attributes or characteristics of a phenomenon are to be displayed, manifold table is used. Such tables display information about various characteristics or attributes.

Parts of a statistical table

Following are the important parts of a statistical table.

1. Title of the table

The title of the table is placed above the table. If there are more than one table in a research, each should bear a number for easy reference.

2. Caption or title of the column

It is also termed as "box head". There may be sub- captions under the main caption.

3. Stub (row heading)

Stub refers to the title given to rows

4. Body (main data)

This is the main body of information needed for the research work.

5. End note (foot note)

This is placed below the table to convey the expansions of abbreviations to caption, stub or main body.

6. Source note

If the table is based on outside information, it should be mentioned in the source note below.

LECTURE NO TWO

Types of reports

Reports may be categorized broadly as Technical Reports and General Reports based on the nature of methods, terms of reference and the extent of in-depth enquiry made etc. On the basis of usage pattern, the reports may also be classified as information oriented reports, decision oriented reports and research based reports. Further, reports may also differ based on the communication situation. For example, the reports may be in the form of Memo, which is appropriate for informal situations or for short periods. On the other hand, the projects that extend over a period of time, often call for project reports. Thus, there is no standard format of reports. The most important thing that helps in classifying the reports is the outline of its purpose and answers for the following questions:

What did you do?

Why did you choose the particular research method that you used?

What did you learn and what are the implications of what you learned?

If you are writing a recommendation report, what action are you recommending in response to what you learned?

Two types of report formats are described below:

I Technical Report

A technical report mainly focuses on methods employed, assumptions made while conducting a study, detailed presentation of findings and drawing inferences and comparisons with earlier findings based on the type of data drawn from the empirical work.

An outline of a Technical Report mostly consists of the following:

Title and nature of the study:

Brief title and the nature of work sometimes followed by subtitle indicate more appropriately either the method or tools used. Description of objectives of the study, research design, operational terms, working hypothesis, type of analysis and data required should be present.

Abstract of Findings:

A brief review of the main findings just can be made either in a paragraph or in one/two pages.

Review of current status:

A quick review of past observations and contradictions reported, applications observed and reported are reviewed based on the in-house resources or based on published observations.

Sampling and Methods employed

Specific methods used in the study and their limitations. In the case of experimental methods, the nature of subjects and control conditions are to be specified. In the case of sample studies, details of the sample design i.e., sample size, sample selection etc are given.

Data sources and experiment conducted

Sources of data, their characteristics and limitations should be specified. In the case of primary survey, the manner in which data has been collected should be described.

Analysis of data and tools used.

The analysis of data and presentation of findings of the study with supporting data in the form of tables and charts are to be narrated. This constitutes the major component of the research report.

Summary of findings

A detailed summary of findings of the study and major observations should be stated. Decision inputs if any, policy implications from the observations should be specified.

References

A brief list of studies conducted on similar lines, either preceding the present study or conducted under different experimental conditions is listed.

Technical appendices

These appendices include the design of experiments or questionnaires used in conducting the study, mathematical derivations, elaboration on particular techniques of analysis etc.

II General Reports

General reports often relate popular policy issues mostly related to social issues. These reports are generally simple, less technical, good use of tables and charts. Most often they reflect the journalistic style. Example for this type of report is the "Best B-Schools Survey in Business Magazines". The outline of these reports is as follows:

1. Major Findings and their Implications
2. Recommendations for Action
3. Objectives of the Study
4. Method Employed for Collecting Data
5. Results

Writing Styles

There are atleast 3 distinct report writing styles that can be applied by students of Business Studies. They are called:

1. Conservative
2. Key points
3. Holistic

1. Conservative Style

Essentially, the conservative approach takes the best structural elements from essay writing and integrates these with appropriate report writing tools. Thus, headings are used to deliberate upon different sections of the answer. In addition, the space is well utilized by ensuring that each paragraph is distinct (perhaps separated from other paragraphs by leaving two blank lines in between).

2. Key Point Style

This style utilizes all of the report writing tools and is thus more overtly 'report-looking'. Use of headings, underlining, margins, diagrams and tables are common. Occasionally

reporting might even use indentation and dot points. The important thing to remember is that the tools should be applied in a way that adds to the report. The question must be addressed and the tools applied should assist in doing that. An advantage of this style is the enormous amount of information that can be delivered relatively quickly.

3. Holistic Style

The most complex and unusual of the styles, holistic report writing aims to answer the question from a thematic and integrative perspective. This style of report writing requires the researcher to have a strong understanding of the course and is able to see which outcomes are being targeted by the question.

LECTURE NO THREE

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) the main text; and (C) the 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. It should contain a clear statement of the objectives of research i.e., enough background should be given to make clear to the reader why the problem was considered worth investigating. A brief summary 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 put in the summarised form.

(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 judgement 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."5

(iv) Implications of the results: Toward the end of the main text, the researcher should again put down the results of his research clearly and precisely. He should, state the implications that flow from the results of the study, for the general reader is interested in the implications for understanding the human behaviour. 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 summarises and recapitulates the main points of the study. The conclusion drawn from the study should be clearly related 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.

Types of reports

Reports may be categorized broadly as Technical Reports and General Reports based on the nature of methods, terms of reference and the extent of in-depth enquiry made etc. On the basis of usage pattern, the reports may also be classified as information oriented reports, decision oriented reports and research based reports. Further, reports may also differ based on the communication situation. For example, the reports may be in the form of Memo, which is appropriate for informal situations or for short periods. On the other hand, the projects that extend over a period of time, often call for project reports. Thus, there is no standard format of

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References

A brief list of studies conducted on similar lines, either preceding the present study or conducted under different experimental conditions is listed.

Technical appendices

These appendices include the design of experiments or questionnaires used in conducting the study, mathematical derivations, elaboration on particular techniques of analysis etc.

LECTURE NO FOUR

Executive Summary:

A brief overview of the entire research report, presented at the beginning, summarizing key objectives, methods, findings, and recommendations.

Purpose / Need:

- Provides a quick snapshot for decision-makers who may not read the full report.
- Highlights what was done, how, and what was found.
- Facilitates efficient communication of results to stakeholders.
- Saves time for busy executives.

Key Elements in an Executive Summary:

- Research problem / objectives
- Methodology (brief)
- Major findings
- Key conclusions and recommendations

Example:

In a research on employee engagement, the executive summary would briefly state the problem (low engagement levels), methodology (survey of 200 employees), key findings (lack of recognition, poor career growth), and recommendations (implement rewards and training).

LECTURE NO FIVE

Chapterization of Research Report

✓Definition:

Dividing the research report into logical, structured chapters to present the content clearly and systematically.

Purpose / Need:

- Enhances readability and flow.
- Ensures logical sequence of research components.
- Makes it easier to navigate and locate information.
- Demonstrates research rigor and professionalism.

Typical Chapter Structure:

Chapter	Content
Chapter 1: Introduction	Research problem, objectives, scope, significance
Chapter 2: Review of Literature	Past research, theories, research gaps
Chapter 3: Research Methodology	Research design, sampling, tools, data collection
Chapter 4: Data Analysis & Interpretation	Statistical analysis, tables, graphs, findings
Chapter 5: Findings, Suggestions, and Conclusion	Summary, implications, recommendations, limitations

Optional: Bibliography, Appendices, Questionnaire

LECTURE NO SIX

Chapter-wise Contents of a Research Report

Chapter 1: Introduction

Purpose:

To introduce the research problem and set the foundation for the entire study.

Contents:

- Background of the Study
- Statement of the Problem
- Research Objectives
- Research Questions or Hypotheses
- Scope and Significance of the Study

- Limitations of the Study
- Structure of the Report (optional)

Chapter 2: Review of Literature

✓Purpose:

To provide a theoretical foundation and identify research gaps.

Contents:

- Theoretical Framework
- Past Studies / Previous Research
- Conceptual Definitions
- Research Gaps
- Need for the Present Study

Chapter 3: Research Methodology

✓Purpose:

To explain how the research was carried out.

Contents:

- Research Design (exploratory, descriptive, causal)
- Population and Sampling Technique
- Sample Size and Sampling Frame
- Data Collection Methods (primary/secondary)
- Research Instrument (e.g., questionnaire, interview)
- Data Analysis Tools (e.g., SPSS, Excel, R)
- Reliability and Validity Measures
- Ethical Considerations

Chapter 4: Data Analysis and Interpretation

✓Purpose:

To present and interpret the research findings using statistical tools.

Contents:

- Descriptive Statistics (mean, SD, frequency)
- Inferential Statistics (t-tests, correlation, regression, etc.)
- Tables and Graphs
- Interpretation of Results
- Link with Objectives or Hypotheses

Chapter 5: Findings, Suggestions, and Conclusion

✓Purpose:

To summarize key insights and provide practical implications.

Contents:

- Major Findings (linked to objectives)
- Suggestions / Recommendations
- Managerial or Practical Implications
- Conclusion
- Limitations of the Study
- Scope for Future Research

Back Matter (Post Chapters)

Contents:

- Bibliography / References (APA/MLA/Harvard style)
- Appendices (questionnaire, raw data, additional tables)
- Glossary (if needed)

LECTURE NO SEVEN

1. Role of Audience in Report Writing

✔Purpose:

Understanding the audience helps shape the content, style, and structure of the report.

Why it matters:

- Determines technical depth and language used.
- Influences the level of explanation for concepts and data.
- Guides formatting, visuals, and tone.

Types of Audiences:

- Academic (professors, researchers): formal, theoretical depth.
- Managerial (executives, business leaders): concise, actionable.
- General/Public: simple, clear, non-technical.

Tip:

Always ask: *Who will read this report?* Tailor your message accordingly.

2. Readability

✔Definition:

How easy and clear the report is to read and understand.

Techniques to Improve Readability:

- Use simple, clear language.
- Break long paragraphs into shorter chunks.
- Use headings, bullet points, and numbering.
- Include tables, charts, and visuals to support text.
- Avoid jargon unless necessary (and define it).

✏ Tools:

- Readability scores (Flesch–Kincaid, Hemingway App)
- Microsoft Word readability statistics

3. Comprehension

✔Definition:

The ability of the reader to grasp, interpret, and apply the content.

How to Enhance Comprehension:

- Use logical flow: introduction → method → results → conclusion
- Reiterate key points and link findings to objectives
- Provide examples or case references
- Include summary sections at the end of chapters

Tip:

If a reader cannot understand your research, its value is lost — clarity is power.

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4. Tone in Report Writing

✔Definition:

The attitude or style conveyed in the writing.

Appropriate Tone:

- Formal and objective
- Avoid emotional or biased language
- Use third person point of view
- Maintain professional distance (e.g., use "The study found..." instead of "I found...")

✖Avoid:

- Slang or conversational phrases
- Subjective opinions not backed by data

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5. Final Proof (Proofreading & Editing)

✓Importance:
To ensure the report is error-free, consistent, and professionally presented.

Checklist:

- ✓Grammar, punctuation, and spelling
- ✓Consistent formatting (fonts, margins, spacing)
- ✓Accurate citations and bibliography
- ✓Page numbers, headings, and table/figure labeling
- ✓Eliminate redundancy and unclear sentences

LECTURE NO EIGHT

1. What is Research Ethics?

✓Definition:
Research ethics refers to the moral principles and guidelines that govern how scientific and scholarly research is conducted. It ensures that the rights, dignity, and welfare of participants are protected.

Purpose:

- To promote honesty, transparency, and integrity in research.
- To prevent harm to participants.
- To ensure trust between researchers, participants, and the public.

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2. Key Principles of Research Ethics

Principle	Description
Informed Consent	Participants must be fully informed about the research and voluntarily agree to participate.
Confidentiality	Personal data and identity of participants must be kept private.
Anonymity	Identities of participants must not be disclosed in any part of the research.
Avoidance of Harm	Participants should not face physical, psychological, or emotional harm.
Integrity & Honesty	Data must not be fabricated, falsified, or manipulated.
Objectivity	Research should be free from personal or financial bias.
Respect for Intellectual Property	Proper citation and acknowledgment of others' work.
Right to Withdraw	Participants must be allowed to withdraw at any stage without any penalty.

---

3. Ethical Behaviour of Researchers

✓Researchers must:

- Be transparent about their methods and findings.
- Report results honestly, even if they are unexpected or unfavorable.
- Avoid plagiarism and always give credit where it's due.
- Treat participants fairly and with respect.
- Disclose conflicts of interest, if any.
- Adhere to institutional and legal guidelines for research involving humans or animals.

✗Unethical Practices Include:

- Fabricating or falsifying data
- Not obtaining informed consent
- Plagiarizing others' work

- Withholding negative results
- Misusing funds or misreporting sources

---

4. Importance of Ethics in Business Research
   - Builds credibility and trust in research outcomes.
   - Prevents legal issues and public backlash.
   - Ensures decisions made using research are fair and responsible.
   - Protects the rights and well-being of employees, consumers, and stakeholders.

LECTURE NO NINE

What is Objectivity in Research?

✓Definition:

Objectivity means approaching research without personal bias, emotion, or prejudice, and relying purely on facts, evidence, and observable data.

Key Features:

- Based on empirical evidence
- Replicable and verifiable by others
- Independent of the researcher's personal views
- Maintains neutrality throughout the research process

Importance:

- Ensures credibility and validity of findings
- Helps in making unbiased decisions
- Supports scientific rigor

Example:

A researcher collects and analyzes sales data to understand seasonal trends—without letting personal opinion about product popularity interfere.

---

2. What is Subjectivity in Research?

✓Definition:

Subjectivity refers to the influence of personal beliefs, values, experiences, or emotions in interpreting or conducting research.

Key Features:

- Perspective-driven
- Based on individual interpretation
- Common in qualitative research
- Aims to understand human experiences, meanings, and context

Importance:

- Valuable in exploring opinions, emotions, or culture
- Enables rich and detailed insights
- Helps interpret meaning beyond numbers

Example:

A researcher studying employee motivation through interviews might interpret responses based on tone, emotion, and personal engagement.

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JEPPIAAR ENGINEERING COLLEGE

DEPARTMENT OF MANAGEMENT STUDIES

I YEAR / II SEMESTER

MB25C08: BUSINESS RESEARCH METHODS

Faculty In charge

Dr. R. AKILA

Anna University Chennai

Regulation 2025

JEPPIAAR ENGINEERING COLLEGE

DEPARTMENT OF MANAGEMENT STUDIES

VISION

To build Jeppiaar Engineering College as an institution of academic excellence in technology and management education, leading to become a world class university..

MISSION

- To excel in teaching and learning, research and innovation by promoting the principles of scientific analysis and creative thinking.
- To participate in the production, development and dissemination of knowledge and interact with national and international communities.
- To equip students with values, ethics and life skills needed to enrich their lives and enable them to contribute for the progress of society.
- To prepare students for higher studies and lifelong learning, enrich them with the practical skills necessary to excel as future professionals and entrepreneurs for the benefit of Nation's economy.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS):

MBA programme curriculum is designed to prepare the post graduate students

- To have a thorough understanding of the core aspects of the business.
- To provide the learners with the management tools to identify, analyze and create business opportunities as well as solve business problems.
- To prepare them to have a holistic approach towards management functions.
- To inspire and make them practice ethical standards in business.

PROGRAMMEOUTCOMES(POS)

On successful completion of the programme,

1. Ability to apply the business acumen gained in practice.
2. Ability to understand and solve managerial issues.
3. Ability to communicate and negotiate effectively, to achieve organizational and individual goals.
4. Ability to understand one's own ability to set achievable targets and complete them.
5. Ability to fulfill social outreach
6. Ability to take up challenging assignments

COURSE OBJECTIVES

This course aims to develop a research-oriented mindset by imparting the principles and practices of scientific Business research. It enables students to systematically approach real-world Business problems using exploratory, descriptive, and causal research designs. Emphasis is placed on quantitative and qualitative research techniques, instrument design, statistical analysis using software tools, and ethical report writing. The course also trains students to critically evaluate research studies and independently prepare Business research reports for data-driven decision-making.

COURSE OUTCOMES (COs)

- CO1: Demonstrate conceptual knowledge of the research process, various research designs, data collection methods, analytical techniques, report writing, and emerging trends and ethical considerations in business research.
- CO2: Interpret and relateresearch questions and objectives to appropriate research designs, measurement scales, sampling techniques, and data analysis methods for conducting scientific inquiry.
- CO3: Apply research design principles, instrument construction, data collection methods, and statistical software to collect, prepare, and analyze both qualitative and quantitative data.
- CO4: Analyze the validity and reliability of research instruments, the outcomes of bivariate and multivariate statistical analyses, and the ethical implications of a research project to derive meaningful insights and conclusions.
- CO5: Evaluate different research methodologies, data analysis techniques, and ethical dilemmas in business research to ensure the integrity, objectivity, and reliability of researchfindings.
- CO6: Develop a comprehensive, ethically sound business research report by integrating knowledge of research design, data collection, analytical methods, and emerging technologies to support data-driven managerial decision-making.

Internal Assessment Methodology –100 Marks

Component	Weightage
Written Test I & II	60%
Assignment, Presentation, Case Study, Quiz, Simulation, Online Certification, Seminar, Mini project	40%

CO–PO–PSO Mapping Matrix::

CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	3	2	3	2	3	2
CO2	3	3	3	3	3	3	3
CO3	3	2	3	3	2	3	3
CO4	3	3	3	3	3	3	2
CO5	3	3	3	2	2	2	3
CO6	2	3	3	3	3	3	3

MS25CO8 BUSINESS RESEARCH METHODS

Foundations of Business Research and Scientific Inquiry

Business Research –Definition and Significance –the research process –Types of Research –Exploratory and causal Research –Theoretical and empirical Research –Cross –Sectional and time –series Research –Research questions / Problems –Research objectives –Research hypotheses –characteristics –Research in an evolutionary perspective –the role of theory in research.

Research Design and Measurement Techniques

Research design –Definition –types of research design –exploratory and causal research design –Descriptive and experimental design –different types of experimental design –Validity of findings –internal and external validity –Variables in Research –Measurement and scaling –Different scales –Construction of instrument –Validity and Reliability of instrument.

Data Collection Methods and Sampling Techniques

Types of data –Primary Vs Secondary data –Methods of primary data collection –Survey Vs Observation –Experiments –Construction of questionnaire and instrument –Types of Validity –Sampling plan –Sample size –determinants optimal sample size –sampling techniques –Sampling methods.

Data Preparation and Analytical Techniques

Data Preparation –editing –Coding –Data entry –Validity of data –Qualitative Vs Quantitative data analyses –Applications of Bivariate and Multivariate statistical techniques, Factor analysis, Discriminant analysis, Cluster analysis, Multiple regression and Correlation, Multidimensional scaling –Conjoint Analysis –Application of statistical software for data analysis.

Report Writing and Research Communication

Research report –Types –Contents of report –need for executive summary –chapterization –contents of chapter –report writing –the role of audience –readability –comprehension –tone –final proof –report format –title of the report –ethics in research –Ethics in research –Subjectivity and Objectivity in research.

Integrity and Trends in Business Research

Research Integrity –Emerging Trends: Digital Surveys, AI in Research, Online Panels, Real-Time Analytics –Case Studies on Ethical Dilemmas in Research.

QUESTION BANK

UNIT-1

PART-A

1. **What is Basic Research**? (**Nov/Dec 2007)**

Basic or pure research attempts to expand the limits of knowledge. Research aim is to solve perplexing questions of a theoretical nature, with little direct influence on actions, performance or policy

2. **Define Hypothesis (Nov/Dec 2006) (June 2011) (2016 Dec)**

"A hypothesis is a conjectural statement of the relation between two or more variables". (Kerlinger, 1956)

"Hypotheses are single tentative guesses, good hunches – assumed for use in devising theory or planning experiments intended to be given a direct experimental test when possible". (Eric Rogers, 1966)

"Hypothesis is a formal statement that presents the expected relationship between an independent and dependent variable."(Creswell, 1994).

3. **What are the features of an Applied Research** (**Nov/Dec 2006)**

- Action research
- Applied to find solution for immediate problems.
- Aimsat conclusion

4. What is applied research?(May/June) 2009?

Research conducted in a particular setting with the specific objective of solving an existing problem in the situation. An attempt to find a solution to an immediate problem encountered by a firm, an industry, a business organization, or the society is known as Applied Research. Examples: Research to identify social, economic or political trends that may affect a particular institution or the copy research (research to find out whether certain communications will be read and understood) or the marketing research evaluation research are examples of applied research.

5. Define null hypothesis? (**May/June 2009) (Nov/Dec 2012) (Nov/Dec 2016)**

The null hypothesis is a proposition that states a definitive, exact relationship between two variables. That is, it states that population correlation between two variables is equal to zero. In general the null hypothesis is expressed as no significant relationship between two variables or no significant difference between two groups. Example: There is no relationship between age and job satisfaction

6. What is quantitative Research? (November / December 2010)

Quantitative research relates to aspects that can be quantified or can be expressed in terms of quantity. It involves the measurement of quantity or amount. The various available

statistical and econometric methods are adopted for analysis in such research. Some such includes correlation, regressions and time series analysis.

7. Define Research Problem (November / December 2010)

Research problem refers to an unanswered question that a researcher might encounter in the context of either a theoretical or practical situation, which he/she would like to answer or find a solution to.

8. How does exploratory research differ from casual research?(June 2011)

Exploratory research seeks to explore a market and its key issues. Usual techniques include observation, literature review, pulling secondary data, and, at times, focus groups and in-depth executive interviews.

Causal research seeks to uncover cause and effect relationships. For instance, does an increase in advertising truly drive purchases? and, if so, by how much. Causal research almost always requires hypothesis creation, tests of the hypothesis, and regression analysis to quantify the relationship.

9. What are One Tailed and Two Tailed Tests? (Nov/Dec 2007)

Two-tailed hypothesis tests are also known as nondirectional and two-sided tests because you can test for effects in both directions. When you perform a two-tailed test, you split the significance level percentage between both tails of the distribution. In the example below, I use an alpha of 5% and the distribution has two shaded regions of 2.5% (2 * 2.5% = 5%).

One-tailed hypothesis tests are also known as directional and one-sided tests because you can test for effects in only one direction. When you perform a one-tailed test, the entire significance level percentage goes into the extreme end of one tail of the distribution.

11. What is Confounding variable? (Nov/Dec2010)

A confounding variable, also known as a third variable or a mediator variable, can adversely affect the relation between the independent variable and dependent variable. This may cause the researcher to analyze the results incorrectly. The results may show a false correlation between the dependent and independent variables, leading to a rejection of the null hypothesis.

12. Diagnostic research (May/June-2008)

Diagnostic research should aim to quantity the added value of a test to clinical information that is commonly available before the test will be applied.

13. **What is the need of the research?**

- To identify and find solutions to the problem
- To help making decisions
- To find alternative strategies
- To develop new concepts

14. Define Experimental research (Nov / Dec 2008)

Experimental research are used for the controlled testing of causal processes. The general procedure is one or more independent variables are manipulated to determine their effect on a dependent variable. These designs can be used where:

1. There is time priority in a causal relationship (cause precedes effect),
2. There is consistency in a causal relationship (a cause will always lead to the same effect), and
3. The magnitude of the correlation is great.

16. **What is Empirical Research? (May/June 2013)**

Empirical research is based on observed and measured phenomena and derives knowledge from actual experience rather than from theory or belief.

17. What is Library Research?

Library Research is conducted with the help of written materials mostly located in large libraries. This research is concerned with the evolution of theories, study involving cause-and-effect relationship and seeking out significant facts and interpretation of the past data which are found in journals, reports and directories

18. What is Motivational research?

- A particular data gathering technique directed toward surfacing information, ideas and thoughts that are not either easily verbalized or remain at the unconscious level in the respondents.
- The motivation research which investigates into the reasons for human behaviour.
- The main aim of this type of research is discovering the underlying motives and desires of human beings by using in-depth interviews.

19. What is Conceptual research?

The research related to some abstract idea or theory is known as conceptual research. Generally, philosophers and thinkers use it for developing new concepts or for reinterpreting the existing ones.

20. What is Clinical Research?

- The kinds of research follow case-study methods or in-depth approaches to reach the basic casual relations.
- Such studies usually go deep into the causes of things or events that interest us, using very small samples and very deep probing data gathering devices.

21. State the Functions of hypothesis:

- It guides the direction of the study.
- It identifies facts that are relevant and those that are not.
- It suggests which form of research design is likely to be most appropriate.
- It provides a framework for organizing the conclusions that result.

22. What is broad problem area?

Broad Problem area refers to the entire situation where one sees a possible need for research and problem solving. Examples:

- The sales volume of a product is not picking up.
- Training programs are perhaps not as effective as anticipated.

23. What is meant by theoretical framework?

A theoretical framework is none other than identification the network of relationship among the variables considered important to the study of any given problem situation**.**

24. What are the oobjectives of research?

- To investigate a subject.
- To collect data regarding the problem.
- To conduct logical and objective study.
- To conduct a systematic enquiry of the subject.
- For carefully recording, reporting and presenting the facts.

25. What is Analytical Research? (May 2007)

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

26. What is Correlation Research?

The main emphasis in a correlation research is to discover or establish the existence of a relationship/association/interdependence between two or more aspects of a situation.

Examples:

- What is the impact of an advertising campaign on the sale of a product?
- What is the relation between technology and unemployment?
- Are smoking and cancer related?

27. What is an exploratory research?

A research study where very little knowledge or information is available on the subject under investigation. Exploratory research is a type of research conducted because a problem has not been clearly defined. The results of exploratory research are not usually useful for decision-making by themselves, but they can provide significant insight into a given situation.

28. Define Alternative Hypothesis?

In statistical hypothesis testing, the alternative hypothesis (or maintained hypothesis or research hypothesis) and the null hypothesis are the two rival hypotheses which are compared by a statistical hypothesis test.

29. What is Diagnostic research design? (Dec 2016)

Identification of a condition, disease, disorder, or problem by systematic analysis of the background or history, examination of the signs or symptoms, evaluation of the research or test results, and investigation of the assumed or probable causes.

30. Define Hypothesis (Nov/Dec 2007)

A hypothesis is a tentative statement about the relationship between two or more variables. A hypothesis is a specific, testable prediction about what you expect to happen in your study. Statistical and Null Hypothesis are its type.

31. Explain Hypothesis types.

- Null Hypothesis
- Alternate Hypothesis

32. What is experiment?

An **experiment** is a procedure carried out to support, refute, or validate a hypothesis. **Experiments** provide insight into cause-and-effect by demonstrating what outcome occurs when a particular factor is manipulated.

33. What are the 3 types of experiment ?

There are three types of experiments you need to know:

- Laboratory / Controlled Experiments. This type of experiment is conducted in a well-controlled environment (not necessarily a laboratory), where accurate measurements are possible. ...
- Field Experiments. ...
- Natural Experiments.

34 **What is the difference between test and experiment?**

While these two words are used interchangeably by retail marketers, the differenceis more than semantics. There are many stark differences between the mind-set, process and outcome of one vs. the other. A test isn't an experiment, and anexperiment isn't a test Experimentation to discover, testing to validate.

35 **What are experimental methods?**

The **experimental method** involves manipulating one variable to determine if changes in one variable cause changes in another variable. This **method** relies on controlled **methods**, random assignment and the manipulation of variables to test a hypothesis.

36 What are the three types of research methods?

Descriptive **research** methods are pretty much as they sound — they describe situations. They do not make accurate predictions, and they do not determine cause and effect. There are **three** main **types** of descriptive methods: observational methods, case-**study** methods and survey methods.

37 What are the significance of research?

- It provides the basis for nearly all government policies in our economic system.
- It helps in solving various operational and planning problems of business and industry.
- It is an aid to decision making.
- It establishes the relation between variables.

38 What is research methods?

Research methods refers to the tools that one uses to do research. These can either be qualitative or quantitative or mixed ..... Qualitative data is non-numerical and focuses on establishing patterns. Mixed methods are composed of both qualitative and quantitative research methods.

39 What is research approach?

Research approach is a plan and procedure that consists of the steps of broad assumptions to detailed method of data collection, analysis and interpretation. ...Research approach is essentially divided into two categories: approach of data collection and. approach of data analysis or reasoning.

40 What is research area?

Interdisciplinary **research** (as in the social sciences) in a distinct geographic, sociocultural, or political **area** aimed at a scientific understanding of the **area** as an entity and at relating it to other **areas**.

41 What are the characteristics of a good hypothesis?

- Conceptual clarity
- Empirical referents
- Objectivity
- Specificity
- Consistency
- Simplicity:

.

42 What is the purpose of field research?

Field research. Any activity aimed at collecting primary (original or otherwise unavailable) data, using methods such as face-to-face interviewing, telephone and postal surveys, and direct observation.

43 What are the various types of field research?

Three types of qualitative field research methods are described here that focus on capturing lived experiences: direct observation; participant observation; and qualitative interviews.

44 What is **Precision and Confidence**?

Precision refers to the closeness of the findings to reality. Precision reflects the degree of accuracy of the results .We ensures that our findings are close to reality. So that we can place reliance or confidence in the results.In social sciences confidence level is 95%.

A **confidence** level is an expression of how **confident** a researcher can be of the data obtained from a sample. **Confidence** levels are expressed as a percentage and indicate how frequently that percentage of the target population would give an answer that lies within the **confidence** interval.

45. Rank the benefits of Cross Sectional Research.

- Used to prove and/or disprove assumptions.
- Not costly to perform and does not require a lot of time. ...
- Contains multiple variables at the time of the data snapshot.

46 **Differentiate Longitudinal and cross sectional studies.**

Longitudinal studies differ from one-off, or cross-sectional, studies. The main difference is that cross-sectional studies interview a fresh sample of people each time they are carried out, whereas longitudinal studies follow the same sample of people over time.

47 What is H0 and H1?

While the null hypothesis (H0) in any experiment or research project is that the connection or conclusion suggested by the experiment is false, the alternative hypothesis (H1) is always the assertion that there is a meaningful connection to be investigated.

48 What is the role of theory in research?

Theories are formulated to explain, predict, and understand phenomena and, in many cases, to challenge and extend existing knowledge within the limits of critical bounding assumptions. The theoretical framework is the structure that can hold or support a theory of a research study.

50. What is the **criteria for Good Research**?

- Purpose should be clearly defined.
- Common concepts should be used that can be understood by all.
- Research procedure should be explained in detail.
- Research design should be carefully planned.
- Researcher should declare all the possible errors and their possible impact on finding.

51. Define Ex Post Facto (After the Fact) Designs

Ex post facto design is a quasi-experimental **study** examining how an independent variable, present prior to the **study** in the participants, affects a dependent variable. A quasi-experimental **study** simply means participants are not randomly assigned.

52. What is empirical research?
    Empirical research is based on observed and measured phenomena and derives knowledge from actual experience rather than from theory or belief.

53. What is motivational research?
    Motivational research is a type of marketing **research** that attempts to explain why consumers behave as they do. **Motivational research** seeks to discover and comprehend what consumers do not fully understand about themselves.

PART-B

1. Describe the steps in research process with an example (Nov/Dec 2007) (Nov/Dec2008) (May/ June 2013)
2. Describe various forms of hypothesis using demographic and sales variables. How does the hypothesis formulated for testing analysis of variance and chi-square test. (May/June-2008) Hypothesis Testing (Nov/Dec2010) (May/June 2013)
3. Explain the various types of research with appropriate illustrative problems (May / June 2013)
4. Write in detail about factors affecting Business research. (MAY/JUNE 2014)
5. Discuss the role of theory. (MAY/JUNE 2014)
6. Illustrate with simple examples the role or exploratory research for one following tasks: (MAY/JUNE 2014)
7. What is Causal Research, and Why is it Important?
8. How would you describe research process (May 2017)
9. Is there an advantage in stating the hypothesis both in the null and in the alternate? Justify your answer with an example. (May 2017).
10. "Research is much concerned with proper fact finding, analysis and evaluation". Do you agree with this statement? Give reasons in support of your answer.
11. Describe various forms of hypothesis using demographic and sales variables. How does the hypothesis formulated for testing analysis of variance and chi-square test.
12. Explain Research Problem? How do you select a Research Problem and establish Research Objective? Illustrate your answer.
13. Why is hypothesis required in research? What are the different types of hypothesis? Gives Examples.
14. Briefly explain the techniques involved in defining a Research Problem with an example.

Why is hypothesis required in research? What are the different types of hypothesis? Gives Examples

UNIT-2

PART- A

1. Discuss the difference between Reliability and Validity (Nov/Dec 2007) (May/June 2013)

Reliabilty(Nov/Dec 2012)	Validity
It is the degree to which a measurement procedure produces similar outcomes when it is repeated.	It is test for determining whether a measure is measuring the concept that the researcher thinks is being measured
A Reliable Test is not necessarily valid	A Valid test is always Reliable

2. What are the advantages of Field Experiment? (Nov/Dec 2007)

- Greater ecological validity than laboratory experiment.
- Less sample bias.
- Fewer demand characteristics if participants are unaware.

3. What is experimental design? (Nov/Dec 2008)

In general usage, **design of experiments (DOE)** or **experimental design** is the design of any information-gathering exercises where variation is present, whether under the full control of the experimenter or not. However, in statistics, these terms are usually used for controlled experiments. Other types of study, and their design, are discussed in the articles on opinion polls and statistical surveys (which are types of observational study), natural experiments and quasi-experiments (for example, quasi-experimental design). See Experiment for the distinction between these types of experiments or studies.

4. Differentiate between questionnaire and interview schedule. (Nov/Dec 2007)

A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents. Interview Schedule is also used as a method of data collection but in this case, the data is collected by an interviewer rather than through a self-administered questionnaire. Interviewers read the questions exactly as they appear on the survey questionnaire. The choice of answers to the questions is often fixed (close-ended) in advance, though open-ended questions can also be included within a structured interview.

5. What is Internal Validity? (Nov/Dec 2007)

Internal Validity is the approximate truth about inferences regarding cause-effect or causal relationships. Thus, internal validity is only relevant in studies that try to establish a causal relationship. It's not relevant in most observational or descriptive studies, for instance.

6. What is Criterion Validity? (Nov/Dec 2006)

Criterion Validity is a valid measure actually measures what it says it will measure. To define a measure as valid, one can assess different types of validity. The type of validity of measurement assessed depends on what the researcher wants to know. Criterion validity is one method for assessing the validity of a measure nal statistics than, for example, single-case designs.

7. Mention the various methods of reliability? (Nov/Dec 2006)

- Inter-rater reliability is the variation in measurements when taken by different persons but with the same method or instruments.
- Test-retest reliability is the variation in measurements taken by a single person or instrument on the same item and under the same conditions. This includes intra-rater reliability.
- Inter-method reliability is the variation in measurements of the same target when taken by a different methods or instruments, but with the same person, or when inter-rater reliability can be ruled out. When dealing with forms, it may be termed parallel-forms reliability.
- Internal consistency reliability assesses the consistency of results across items within a test.

8. Define Experimental research. (Nov / Dec 2008)

Experimental research designs are used for the controlled testing of causal processes. The general procedure is one or more independent variables are manipulated to determine their effect on a dependent variable. These designs can be used where:

- There is time priority in a causal relationship (cause precedes effect),
- There is consistency in a causal relationship (a cause will always lead to thesameeffect), and
- The magnitude of the correlation is great.

9. What are the various types of reliability (May/June) 2009?

Reliability means the extent to which the measurement process is free from errors.It is an indication of the stability and consistency with which the instrument measures the concept and helps to assess the goodness of a measure.

10. Content Validity? (Nov/Dec 2010)

Content validity (also known as logical validity) refers to the extent to which a measure represents all facets of a given social construct. For example, a depression scale may lack content validity if it only assesses the affective dimension of depression but fails to take into account the behavioural dimension.

11. What do you mean by quasi experiments? (June 2011)

A quasi-experiment is an empirical study used to estimate the causal impact of an intervention on its target population. Quasi-experimental research designs share many similarities with the traditional experimental design or randomized controlled trial, but they specifically lack the element of random assignment to treatment or control. Instead, quasi-experimental designs typically allow the researcher to control the assignment to the treatment condition, but using some criterion other than random assignment (e.g.eligibility cutoff scores). In some cases, the researcher may have no control over assignment to treatment condition**.**

12. Define Validity and point out the different types of validity (June 2011)

Validity is the extent to which a test measures what it claims to measure. It is vital for a test to be valid in order for the results to be accurately applied and interpreted.

Types

- Content validity

- Criterion-related Validity
- Construct Validity

13. Draw the format of ANNOVA Table? (Nov/Dec2012)

Table 3

Sample ANOVA Table

Stubhead	*df*	*F*	η	*p*
	Column spanner			
Row 1	1	0.67	.55	.41
Row 2	2	0.02	.01	.39
Row 3	3	0.15	.33	.34
Row 4	4	1.00	.76	.54

Note: This is where authors provide extra information important to the data, such as findings that approach statistical significance depending on the p value: Signicant at the p<0.05 level.

14. Give an example for each Nominal and Ordinal scales. (Nov/Dec2012)

Nominal - Qualitative variable with out order (only categorization possible)Example:Gender,departments,etc. Ordinal - Qualitative variable with order (categorization and order) example Rank, credit rating as High risk, medium risk, Low risk etc.

15. Explain Thurston Measurement Scale (May / June 2013)

In psychology and sociology, the **Thurstone scale** was the first formal technique to measure an attitude. It was developed by Louis Leon Thurstone in 1928, as a means of measuring attitudes towards religion. It is made up of statements about a particular issue, and each statement has a numerical value indicating how favorable or unfavorable it is judged to be. People check each of the statements to which they agree, and a mean score is computed, indicating their attitude.

16. Define research design.

- Research design constitutes the blueprint for the collection, measurement and analysis **of data.**
- **Research design aids the researcher** in the allocation of limited resources by posing crucial choices in methodology.
- Research design is the plan and structure of investigation conceived as to obtain answers to research questions. The plan is the overall scheme or program of the research. It includes an outline of what the investigator will do from writing hypothesis and their operational implications to the final analysis of data.

17. What is Experimental design?

A set of procedures for devising an experiment such that a change in a dependent variable may be attributed solely to the change in independent variables.

18. Mention the various notations used in experimental design.

- X --- Represents the introduction of an experimental stimulus to a group. The effect of this independent variable(s) is of major interest. The manipulation or change of an independent variable.
- O --- Identifies a measurement or observation activity.
- R --- Indicates that the group members have been randomly assigned to a group.

E ---------- Experimental effect: that is, the change in the dependent variable due to the independent variable.

19. Classify the experimental design.

The various experimental designs are as follows:

- "Quasi-" and "true" experimental designs
- Purely post-design
- Before-after design
- Factorial design
- Latin square design
- Ex-post facto design

20. What is Quasi and True experimental design?

- **Quasi designs:** designs which do not properly control for the effects of extraneous variables.
- **True designs:** designs which properly control for the effects of extraneous variables and isolate the effects of independent variables on the dependent variables.

21. What is Ex-post Facto Design?

With an ex post _facto design, investigators have no control over the variables in the sense of being able to manipulate them. They can only report what has happened or what is happening.

22. What is Simulation?

- Simulation uses a model-building technique to determine the effects of changes, and computer-based simulations are becoming popular in business research.
- For example, in the study by Koolstra and Beentijes (1999), elementary students participated in different television-based treatments in vacant school rooms similar to their actual classrooms.

23. What is the prospective study design?

The prospective studies refer to the likely prevalence of a phenomenon, Situation, problem, attitude or outcome in the future.

Examples:

- To determine, under field conditions, the impact of maternal and child health services on the level of infant mortality.
- To establish the effects of a counselling service on the extent of marital problems.
- To find out the effect of parental involvement on the level of academic achievement of their children.

24. What is the retrospective- prospective study design?

- Studies focus on past trends in a phenomenon and study it into the future.

- In a retrospective-prospective study a part of the data is collected retrospectively from the existing records before the intervention is introduced and then the study population is followed to ascertain the impact of the intervention
- **Example:**
  - ✓ Trend studies.

25. What are Cohort studies?

- ❖ Cohort studies are based upon the existence of a common characteristic such as year of birth, graduation or marriage, within a subgroup of a population.
- ❖ **Example:**
- ❖ Suppose you want to study the employment patterns of a batch of accountants who graduated from a university in 1975 or to study the fertility behaviour of women who were married in 1930.

26. What are solomon four group designs?

- ❖ The experimental design that sets up two experimental groups and two control groups, subjecting one experimental group and one control group to both the pre-test and the post test, and the other experimental and control group to only the post test.

Group	Pre-test	Treatment	Post test
1. Experimental	O_1	X	O_2
2. Control	O_3		O_4
3. Experimental		X	O_5
4. Control			O_6

Treatment effect (E) could be judged by:

$E= (O_2-O_1)$

$E= (O_2-O_4)$

$E= (O_5-O_6)$

$E= (O_5-O_3)$

$E= [(O_2-O_1)-(O_4-O_3)]$

If all Es are similar, the cause and effect relationship is highly valid.

27. What is interviewing Variable?

An interviewing variable is one that surfaces between the time the independent variables start operating to influence the dependent variable and the time their impact is felt on it.

28. What is External validity?

Refers to the extent of generalizability of the results of a causal study to other settings, people or events.

29. What are the factors affecting internal validity?

- History
- Maturation
- Testing
- Instrumentation
- Selection
- Statistical regression
- Experimental mortality

30. What is a longitudinal study?(May/June) 2009

A research study for which data are gathered at several points in time to answer aresearch question is called longitudinal study.A longitudinal study is like a crosssectional an observational one.

For example

We might choose to look at the change in cholesterol levels among women over 40 who walk daily for a period of 20 years. The Longitudinal study design would account for cholesterol levels at the onset of a walking regime and the walking behaviour continued over time. The researcher might want to study employees' behaviour before and after a change in the top management, so as to know what effects the change accomplished.

31. Can you explain the term Likert Scale?

Named after Rensis **Likert**, a **Likert scale** is a measurement device that requires people to indicate the extent to which they agree to several statements. The range of options in **Likert scales** are ordinal, which **means** that while they are ranked, the distance between two options is not necessarily equal.

32. What is meant by Data Aanlysis?

Data analysis is a process of inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, informing conclusions, and supporting decision-making All of the above are varieties of data analysis.

33. Explain Factor Scales?

A scale factor is a number which scales, or multiplies, some quantity..... The ratio of any two corresponding lengths in two similar geometric figures is also called a scale factor.

34. What is a Rating scaling?

A rating scale is a set of categories designed to elicit information about a quantitative or a qualitative attribute

35 Name four levels of measurement

The four levels of measurement are nominal, ordinal, interval and ratio.

36. Distinguish between naturalistic and controlled observation

Naturalistic observation is carried out on participants in an environment which is familiar to them / for example a child's home, school-room or playground. / In controlled observation, the psychologist exercises some control over events which influence the participants / e.g. some aspect of their normal, everyday environment is changed / in order to observe the effect.

37. What is a pilot study? What is the purpose of pilot studies?

A pilot study is a small-scale / dummy-run of a proposed research procedure. / Its purpose is to show up any deficiencies in the procedure / so that they can be put right, and the procedure perfected, / before the full-scale study is carried out.

38 What are standardised instructions?

Standardised instructions are directions that are given to research participants in the same way. / It is a form of control used in order to avoid favouring some participants over others.

39. What is experimental validity?

Experimental validity refers to the internal 'worth' of the research design / i.e. is it really measuring what it is supposed to measure / or are there biases or other design problems getting in the way?

40. What is ecological validity?

Findings from a research study have ecological validity if they are generalisable across different settings / (contextual validity

41. What is a directional hypothesis and when would it be used?

A directional hypothesis predicts the direction in which results will fall / e.g. the population mean of sample A is higher than the mean of sample B / or the correlation between C and D is positive. / Such hypotheses are used only when we have good reason to predict the direction of the results / e.g. when previous research or careful reasoning suggest it.

42. What is randomisation?

Randomisation can refer to the random allocation of participants to conditions to help control for variation due to participants. / Secondly, it can refer to randomising the order in which participants take part in conditions (thus achieving a similar effect to counterbalancing). / Thirdly, it can refer to randomising the order of stimulus materials for each participant e.g. a word list in a memory experiment might be given on a different order to each participant.

43. What is a control group?

In a simple two-sample experiment, control group participants are affected by everything the experimental group experiences with the exception of the IV. / Scores from the control group thus provide baseline data / against which scores from the experimental group can be compared.

44 What is an extraneous variable?

Extraneous variables are all other variables apart from the IV and DV that need to be controlled in an experiment / e.g. the testing environment, time of day, instructions to participants. / If extraneous variables are not taken care of they could obscure the effect of the IV / or, if systematic, turn into a confounding variable.

45. How would you identify the Exploratory Study?

Exploratory research (or ER) is an examination into a subject in an attempt to gain further insight. With ER, a researcher starts with a general idea and uses**research** as a tool to **identify** issues that could be the focus of future **research**.

46. Why exploratory research is conducted ?

Exploratory research, as the name implies, intends merely to explore the research questions and does not intend to offer final and conclusive solutions to existing problems. This type of research is usuallyconducted to study a problem that has not been clearly defined yet.

47 Differentiate Exploratory Research with explanatory research.

Explanatory Research. We began exploring something new with exploratory research. Then, we conducted descriptive research to increase our knowledge of it..... Explanatory research is defined as an attempt to connect ideas to understand cause and effect, meaning researchers want to explain what is going on.

48. How would you show your understanding by measurement?

Measurement is the process observing and recording the observations that are collected as part of a research effort.

49. Why is measurement is important in research?

Reliability is **important** because it enables **researchers** to have some confidence that the **measure** they taken are close to the true **measure**. ... 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.

50. How do you measure variables in research?

Variables are **measurement** using an instrument, device, or computer. The scale of the variable **measured** drastically affects the type of analytical techniques that can be used on the data, and what conclusions can be drawn from the data. There are four scales of **measurement**, nominal, ordinal, interval, and ratio.

PART-B

1. Explain Focus Groups. Static and Dynamic Data Collection methods. When each one of them to be used? (Nov/Dec2006)(Nov / Dec 2012)
2. Explain the Factors affecting of internal validity and external validity and their interrelationship (MAY/JUNE2009), (JUNE 2011), (NOV/DEC 2014)
3. Describe the different types of research designs with relevant research Problems (May / June 2013) (Nov / Dec 2012)
4. What is focus group interview? And its advantages. (May/June 2014)
5. Explain in detail in-depth of interviews. (May/June 2014)
6. Distinguish between nominal scale and ordinal scale as well as between interval scale and ratio scale – Give simple examples. (Nov/Dec 2014).

7. Explain the concept of trade off between internal validity and external validity". (May 2017)
8. Briefly explain the types of experimental designs used in business. (April 2015)
9. Discuss the various types of measurement scales (April 2015).
10. Illustrate the research design process, types and benefits in the context of any functional management research. (June 2016).
11. What are the types of informal experimental design?
12. Narrate the procedure for developing a scalogram and illustrate the same by an example.
13. What do you mean by Research Variable? Give different types of Research Variable.
14. Sketch the importance of Experimental Group and Control Group.
15. Compare Likert's scale and Semantic Differential Scale, What are the special features of the semantic differential Scale?

UNIT-3

PART-A

1. What are the determinants of optimal sample size? (Nov/Dec 2016)

- The number of elementary units in a sample is called sample size.
- The first factor that must be considered in estimating the sample size, is the permissible error (E)
- Greater the desired precision, larger will be the sample size.
- Higher the confidence level in the estimate, the lager the sample must be. There is a trade off between the degree of confidence and degree of precision with a sample of fixed size.
- The greater the number of sub-groups of interest within the sample, the greater the size must be.

2. Distinguish between primary data and secondary data(Nov / Dec 2008)

Primary data uses an immediate data, whereas secondary data is means to reprocess and reuse collected information.

3. Distinguish between normal scale and ordinal scale (Nov / Dec 2008)

A categoricalvariable, also called a *nominal* variable, is for mutual exclusive, but not ordered, categories. For example, your study might compare five different genotypes. You can code the five genotypes with numbers if you want, but the order is arbitrary and any calculations (for example, computing an average) would be meaningless.

A*ordinal* variable is one where the order matters but not the difference between values. For example, you might ask patients to express the amount of pain they are feeling on a scale of 1 to 10. A score of 7 means more pain that a score of 5, and that is more than a score of 3. But the difference between the 7 and the 5 may not be the same as that between 5 and 3. The values simply express an order. Another example would be movie ratings.

4. Define non-probability sampling (Nov / Dec 2008)

No probability sampling techniques *cannot* be used to infer from the sample to the general population. Any generalizations obtained from a non probability sample must be filtered through one's knowledge of the topic being studied. Performing no probability sampling is

considerably less expensive than doing probability sampling, but the results are of limited value.

5. What is Category Scale?

The category scale uses multiple items to elicit a single response as per the followingexample. This also uses the nominal scale.

E.g. Where in northern California do you reside?

1. North Bay
2. South Bay
3. East Bay
4. Peninsula

6. What are the various types of measurement scale? (May/June) 2009

- Nominal scale
- Ordinal scale
- Interval scale
- Ratio scale

7. What is optimum sampling? (Nov/Dec 2010)

When clusters are in the form of some geographic subdivisions, then cluster sampling is termed as area sampling. That is, when the primary sampling unit represents a cluster of units based on geographic area, the cluster designs are distinguished as area sampling. The merits and demerits of cluster sampling are equally applicable to area sampling.

8. What is Focus group Interview? (Nov/Dec 2010)

A **focus group** is a form of in which a group of people are asked about their perceptions, opinions, beliefs and attitudes towards a product, service, concept, advertisement, idea, or packaging

9. What is Data Mining? (June 2011)

Data mining (the analysis step of the knowledge discovery in databases process, or KDD), a relatively young and interdisciplinary field of computer science is the process of discovering new patterns from large data sets involving methods at the intersection of artificial intelligence, machine learning, statistics and database systems. The goal of data mining is to extract knowledge from a data set in a human-understandable structure and involves database and data management, data preprocessing, model and inference considerations, interestingness metrics, complexity considerations, post-processing of found structure, visualization and online updating.

10. How is sample size determined? (June 2011)(May / June 2013)

Determinants of Sample Size

- Type of analysis to be employed
- The level of precision needed

- Population homogeneity/heterogeneity
- Available resources
- Sampling technique used

11. What is snowball sampling? (Nov/Dec2009)

In sociology and statistics research, snowball sampling (or chain sampling, chain-referral sampling, referral sampling) is a non-probability sampling technique where existing study subjects recruit future subjects from among their acquaintances. Thus the sample group appears to grow like a rolling snowball. As the sample builds up, enough data is gathered to be useful for research. This sampling technique is often used in hidden populations which are difficult for researchers to access; example populations would be drug users or sex workers. As sample members are not selected from a sampling frame, snowball samples are subject to numerous biases. For example, people who have many friends are more likely to be recruited into the sample.

12. Semantic differential scale (May/June-2008)

The semantic differential (sd) measures peoples reactions to stimulus words and concepts in terms of ratings on bipolar scales defined with contrasting adjective at each end. The semantic differential scale asks a person to rate a product, brand, or company based upon a seven-point rating scale that has two bi-polar adjectives at each end. The following is an example of semantic differential scale question.

Example:

Would you say our website is?

- (7) very active
- (6)
- (5)
- (4)
- (3)
- (2)
- (1) very unattractive

13. Intension to buy scale (May/June-2008)

Intent to buy scale translation is a mathematical technique used by marketers to converts stated purchase intentions into purchase probabilities , that is, into an estimate of actual buying behavior, it takes survey data on consumes purchase intentions and converts its into actual purchase probabilities.

A survey might ask a question using a five point scale such as:

_____i definitely would use product X
_____I probably would use product X
_____I might use product X
_____I probably would not use product X
_____I definitely would not use product X

14. Household consumer panel (May/June-2008)

Household consumer panel data is collected after each panel list shopping trip. Members of the panel record their purchases, capturing not only what is purchased, but also where the purchases was made (store or channel), and whether the purchases were the results of a promotional deal. This purchase information is then tied back to the general demographics of the household.

15. What is Dichotomous Scale?

The dichotomous scale is used to elicit a Yes or No answer, as in the example below. Note that a nominal scale is used to elicit the response.e.g. Do you own a car? Yes No

16. What are the characteristics of secondary data collection? (May / June 2013)

1. Reliability of Data :
2. Suitability of Data
3. Adequacy of Data
4. Continuity of Data

17. What is Rosenthal Effect?

Inferences about cause-consequence relationships may not be generalizable to other investigators or researchers.

18. What is dependent variable?

- The dependent variable is the variable of primary interest to the researcher.
- The researcher's goal is to understand and describe the dependent variable or to explain its variability or predict it.
- Example
  - ✓ A manager is concerned that the sale of a new product introduced after test marketing it do not meet with his expectations.
  - ✓ The dependent variable here is sales.
  - ✓ Since the sales of the product can vary – can be low, medium or high – it is a variable.
  - ✓ Since sales in the main focus of interest to the manager, it is the dependent variable.

19. What is independent variable?

- An independent variable is one that influences the dependent variable in either a positive or negative way.
- That is, when the independent variable is present, the dependent variable is also present and with each unit of increase in the independent variable, there is an increase or decrease in the dependent variable also.
- Example

  Research studies indicate that successful new product development has an influence on the stock market price of the company. Therefore the success of the new product is the independent variable and stock market price the dependent variable.

20. What ismoderating variable?

The moderating variable is one that has a strong contingent effect on the independent variable – dependent variable relationship. That is the presence of a third variable (mv) modifies the original relationship between the independent and dependent variables.

21. What are variables in Research?

- A variable is anything that can take on differing or varying values.
- The values can differ at various times for the same object or person or at the same time for different objects or persons.
- Examples
  - Production Units, Absenteeism ,Motivation

22. What is Likert Scale?

The Likert scale is designed to examine how strongly subjects agree or disagree with statements on a 5-point scale with the following anchors:

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
1	2	3	4	5

23. What is Numerical Scale?

The numerical scale is similar to the semantic differential scale, with the difference that numbers on a 5 point or 7 point scale are provided, with bipolar adjectives at both ends, as illustrated below. This is also an interval scale.

E.g.

How pleased are you with your new real estate agent?

Extremely Pleased	7	6	5	4	3	2	1	Extremely Displeased

24. What is Fixed or Constant Sum Scale?

The respondents are here asked to distribute a give number of points across various items as per the example below. This is more in the nature of an ordinal scale.

25. What is Stapel scale?

This scale simultaneously measures both the direction and intensity of the attitude toward the items under study. The characteristic of interest to the study is placed at the centre and a numerical scale ranging, say, from +3 to -3, on either side of the item as illustrated below. This gives an idea of how close or distant the individual response to the stimulus is, as shown in the example below. Since this does not have an absolute zero point, this is an interval scale.

26. What is Graphic Rating Scale?

A graphical representation helps the respondents to indicate on this scale their answers to a particular question by placing a mark at the appropriate point on the line, as in the following

example. This is an ordinal scale, though the following example might appear to make it look like an interval scale.

27. What is meant by Test / Re-test reliability?

- This is a commonly used method for establishing the reliability of a research tool.
- In the test/re test an instrument is administered once, and then again, under the same or similar conditions. The ratio between the test and re test scores is an indication of the reliability of the instrument.
- The greater the value of the ratio, the higher the reliability of the instrument.

28. What is meant by the split – half technique?

A test given and divided into halves and are scored separately, then the score of one half of test are compared to the score of the remaining half to test the reliability (Kaplan &Saccuzzo, 2001).

29. What do you mean by Interview?

An interview is a conversation where questions are asked and answers are given. In common parlance, the word "interview" refers to a one-on-one conversation between an interviewer and an interviewee.

30 Tabulate the different methods of collection of Data

- Interviews.
- Questionnaires and Surveys.
- Observations.
- Focus Groups.
- Ethnographies, Oral History, and Case Studies.
- Documents and Records.

31. What do you mean by Observation?

Observation is a systematic data collection approach. Researchers use all of their senses to examine people in natural settings or naturally occurring situations.

32. Prepare the Characteristics of a good sample design.

- Sample design should be a representative sample:
- Sample design should have small sampling error:
- Sample design should be economically viable:
- Sample design should have marginal systematic bias:
- Results obtained from the sample should be generalized and applicable to the whole universe:

33. How does the snowball method work?

Snowball sampling is where research participants recruit other participants for a test or study. It is used where potential participants are hard to find. It's called snowball sampling because (in theory) once you have the ball rolling, it picks up more “snow” along the way and becomes larger and larger.

34. What are the disadvantages of snowball sampling?

The researcher has little control over thesampling method. The subjects that the researcher can obtain rely mainly on the previous subjects that were observed. ... Sampling bias is also a fear of researchers when using this sampling technique.

35. What are the four types of non probability sampling?
There are five types of non-probability sampling technique that you may use when doing a dissertation at the undergraduate and master's level: quota sampling, convenience sampling, purposive sampling, self-selection sampling and snowball sampling.

36. What is quota sampling method?
A sampling method of gathering representative data from a group. As opposed to random sampling, quota sampling requires that representative individuals are chosen out of a specific subgroup. For example, a researcher might ask for a sample of 100 females, or 100 individuals between the ages of 20-30.

37. What is criterion sampling?
Criterion sampling involves selecting cases that meet some predetermined criterion of importance (Patton, 2001, p. 238). For example: Every patient at a practice receives a satisfaction survey at the end of his or her visit.

38. What are the limitations of convenience sampling?
- Highly vulnerable to selection bias and influences beyond the control of the researcher.
- High level of sampling error.
- Studies that use convenience sampling have little credibility due to reasons above.

39. What is difference between probability and Nonprobability sampling?
The difference between nonprobability and probability sampling is thatnonprobability sampling does not involve random selection and probability sampling does. ... At least with a probabilistic sample, we know the odds orprobability that we have represented the population well.

40. What is the problem with convenience sampling?
The most obvious criticism about convenience sampling is sampling bias and that the sample is not representative of the entire population. This may be the biggest disadvantage when using a convenience sample because it leads to more problems and criticisms. Systematic bias stems from sampling bias.

41 How can you prevent bias in convenience sampling?
42 To reduce sampling bias, the two most important steps when designing a study or an experiment are (i) to avoid judgment or convenience sampling (ii) to ensure that the target population is properly defined and that the sample frame matches it as much as possible.

43 How do you validate a questionnaire?

- Establish Face Validity.

- Pilot test.
- Clean Dataset.
- Principal Components Analysis.
- Cronbach's Alpha.
- Revise (if needed)
- Get a tall glass of your favorite drink, sit back, relax, and let out a guttural laugh celebrating your accomplishment.

44. Why is validity and reliability important in research?
    Validity and reliability are important concepts in research. The everyday use of these terms provides a sense of what they mean (for example, your opinion is valid; your friends are reliable). ... To assess the validity and reliability of a survey or other measure, researchers need to consider a number of things.

45. How do you make a good questionnaire?

- Write a study protocol. ...
- Draw a plan of analysis. ...
- Draw a list of the information needed. ...
- Design different parts of the questionnaire. ...
- Write the questions. ...
- Decide on the order of the questions asked. ...
- Complete the questionnaire. ...
- Verify the content and style of the questions.

46. How does Cronbach's alpha work?
    Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability. A "high" value for alpha does not imply that the measure is unidimensional.

47. What is a sampling plan in market research?
    The processes that are involved in identifying and obtaining a sample are known collectively as the sampling plan. A sample unit is the group of potential researchparticipants or respondents from which the sampling frame will be developed and from which the sample will ultimately be selected.

48. Why is probability sampling better than Nonprobability sampling?
    The two main methods used in survey research are probability sampling and non-probability sampling. The big difference is that in probability sampling all persons have a chance of being selected, and results are more likely to accurately reflect the entire population.

49. Is cluster sampling a probability sampling?
    In two-stage cluster sampling, a random sampling technique is applied to the elements from each of the selected clusters .....In stratified sampling, a random sample is drawn from each of the strata, whereas in cluster sampling only the selected clusters are sampled.

50. What is the rule of thumb for sample size?

There is no certain rule of thumb to determine the sample size. Some researchers do, however, support a rule of thumb when using the sample size. For example, in regression analysis, many researchers say that there should be at least 10 observations per variable.

PART-B

1. Briefly explain various sampling techniques available to the researcher (Nov/Dec2010)(May / June 2013) (May / June 2012).
2. Explain various rating and ranking scales used in Business Research (Nov/Dec 2007)
3. Factors to determine the sample size (june2010) (May/June 2013)
4. List and explain about eight most essential factors to be borne in mind while designing questionnaires. (Nov/Dec 2014)
5. Find out the sample size needed to determine the average monthly income per student – customer for an university –cafeteria: whereas some students spend up to range of Rs. 360 per head per month, other students do not patronize the cafeteria at all. The cafeteria – management wants you to find out with 95 percent confidence (Z = 1.96) and error not exceeding plus or minus Rs.5 the sample size needed.
6. Discuss the role of direct observation as a business research method. (May/June 2014)
7. Discuss the importance of sampling design. (May/June 2014).
8. Explain the principles of wording, stating how these are important in questionnaire design, citing a few examples. (May 2017)
9. Differentiate probability method of sampling from that of non-probability method of sampling providing examples for each. (June 2016)
10. List out the different methods of primary data collection to carry out a business research and explain the purpose of every method. (June 2016)
11. What do you mean by Observation? Explain various types of observation.
12. Explain interview? Can you elaborate the steps involved in interview method of data collection? How To Make Interview Successful?
13. Prioritize the methods available for collecting primary data? Explain in detail the construction of Questionnaire.
14. Write in detail on focus group interview and also state its advantages and disadvantages.
15. Describe the probability and Non-Probability Sampling Methods.

UNIT-4
PART A

1. **What is internal statistics**? **(Nov/Dec 2006)**

Internal statistics is an inductive estimate of the degree to which conclusions about causal relationships can be made (e.g. cause and effect), based on the measures used, the research setting, and the whole research design. Good experimental techniques, in which the effect of an independent variable on a dependent variable is studied under highly controlled conditions, usually allow for higher degrees of inter

2. Describe Confidence level and Confidence Interval.(Nov/Dec 2006)

The **confidence interval** is the plus-or-minus figure usually reported in newspaper or television opinion poll results. For example, if you use a confidence interval of 4 and 47% percent of your sample picks an answer you can be "sure" that if you had asked the question of the entire relevant population between 43% (47-4) and 51% (47+4) would have picked that answer.

3 What is varimax method?(Nov / Dec 2008)

Varimax methods use the idea of maximising the sum of the variances of the square of the loadings

4. What is discriminant analysis?(Nov / Dec 2008)

Discriminant analysis is a technique for classifying a set of observations into predefined classes.

5. What is the statistical test is used to compare the difference of mean?(Nov/Dec 2010)

A **statistical hypothesis test** is a method of making decisions using data, whether from a controlled experiment or an observational study (not controlled). In statistics, a result is called statistically significant if it is unlikely to have occurred by chance alone, according to a pre-determined threshold probability, the significance level.

6. Types of correlation? (Nov/Dec 2010)

- Positive,
- Negative
- no
- Perfect
- Strong ,
- Weak

7. Distinguish between R and adjusted R^2. (June 2011)

R^2 is a statistic that will give some information about the goodness of fit of a model. In regression, the R2 coefficient of determination is a statistical measure of how well the regression line approximates the real data points. An R^2 of 1.0 indicates that the regression line perfectly fits the data.

8. **What is cluster analysis? (June 2011)**

Cluster analysis, also called as classification analysis or numerical taxonomy is a class of techniques used to classify objects or cases into relatively homogeneous groups called clusters. Objects within a cluster are similar and between the clusters are dissimilar

9. When to use parametric test? **(Nov/Dec2009)**

Parametric statistics is a branch of statistics that assumes that the data has come from a type of probability distribution and makes inferences about the parameters of the distribution. Most well-known elementary statistical methods are parametric. Generally speaking parametric methods make more assumptions than non-parametric methods. If those extra assumptions are correct, parametric methods can produce more accurate and precise estimates. They are said to have more statistical power.

10. k-mean cluster (May/June-2008)

K-means clustering is an algorithm to classify or to group your objects based on attributes/featuring into k number of group. K is positive integer number. The grouping is done by minimizing the sum of squares of distance between data and the corresponding cluster centroid. Thus the purpose of k-mean clustering is to classify the data.

11. Discriminant analysis (May/June-2008)

Discriminant analysis is a technique for classifying a set of observations into predefined classes. The purpose is to determine the class of an observation based on a set of variable. The model is built based on asset of variable known as predictors or input variables. The model is built based on a set of observations for which the classes are known. The set of observations is sometimes referred to as the training set. Based on the training set, the technique contructs a set of linear functions of the predictors, known as discriminant coefficients, the x's are the input variables or predictors are c is a constant.

12. What is scaling?

The assignment of numbers or symbols to an indicant of a property or objects to impart some of the characteristics of the numbers to the property; assigned according to a value or magnitude.

13. What is meant by Parallel forms of the same test?

- In this procedure you construct two instruments that are intended to measure the same phenomenon.
- The two instruments are then administered to two similar populations.
- The results obtained from one test are compared with those obtained from the other.
- If they are similar, it is assumed that the instruments are reliable.

14. What is meant by loaded questions?

Questions that would elicit highly biased emotional responses from subjects.Example:

✓ Do you think the civic body is inc 5

✓ To what extend do you think the management is likely to be vindictive if the union decides to go on strike?

✓ Here the words- incompetent, strike and vindictive are loaded.

15. What is meant by Personification?

Participants are asked to imagine inanimate objects with the traits, characteristics and features and personalities of humans. "If brand X were a person, what type of person would brand x be?

16. What is meant by Simple Tabulation or One-way Tabulation?

When the data are tabulated to one characteristic, it is said to be simple tabulation or one-waytabulation.**For Example:** Tabulation of data on population of world classified by one characteristic like Religion is example of simple tabulation.

17. What is meant by Double Tabulation or Two-way Tabulation?

When the data are tabulated according to two characteristics at a time. It is said to be double tabulation or two-way tabulation.**For Example:** Tabulation of data on population of world classified by two characteristics like Religion and Sex is example of double tabulation.

18. What is meant by Complex Tabulation?

When the data are tabulated according to many characteristics, it is said to be complex tabulation.**For Example:** Tabulation of data on population of world classified by two characteristics like Religion, Sex and Literacy etc…is example of complex tabulation.

19. What is Qualitative Data Analysis?

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

20. What is meant by correlation?

- Correlation is a technique which measures the strength of association between two variables.
- When the changes in one variable appear to be linked with the changes in the other variable, the two variables are said to be correlated.
- When the two variables are meaningfully related and both increase or both decrease simultaneously, then the correlation is termed as positive.
- If increase in any one variable is associated with decrease in the other variable, the correlation is termed as negative or inverse.

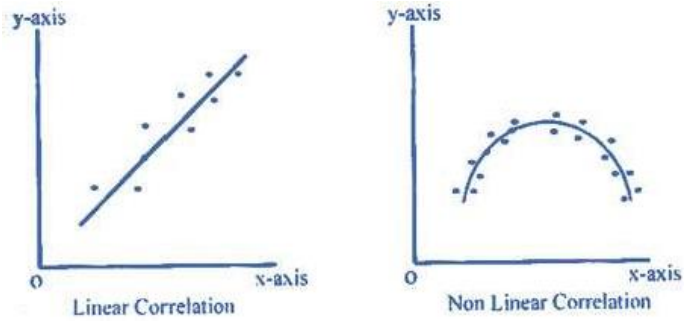
$$r = \frac{\Sigma\left(X-\bar{X}\right)\left(Y-\bar{Y}\right)}{\sqrt{\Sigma\left(X-\bar{X}\right)^2\,\Sigma\left(Y-\bar{Y}\right)^2}}$$

21. What is meant by Linear and non linear Correlation?

Correlation is said to be linear if the ratio of change is constant. The amount of output in a factory is doubled by doubling the number of workers is the example of linear correlation. In other words it can be defined as if all the points on the scatter diagram tends to lie near a line which are look like a straight line, the correlation is said to be linear, as shown in the figure.

Non Linear (Curvilinear) Correlation:

Correlation is said to be non linear if the ratio of change is not constant. In other words it can be defined as if all the points on the scatter diagram tends to lie near a smooth curve, the correlation is said to be non linear (curvilinear), as shown in the figure.

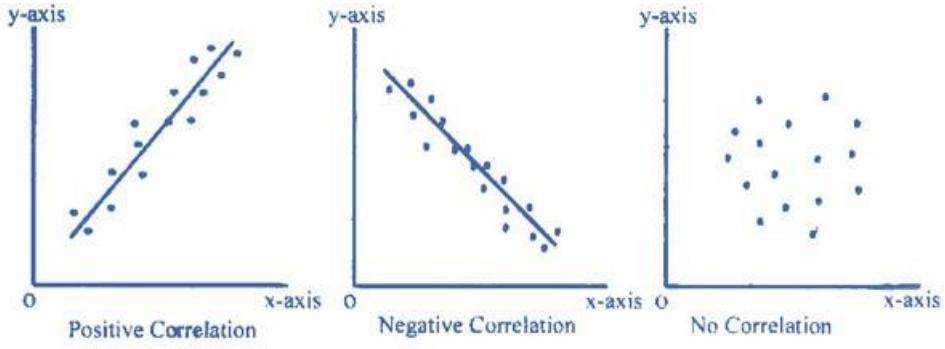


22. What is meant by Positive and negative Correlation?

Positive correlation: The correlation in the same direction is called positive correlation. If one variable increase other is also increase and one variable decrease other is also decrease. For example, the length of an iron bar will increase as the temperature increases.

Negative Correlation: The correlation in opposite direction is called negative correlation, if one variable is increase other is decrease and vice versa, for example, the volume of gas will decrease as the pressure increase or the demand of a particular commodity is increase as price of such commodity is decrease.

No Correlation or Zero Correlation: If there is no relationship between the two variables such that the value of one variable change and the other variable remain constant is called no or zero correlation.



23. What is meant by SPSS?

SPSS (originally, Statistical Package for the Social Sciences) was released in its first version in 1968 after being developed by Norman H. Nie and C. Hadlai Hull. Norman Nie was then a political sciencepostgraduate at Stanford University, and now Research Professor in the Department of Political Science at Stanford and Professor Emeritus of Political Science at the University of Chicago.

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24. State Uses of MDS.

1) Illustrating market segments based on preference and judgments.
2) Determining which products are more competitive.
3) Deriving the criteria used by people while judging objects (products, brands, advertisements etc.)

25. Define Factor analysis.

- Factor analysis is **a set of techniques which by analyzing correlation between variables, reduces their number into fewer factors which explain much of original data, more economically.**
- It is aclass of procedures primarily used for data reduction and summarization.
- The purpose of factor analysis is to simplify the data
- Each factor will account for one or more component.
- Each factor is a combination of many variables.

26. Define 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 of the loadings that is important in the interpretation of a factor.

27. What is meant Communality (h^2)?

- It 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 a under:
- H^2 of the ith variable= (i^{th} factor loading of factor A)+(i^{th} factor loading of factor B)+…..

28. What is meant by Eigen value (latent root)?

- When we take the sum of squared values of factor loadings relating to a factor, then such sum is referred 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

29. What is meant Factor scores?

- Factor scores 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.

30. What is meant by Principle component analysis?

When the objective is to summarize information from a large set of variables into fewer factors, principle component factor analysis is used.

31. What is a dummy variable in Stata?

A **dummy variable** is a **variable** that takes on the values 1 and 0; 1 means something is true (such as age < 25, sex is male, or in the category "very much").**Dummy variables** are also called indicator **variables**.

32. What does the coefficient of a dummy variable mean?

A **dummy variable** is a numerical **variable** used in regression analysis to **represent**subgroups of the sample in your study .....In the simplest case, we would use a 0,1**dummy variable** where a person is given a value of 0 if they are in the control group or a 1 if they are in the treated group.

33. What does i variable mean in Stata?

Stata handles factor (categorical) **variables** elegantly. You **can** prefix a **variable**with i. to specify indicators for each level (category) of the **variable**. ... If you want to interact a

continuous **variable** with a factor **variable**, just prefix the continuous**variable** with c.. You **can** specify up to eight-way interactions.

34. How many dummy variables are needed?
    it's simply k-1, where k is the number of levels of the original variable. You could also create dummy variables for all levels in the original variable, and simply drop one from each analysis. In this instance, we would need to create 4-1=**3 dummy variables**

35. What is a reference group in statistics?
    A **reference group** is a **group** to which an individual or another **group** is compared. Ie: Demographic Sociologists call any **group** that individuals use as a standard for evaluating themselves and their own behavior a **reference group**.

36. what is meant by multivariate analysis
    Statistical procedure for **analysis** of data involving more than one type of measurement or observation. It may also **mean** solving problems where more than one dependent variable is **analyzed** simultaneously with other variables.

37. Distinguish between Observable & Latent variable?
    Observed vs. **Latent Variables**. **The** opposite of an **observed variable** is a **latent variable**, also referred to as a **factor** or construct. ... An important **difference between the** two types of **variables** is that an **observed variable** usually has a measurement error associated with it, while a **latent variable** does not.

38. What isAcceptance Region and Rejection Region.
    Used in the context of hypothesis testing. Possible values of the test statistic are divided into two ranges. The range containing values that are consistent with the null hypothesis is the "**acceptance region**"; the other range, in which the null hypothesis is **rejected**, is the **rejection region** (or **critical region**).

39. How is the rejection region related to the P value?
    The significance level is the probability of getting a result in the **rejection region**, given the null hypothesis is true.....Simply put, critical **value** is to test statistic as significance level is to **p-value**. As a reminder, the critical **value** is the boundary of the **rejection region**.

40. What is p value in Z test?
    The **Z** score is a **test** of statistical significance that helps you decide whether or not to reject the null hypothesis. The **p-value** is the probability that you have falsely rejected the null hypothesis. **Z** scores are measures of standard deviation.

41. What is D value and Z value?

n microbiology, **D-value** refers to decimal reduction time (or decimal reduction dose) and is the time (or dose) required at a given condition (e.g. temperature), or set of conditions, to kill 90% (or 1 log) of the exposed microorganisms.

42. What is the critical region in hypothesis testing?
    The critical region is the region of values that corresponds to the rejection of the null hypothesis at some chosen probability level. The **shaded** area under the Student's t distribution curve is equal to the level of significance.

43. How do you know if it's a one tailed or two tail test?
    Our null hypothesis is that **the** mean is equal to x. A **one-tailed test** will **test** either **if the** mean is significantly greater than x or **if the** mean is significantly less than x, but not **both** **The one-tailed test** provides more power to **detect** an effect in **one**direction by not **testing the** effect in **the** other direction.

44. What is a 2 tailed test?
    A two-**tailed test** is a statistical **test** in which the critical area of a distribution is two-sided and **tests** whether a sample is greater than or less than a certain range of values. If the sample being **tested** falls into either of the critical areas, the alternative hypothesis is accepted instead of the null hypothesis.

45. What is MDS?
    Multidimensional scaling (**MDS**) is a means of visualizing the level of similarity of individual cases of a dataset. It refers to a set of related ordination techniques used in information visualization, in particular to display the information contained in a distance matrix.

46. Explain the concepts of Multicollinearity?
    Multicollinearity refers to a situation in which two or more explanatory variables in a multiple regression model are highly linearly related. We have perfect**multicollinearity** if, for example as in the equation above, the correlation between two independent variables is equal to 1 or −1.

47. Define Bivariate Analysis.
    Bivariate analysis is one of the simplest forms of quantitative (statistical) **analysis**. It involves the**analysis** of two variables (often denoted as X, Y), for the purpose of determining the empirical relationship between them. ... Like univariate **analysis**, **bivariate analysis** can be descriptive or inferential.

48. What is a bivariate regression?
    Bivariate Regression Analysis. ... It is often considered the simplest form of**regression** analysis, and is also known as Ordinary Least-Squares **regression** or linear **regression**. Essentially, **Bivariate Regression** Analysis involves analysing two variables to establish the strength of the relationship between them.

49. State the formula for pearson's Rank corelation.

- Find the mean of all the x-values.
- Find the standard deviation of all the x-values (call it s_x) and the standard deviation of all the y-values (call it s_y). ...
- For each of the n pairs (x, y) in the data set, take.
- Add up the n results from Step 3.
- Divide the sum by $s_x * s_y$.

50. What is meant by Canonical Correlation Analysis?

The **Canonical Correlation** is a multivariate**analysis of correlation**. **Canonical** is the statistical term for analyzing latent variables (which are not directly observed) that represent multiple variables (which are directly observed) A **Canonical** Variate is the weighted sum **of** the variables in the **analysis**.

PART-B

1. What are the variation fields of the application in using multiple regressions? How does the regression analysis used in demand forecasting? (May/June-2008)
2. What is discriminant analysis? What are the methods involved in discriminant analysis?(June2011)
3. Explain the series of steps to be taken in the application of multivariate regression. Give example.(June2011) (May/june 2014)
4. Explain the following terms:
   - Communality
   - Unique variance
   - Eigen value
   - Pie chart
   - Line chart
   - Bar chart
5. Describe the data preparation process, commencing from the stage of questionnaire checking, up to the stage of selecting a data analysis strategy. (Nov/Dec 2014)
6. Illustrate with any three simple practical examples, the concept of discriminanat analysis. (Nov/Dec 2014)
7. Explain the terms: (May/June 2014)
   a. Cross Tabulation
   b. Multi – Collinearity
   c. Coefficient of variation.
   d. Analysis of variance.(ANOVA)
8. What is the significance of using multiple discriminant analysis? Explain the technical details involved in such a techniques. (May 2017)
9. Discuss about measures of central tendency and how they are useful in any business research work. (June 2016).
10. Explain the objective, process and application of multiple regression, and correlation analysis to solve business research problems. (June 2016).

11. Describe the various types of analysis of data and state the assumptions made and significance of it.
12. Identify how the data is processed? Explain in detail. Give its advantages
13. Enumerate the series of steps to be taken in the application of Multivariate Regression. Give Example.
14. Analyze the objective, process and application of Multiple Regression and Correlation Analysis to solve business research Problems.
15. Explain the factors of SPSS with its Features?

UNIT-5

PART A

1. What is a Synopsis? (Nov/Dec 2006)

A synopsis is only a brief overview of the entire report and may either highlight the main points as they appear in the report or simply inform the reader as to the content of the report.

2. Enumerate the guidelines for preparing bibliography. (Nov / Dec 2008)

It is a brief summary of all the published work relating to the research topic

- Author's Name
- Year of publication
- Full title of the paper
- Source of publication
- Edition, issue no., volume no.
- Page no.'s
- Place of publication/publisher

3.Give a brief account of typing/printing instructions while preparing aresearch report (Nov / Dec 2008)

Most scientific research reports, irrespective of the field, parallel the method of scientificreasoning. That is: the problem is defined, a hypothesis is created, experiments are devised to test the hypothesis, experiments are conducted, and conclusions are drawn. The exact format of scientific reports is often discipline dependent with variations in order and content.

4. Why synopsis is essential for research report? (May/June 2009), (May/June2008)

A synopsis is a brief summary of the major points of a written work, either as prose or as a table; an abridgment or condensation of a work.

5. What is long report? (Nov/Dec 2010)

A Long report is the document which contains details of the study into pages and pages with some systematic structure.

6. **What are the different types of Diagrams known to you? (Nov/Dec 2010)**

- A histogram consists of tabular frequencies, shown as adjacent rectangles, erected over discrete intervals (bins), with an area equal to the frequency of the observations in the interval.

- A bar chart is a chart with rectangular bars with lengths proportional to the values that they represent. The bars can be plotted vertically or horizontally.
- A pie chart shows percentage values as a slice of a pie.
- A line chart is a two-dimensional scatter plot of ordered observations where the observations are connected following their order

7. **Why synopsis should be presented?**

It provides an overview of the research problem identified and highlights the important information such as the sampling design, data collection method used, results of data analysis, findings and recommendation The purpose of synopsis is to entice the audience to read the report.

8. **How do findings differ from conclusions in research report.(June 2011)**

The conclusion is where you build upon your discussion and try to refer your findings to other research and to the world at large. This is probably the most variable part of any research paper, and depends upon the results and aims of the experiment**.** For quantitative research, it is a presentation of the numerical results and data, whereas for qualitative research it should be a broader discussion of trends, without going into too much detail.

9. Deductive method of interpretation (May/June-2008)

The deductive method is a very important method for testing theories or hypotheses. It is sometimes said to be "the scientific method". This is not quite correct because surely there is not quite correct because surely there is not just this one method is of central importance , because it is one of the more basic methods common to all scientific disciplines, whether it is economics, physics, or biochemistry.

10. Steps in data preparation? (May / June 2013)

- Questionnaire
  - Editing
  - Coding
- Transcribing**:**
  - Cleaning**:**
  - Statisticaladjustments**:**
  - Analysis strategy selection

11. List down any two widely used statistical software for data analysis. (May / June 2013)

- SPSS
- AMOS
- SEM
- EXCEL
- SYSTAT

12. List down the types of reports.(May / June 2013)

I. On the Basis Of Legal Formalities:

a. Informal Report
b. Formal Reports

II. On the Basis Of Frequency
a. Periodic or Routine
b. Special Reports

III. On the Bases of Function:
a. Information
b. Interpretative

IV. On the Bases of the Nature of the Subject dealt with
a. Problem determining report
b. Technical Report

13. What is meant by Cluster analysis?

- Cluster analysis, also called as classification analysis or numerical taxonomy is a class of techniques used to classify objects or cases into relatively homogeneous groups called clusters.
- Objects within a cluster are similar and between the clusters are dissimilar.

14. Explain the different distance measures used in cluster analysis.

- The **Euclidean distance** is the most commonly used measure. It is the square root of the sum of the squared differences in values for each variable.
- The **city-block or Manhattandistance** measure the distance between two objects in terms of the sum of the absolute differences in values for each variable.
- The **chebychev distance** between two objects id the maximum absolute difference in values for any variable.

15. What is meant by Variance methods?

- The variance method attempts to minimize the within cluster variance.
- **Wards procedure** is a commonly used variance method.
- For each cluster, the means of all the variables are computed; subsequently for each object the squared Euclidean distance to the clusters means is calculated.
- The distances are summed for all the objects.
  At each stage, the two clusters with the smallest increase in the overall sum of squares within the cluster are combined.

16. What is meant by Research report?

The documents that describes the research project, its findings, analysis of findings, interpretations, conclusions, and, sometimes, recommendations is called research report.

Types of report:

There are two types of reports:

- Oral report
- Written report

17. State the types of report.

- Short report
- Long report
- Formal report
- Informal report
- Government report

18. What is meant by Bibliography?

A bibliography, also called a works cited page, provides source information, and helps keep all resources and references together and organized, and helps people know where you got your sources. Most important, it lets readers know that you did not plagiarize any part of your paper.

19. Define Ethics.

- Ethics **are norms or standards of behaviour that guide moral choices about our behaviour and our relationship with others.**
- The goal of ethics in research is to ensure that no one is harmed or suffers adverse consequences from research activities.
- According to Collins Dictionary, ethical means **"in accordance with principles of conduct that are considered correct, especially those of a given profession or group".**
- **Ethics is** nothing but the accepted code of conduct.

20. What is meant by informed consent?

Informed consent implies that subjects are made adequately aware of the type of information you want from them, why the information is being sought, what purpose it will be put to, how they are expected to participated in the study, and how it will directly or indirectly affect them.

21. What is meant by harm in conducting research?

Harm includes not only hazardous medical experiments but also any social research that might involve such things as discomfort, anxiety, harassment, invasion of privacy, or demeaning or dehumanising procedures.

21. Mention any four statistical packages used for data analysis

- SPSS
- SAS
- MATLAB
- MINITAB
  SYSSTAT

22. What is meant by in depth interviews?

In depth interviewing is "repeated face to face encounters between the researcher and informants directed towards understanding informants' perspectives on their lives, experiences or situations as expressed in their own words".

22. What does a synopsis include?

A synopsis conveys the narrative **arc**, an explanation of the problem or plot, the characters, and how the book or novel ends. It ensures character actions and motivations are realistic and make sense. It summarizes what happens and who changes from beginning to end of the story.

24. What is meant by informed consent?

Informed consent implies that subjects are made adequately aware of the type of information you want from them, why the information is being sought, what purpose it will be put to, how they are expected to participated in the study, and how it will directly or indirectly affect them.

25. What is meant by the footnotes?

A **footnote** is a reference, explanation, or comment[1] placed below the main text on a printed page. **Footnotes** are identified in the text by a numeral or a symbol. In**research** papers and reports, **footnotes** commonly acknowledge the sources of facts and quotations that appear in the text.

26. How do you overcome subjectivity in research?

Subjectivity is a central philosophical concept, related to consciousness, agency, personhood, reality, and truth, which has been variously **defined** by sources. Something being a subject, narrowly meaning an individual who possesses conscious experiences, such as perspectives, feelings, beliefs, and desires.

27. What are the quality factors of the report writing?

A well written report will demonstrate your ability to:

- understand the purpose of the report brief and adhere to its specifications;
- gather, evaluate and analyse relevant information;
- structure material in a logical and coherent order; present your report in a consistent manner according to the instructions of the report brief;
- make appropriate conclusions that are supported by the evidence and analysis of the report;
- Make thoughtful and practical recommendations where required.

28. State the need of executive's summary in research report.

The **purpose** of the **executive summary** is to explain the main features of your business in a way that will make the reader want to learn more. Yet it must also include enough information that investors can see the potential behind your business without having to read the entire plan.

29. What are the steps in processing of DATA?

- Preparing raw data.
- Editing
- Coding
- Tabulation
- Summarizing the data
- Usage of statistical tools.

30. What is meant by Editing?

- ❖ Editing is nothing but process of ensuring that the data are clean-that is free from inconsistencies and incompleteness.
- ❖ Editing detects errors and omissions, corrects them when possible, and certifies that maximum data quality standards are achieved.
- ❖ The editor's purpose is to guarantee that data are:
  - ➢ Accurate
  - ➢ Consistent with the intent of the question and other information in the survey.
  - ➢ Uniformly entered
  - ➢ Arranged to simplify coding and tabulation.

31. What are parts of research report?

The six components of a **research report** are as follows: An abstract, introduction, methodology, results, discussion, and references. The Abstract. The abstract is an overview of the **research** study and is typically two to four paragraphs in length. ... Introduction.

32. What is the purpose of a research report?

The **purpose of a Research Report** is to demonstrate or develop your ability to undertake a complete piece of **research** including **research** design, and an appreciation of its significance in the field

33. What is layout of research report?

Layout of Research Report..... Any **research report** is to be conveyed to end-user or recorded for future use. So, there is a standard design which is to be followed for presenting **report**. The format of a **research report** has three main divisions. Preliminary section.

34. What should a report contain?

Essentially, a **report** is a short, sharp, concise document which is written for a particular purpose and audience. It generally sets outs and analyses a situation or problem, often making recommendations for future action. It is a factual paper, and **needs to** be clear and well-structured.

35. Why is a research report important?

The Purpose of **Reports**. **Reports** communicate information which has been compiled as a result of **research** and analysis of data and of issues. **Reports** can cover a wide range of topics, but usually focus on transmitting information with a clear purpose, to a specific audience.

36. Why is a research report prepared?

Research report is a written document containing key aspects of **research** project.**Research report** is a medium to communicate **research** work with relevant people..... Many times, **research** findings are not followed because of improper presentation. **Preparation** of **research report** is not an easy task.

37. What's a research proposal?

A **research proposal** is a concise and coherent summary of your proposed**research**. It sets out the central issues or questions that you intend to address. It outlines the general area of study within which your **research** falls, referring to the current state of knowledge and any recent debates on the topic.

38. What makes a good report?

Essentially, a **report** is a short, sharp, concise document which is written for a particular purpose and audience. It generally sets outs and analyses a situation or problem, often making recommendations for future action. It is a factual paper, and needs to be clear and well-structured.

39. What is interpretation in research?

Interpretation of data in **Research** Methodology. **Interpretation** of data refers to the task of drawing inferences from the collected facts after an analytical and/or experimental **study**. In fact, it is a search for broader meaning of **research** findings.

40. What is an effective report?

An effectively written **report** is one that has a logical flow of ideas and is cohesive. ... At this point in the **report** writing unit we strongly recommend you follow the links from this page and explore the devices you can use to improve the effectiveness of your **report** writing.

41. What are interpretation techniques?

Simultaneous **interpretation** is a **technique** in which the interpreter renders the**interpretation** simultaneously while the speaker is still speaking. Simultaneous**interpretation** is used in large conferences, conventions, and seminars where there is only one speaker addressing an audience.

42. What are the features of a good research?

It should be easily and clearly understandable by all those for whom it is meant. A good report should create interest among readers because of its lucid and convincing

style. Clear thinking, objective tone and logical arrangement of thoughts make the report **simple** and lucid.

43. Explain the ethics in research?

Show proper **respect** and care for animals when using them in research. Do not conduct unnecessary or poorly designed animal experiments. Human Subjects Protection: When conducting research on human subjects, minimize harms and risks and maximize benefits; **respect** human dignity, privacy, and **autonomy**.

44. what do you mean by ethical dilemma?

An **ethical dilemma** or **ethical** paradox is a decision-making problem between two possible **moral** imperatives, neither of which is unambiguously acceptable or preferable. The complexity arises out of the situational conflict in which obeying one **would** result in transgressing another

45. What is meant by Quotations?

A **quotation** is an exact reproduction of another speaker's or writer's words. ... **Quotation** and paraphrase, along with summary (which is a brief restatement of the main points of a longer work), are three ways of incorporating information from other sources into your own writing.

46. What is meant by Glossary?

A **glossary**, also known as a vocabulary or clavis, is an alphabetical list of terms in a particular domain of knowledge with the definitions for those terms. Traditionally, a**glossary** appears at the end of a book and includes terms within that book that are either newly introduced, uncommon, or specialized.

47. What is referencing?

Referencing allows you to acknowledge the contribution of other writers and researcher in your work. Any university assignments that draw on the ideas, words or **research** of other writers must contain citations. ... **Referencing** is a way to provide evidence to support the assertions and claims in your own assignments.?

48. What is the difference between oral and written presentation?

While both can be powerful, there are quite a few **differences in the** way that they are affected through communication. A **written presentation** tends to be rather direct and to the point. ... **Oral** communication is by nature a very dynamic method for transferring information **between** individuals and/or groups.

49. What is an effective presentation?

An **effective presentation** makes the best use of the relationship between the presenter and the audience. It takes full consideration of the audience's needs in order to capture their interest, develop their understanding, inspire their confidence and achieve the presenter's objectives. Careful planning is essential.

50. **What is interpretation?**

Interpretation of data refers to the task of drawing inferences from the collected facts after an analytical and/or experimental **study**. In fact, it is a search for broader **meaning** of **research** findings.

PART-B

1. Describe in detail how a research report should be written and its format. (Nov/Dec2007), (May/June 2009), (June2010), (June2011), May/June2008, (May/ June 2013), (Nov/Dec 2012) (May/June 2014).
2. Draft the proposal for the conducting focus the groups with selected manner of the consumer groups. Explain (May/June-2008).
3. Explain the types of reports. (Nov / Juan 2012).
4. Explain about eight vital guidelines that the client should remember while evaluating the goodness of a research report. (Nov/.Dec 2014).
5. Discuss the ethical issues to be taken care of at the research design stage, field work stage, data analysis stage and findings presentation stage. (Nov/.Dec 2014).
6. Discuss the different stages in report writing.
7. How does technical advancement helped in writing and presenting research reports? Why is it necessary specify the limitations of the study in the research reports? (May 2017).
8. Write a short notes on
    a) Characteristics of a good research report.
    b) Bibliography and its importance in context of research report.
9. Discuss the importance of language, cauterization, tone, and proof reading in a research report preparation.
10. State the precautions in writing a research report.
11. Assess the structure and components of a Research Report. Add a note on the importance of executive summary and chapterization in a research report.
12. What are the main components that should be taken into account in the mechanisms of thesis writing?
13. Describe the research ethics by emphasizing on
    i) Ethical treatment of respondents and subjects.
    ii) Ethics and the client.)
    iii) Researchers and team members.
14. Explain the application of Graphic Technique in the preparation of a Research report.
15. Contrast the precautions in writing a Research Report.

UNIT-6

PART A

1. **What is research integrity?**
   Research integrity refers to conducting research honestly, ethically, and responsibly, ensuring accuracy and transparency in all research activities.
2. **Why is research integrity important?**
   It ensures the credibility of research findings and maintains public trust in scientific and academic work.
3. **What is plagiarism in research?**
   Plagiarism is presenting someone else's ideas, data, or words as one's own without proper acknowledgment.
4. **Define data fabrication.**
   Data fabrication is the creation of false data or results and reporting them as if they were real.
5. **What is data falsification?**
   Data falsification involves manipulating research materials, processes, or data to misrepresent results.
6. **What is authorship ethics?**
   Authorship ethics means giving proper credit only to individuals who have made significant contributions to the research.
7. **What is conflict of interest in research?**
   A conflict of interest occurs when personal or financial interests influence, or appear to influence, research outcomes.
8. **What is informed consent?**
   Informed consent is the process of obtaining voluntary agreement from participants after explaining the purpose, risks, and benefits of the research.
9. **What is peer review?**
   Peer review is the evaluation of research work by experts in the same field to ensure quality and validity.
10. **How can research misconduct be prevented?**
    Research misconduct can be prevented through proper training, ethical guidelines, supervision, and adherence to institutional policies.
11. **What are digital surveys?**
    Digital surveys are data collection tools conducted through online platforms such as websites, emails, or mobile apps.
12. **Mention one advantage of digital surveys.**
    Digital surveys allow faster data collection and reduce cost compared to traditional paper-based surveys.
13. **What is the role of AI in research?**
    AI helps in automating data analysis, identifying patterns, and improving accuracy in research outcomes.
14. **How does AI improve data quality in research?**
    AI reduces human errors by detecting inconsistencies, missing data, and biases in datasets.
15. **What are online research panels?**
    Online panels are pre-recruited groups of participants who agree to take part in surveys and research studies.

16. **State one benefit of using online panels.**
    Online panels provide quick access to targeted respondents for specific research needs.
17. **What is real-time analytics?**
    Real-time analytics refers to the immediate analysis of data as it is collected or generated.
18. **Why is real-time analytics important in research?**
    It enables faster decision-making by providing instant insights and timely results.
19. **How do emerging technologies impact research efficiency?**
    They shorten research cycles by automating data collection, processing, and analysis.
20. **Mention one challenge of using AI in research.**
    Ethical concerns such as data privacy and algorithmic bias are major challenges.

PART B

1. **Explain the concept of research integrity.** Discuss its core principles and importance in maintaining the credibility of academic and scientific research.
2. **Describe different forms of research misconduct.** Explain fabrication, falsification, and plagiarism with suitable examples.
3. **Discuss the role of ethical guidelines and institutional review boards (IRBs)** in ensuring research integrity.
4. **Examine the importance of authorship ethics and proper citation practices** in maintaining honesty and transparency in research.
5. **Analyze the impact of plagiarism on academic research.** Suggest effective measures to prevent plagiarism.
6. **Explain the concept of conflict of interest in research.** Discuss how it can affect research outcomes and ways to manage it.
7. **Discuss the importance of informed consent and confidentiality** in research involving human participants.
8. **Evaluate the role of peer review in promoting research integrity.** Highlight its strengths and limitations.
9. **Explain data management and data sharing practices** that support transparency and integrity in research.
10. **Discuss the consequences of lack of research integrity** for researchers, institutions, and society.
11. **Explain the concept of digital surveys.** Discuss their advantages, limitations, and applications in modern research.
12. **Analyze the role of Artificial Intelligence (AI) in research.** Explain how AI is transforming data collection and analysis.
13. **Discuss the ethical challenges associated with the use of AI in research**, including bias, transparency, and data privacy.
14. **Explain the concept of online research panels.** Discuss their significance in market and social research.
15. **Compare traditional survey methods with digital surveys**, highlighting key differences in cost, reach, and data quality.
16. **Describe real-time analytics and its importance in research decision-making.** Provide relevant examples.
17. **Examine how emerging digital technologies have improved research efficiency and accuracy.**

18. **Discuss the integration of AI and real-time analytics in research.** Explain how this combination enhances insights and predictions.
19. **Analyze the challenges and limitations of using online panels and digital tools** in research studies.
20. **Evaluate future trends in research methodology**, focusing on digital surveys, AI, online panels, and real-time analytics.

CASE STUDY

1. The Diet drink manufacturer in the study finds that young women are more health conscious and are looking at low calories options. Thus, any communication or advertisement for the product has to emphasize the health aspect. The purchase probability is also influenced by their education level and the nature of their profession. Other factors such as available brands, celebrity endorsement and dieticians recommendations also have an impact on them.

a) Identify your research problem and hypothesis. (5marks) b) Identify and classify the variables under study. (5marks) c) is it possible to generate a theoretical framework for the study? (5marks)

2. The Indian Army wants to ascertain why young students do not select the armed forces as a career option in their graduation.

a) How would you formulate a research problem to resolve the dilemma? (5marks) b) What would be the variables under study? (5marks) c) How would you generate the descriptive and relational hypothesis for the study? (5marks).

3. Shameem answered that the team was apathetic and there could be multiple reasons for this apathy.Thus, it was essential that the team be studied to identified what was the group reaction to the working conditions at Danish.Also it was important to identify what was perceived as the major problem area. Shameem was also of the opinion that there might be a difference between the old and new employees. Thus this angle also was to be given due recognition when conducting a survey. Raghu said,this seems to be a logical approach to the problem, but don't you think before you go to the team members you must at least identify what could be the reasons for the lackluster performance at Danish by looking at the other organizations or by talking to the HR consultants who have some experience of the same".Shameem listened attentively and said, "I think there is a lot of merit in what you say. So this is what I will do_____"

Questions: a) What is the research design(s) Shameem is likely to recommend? Why? (10marks) b) Identify the variables, hypotheses and the units under the study. (5marks).

4. You are employed by the product manager of Tarai Foods Ltd. Who wants to know the ideal price differential between the company frozen vegetables and those marketed by Mother diary. The customers of the frozen vegetables are mostly working women. Identify the Variables, test units, Hypotheses and research design.

5. You are the HRD Manager with ABB (India) .ABB has recently taken over a major unit in Kolkata. You are sent on a posting there and are given the task of introducing a new

operation scheme which your parent organization feels will improve efficiency. But you perceive during your stay that there is an underlying dissatisfaction amongst the employees and it is essential to gauge their views and opinion about the takeover and their expectations before introducing the scheme. What is the recommended research design? What would be the variables, hypotheses and the population under study?

6. Develop a likert scale to measure the perception of bank customers towards the concept of internet banking.

7. Sridhar from Bengaluru, had developed an electric car- VERVE (it is fully automatic, no clutch, no gears) two – door hatch back, easily seating two adults and two children with a small turning radius of just 3.5 meters). It runs on batteries and as compared to other electric vehicles, has an onboard charger to facilitate easy charging which can be carried out by plugging into any 15 amp socket at home or work. A full battery charge takes less than seven hours and gives a range of 80 km. A full charge consumes just about 9 units of electricity. Somehow the product did not take off the way he expected. He is contemplating about repositioning the car. As he stood looking at the prototype, he knew that there were a couple of questions to which he must find answers before he undertook the repositioning exercise. Who should be the targeted segment- old people, young students, just going to college, housewives? What should be the positioning stance? What kind of image would these customers relate to? Was a new name or punch0 line required? How should the promotions be undertaken? Hyundai had done it with Shah Rukh Khan, should he also consider a celebrity? If yes who?
Questions: 1. What kind of research study should Sridhar undertake? Define the objectives of his research. (5marks) 2. Do the stated objectives have scope for a qualitative research? (5marks) 3. Which methods would you recommend and why? (5marks).

8. Indicate the type of measurement scale you would use for each of the following characteristics. Why did you choose the scale you did? Develop the appropriate question for each characteristic and the scale chosen. • Colour of a dishwasher • Age of a TV • Occupation Brand Loyalty • Readership of a newspaper • Intention to purchase a TV.

9. Mr.Mohan Mehta has a chain of restaurants in many cities of northern India and was interested in diversifying his business. His only son, Kamal, never wanted to be in the hospitality line. To settle Kamal into a line which would intrest him, Mr.Mehta decided to venture into a garment manufacturing. He gave this idea to his son, who liked it very much. Kamal had already done a course in fashion designing and wanted to do something different for the consumers of this industry. An idea struck him that he should design garments for people who are very bulky but want a lean look after wearing readymade garments. The first thing that came to his mind was to have an estimate of people who wore large sized shirts(40 size and above) and large sized trousers (38 size and above)A meeting was called of experts from the garment industry and a number of fashion designers to discuss on how they should proceed. A common for many of them was to know the size of such a market. Another issue that was bothering them was how to approach the respondents, It was believed that asking

people about the size of their shirt or trouser may put them off and there may not be any worthwhile response. A Suggestion that came up was that they should employ some observers at entrances of various malls and their jobs would be to look at people who walked into the malls and see whether the concerned person was wearing a big size shirt or trouser. This would be a better way of approaching the respondents .This procedure would help them to estimate in a very simple way the proportion of people who wore a big sized garments. Questions: a. Name the sampling design that is being used in the study. (3marks) b. What are the limitations of the design so chosen? (5marks) c. Can you suggest a better design? (3marks) d. What method of data collection is being employed? (4marks).

10. Identify an organization and prepare a report which contains recommendations for improving its operations in India.

UNIT III

UNIT III- DATA COLLECTION

Types of data – Primary Vs Secondary data – Methods of primary data collection – Survey Vs Observation – Experiments – Construction of questionnaire and instrument – Types of Validity – Sampling plan – Sample size – determinants optimal sample size – sampling techniques – Sampling methods.

CO-PO AND BLOOMS TAXONOMY

Lecture No	Concept	CO	PO	PSO	Blooms Taxonomy
1	Types of data – Primary Vs Secondary data	CO3	1,2,3,4,5	1,2	K1, K2
2	Methods of primary data collection	CO3	1,2,3,4,5	1,2	K1, K2,K3
3	Survey Vs Observation, Experiments	CO3	1,2,3,4,5	1,2	K1, K2, K3,K4,K5
4	Construction of questionnaire and instrument	CO3	1,2,3,4,5	1,2	K1, K2, K3,K4,K5,K6
5	Validation of questionnaire	CO3	1,2,3,4,5	1,2	K1, K2,K3,K4
6	Sampling plan – Sample size – determinants optimal sample size	CO3	1,2,3,4,5	1,2	K1, K2,K3,K4,K5,K6
7	sampling techniques –	CO3	1,2,3,4,5	1,2	K1, K2,K3,K4
8	Probability sampling techniques –	CO3	1,2,3,4,5	1,2	K2,K3 K5,K6
9	Non–probability sampling methods	CO3	1,2,3,4,5	1,2	K2,K3, K4,K5

LECTURE NO ONE

Primary Data:

It is known as the data collected for the first time through field survey. Such data are collected with specific set of objectives to assess the current status of any variable studied. Primary data are generally information gathered or generated by the researcher for the purpose of the project immediately at hand. When the data are collected for the first time, the responsibility for their processing also rests with the original investigator.

Secondary data

It refers to the information or facts already collected. Such data are collected with the objective of understanding the past status of any variable.

Secondary data can be obtained internally ie within the firm or external from one or more outside agencies

PRIMARY vs SECONDARY DATA

Criteria	Primary data	Secondary data
Accuracy	• A direct approach that starts from scratch. Data is highly accurate and zooms in on your research problem.	• An indirect approach that hinges on existing data. May not be specific to your research problem.
Control	• Researchers have a high degree of control.	• Less control over data.
Relevancy	• Very relevant to your research.	• Negligible or less relevant to a new research.
Ownership	• Researcher has ownership of the data.	• No ownership of the data.
Cost and time	• Expensive and time consuming task.	• Saves you money and time.
Accessibility	• Not freely or easily available to the public.	• Available to the public and your competitors.
Bias	• The data does not favor the researcher who collected the data.	• The data may lean toward the researcher who collected the data.
Sampling errors	• Errors in sampling arise by selecting the wrong sample size.	• Errors arise by selecting outdated, irrelevant data that is no longer pertinent to the research problem.
Sources	• Websites, journals, dissertations, literature reviews, balance sheets, and more	• Case studies, surveys, interviews, questionnaires, field observations, experiments, etc.

Secondary data

The secondary data means which have already been collected by someone else and which have already been passed through the statistical process. The researcher would have to decide which sort of data he would be using (thus collecting) for his study and accordingly he will have to select one or the other method of data collection.

Sources

I. **Internal Sources**

A. **Accounting Record**

- ✓ Sales Invoice
- ✓ Sales record
- ✓ Cost detail
- ✓ Level of profit
- ✓ Advertisig expenditure
- ✓ Budget etc.

B. **Sales force Report**

- Marketing information
- Customers opinion
- Competitor information
- AreaWise Sales

C. **Internal Expert**

Experts working in the company like product manager, marketing research managers, public relation personnel and advertising personnel etc.

C. **Miscellaneous**

- ✓ Company history
- ✓ Company background
- ✓ Market share
- ✓ Pamplet
- ✓ Prospectus
- ✓ Annual General Body Meeting Report.
- ✓ Organization manual, chart.
- ✓ Organisation report.

External Sources

i) Publication of (Government)

a. Reserve Bank of India Bulleting
b. Census Report
c. Registrar general of India
d. Central Statistical organization
e. Director general of commercial intelligence
f. Minisry of commerce & industry
g. Economic Advisor Office
h. Ministry of Agriculture
i. Labour Bureau.

ii) Non-government Publication

a. Private agencies
b. Stock –exchange directories
c. Chamber of commerce
d. Federation of Indian Chamber of Commerce
e. Associate Chamber of commerce & Industry Of India
f. Indo- Amercian Chamber of Commerce etc
g. Promotion
h. Market Research & Statistical Bureau

iii) Syndicated Services

These are provided provided by certain organization which collect and tabulate marketing information on a continuing basis. Report based on the marketing information collected by such organization is sent periodically to clients who are subscribers. Apart from syndicated services a number of research agencies, offer and customized research services to their clients.

iv) Technical and trade journals

v) Books, magazines & newspapers

vi) Reports prepared by research scholars universities economists etc in diff fields

vii) Public records and statiscits, historical documents and other sources of published information

viii) Various publications of foreign government or of international bodies and their subsidiary organizations.

CHARACTERISTCS OF SECONDARY DATA

1. **Reliability of Data** :

The reliability can be treated 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 the compiler ?
f. What level of accuracy was desired ?

2. **Suitability of Data**

The data that are suitable for one enquiry may not necessarily be found suitable for one enquiry may not necessariyly be found suitable in another enquiry. Hence if the available data are found to be unsuitable. The researcher should not use them.

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 used by the researcher. The data will also be considered adequate.

4. Continuity of Data

This is another problem in using secondary data. For eg, the format used for providing some date may not be consistently followed by the source. Depending upon the page constraints or availability of material the data presentaion ina format is decided. So frequent change in the format would only add to confusion to the people using the data from such sources.

SPECIAL SOURCES

Computer Search & Internet Applications

Generally most databases allow the researcher to undertake precise searches using combination of key words in the website.

1. **Scanning & Browsing** :

New publications such as journals are unlikely to be indexed immediately in tertiary literature so you will need to browse through these publications to gain an idea of their content. In contrast scanning involves going through individual items such as journal articles to pick out points that are related to your own research.

2. **Searching the Internet**

The Internet is a worldwide network of computers that provides access to a vast range of literature and other resources stored on computer around the world. Searching these will uncover further material with which you can compare and contrast your ides. The places where these resources are stored are known as websites.

3. **Home Page**

Access to a website is through its home page. The home page, which has links to other pages in the site, is similar to a title or contents page. Although they often contain publicity for a company or institution they are an excellent way of navigating the site.

4. **Search Tools:**

It often referred to as search engines, are probably the most important way of searching the internet for reviewing the literature on your research subject as they enable you to locate the most current and up to date items.

5. **Book marking**

Once you have found a useful internet site, you will need to note its address. This process termed bookmarking uses the internet browser to note the address so that you will be able to access it again directly.

SELECTION OF APPROPRIATE METHOD OF DATA COLLECTION: -

There are various methods of data collection; as such the researcher must judiciary selects the method of his own study.

1. **Nature, Scope and Object of enquiry**: This constituted the most important factory 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.
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 efficient as some other costly method.

3. **Time Factor**: Availability of time has also to be taken into account in deciding a particular method of data collection. Some method, take relatively more time whereas with others the data can be collected in a comparatively shorter duration.
4. **Precision Required**: The very important condition is the level of accuracy of the data collected. In cases of compilation of data regarding the deviation from the standard measurements in a workshop, the data should be cent % accurate. Similarly the data regarding the patient condition explained through various parameters should be very accurate.
5. **Period of Study**: A study based on historical data requires secondary data source while the study on the patient status in a hospital require primary data.

LECTURE NO TWO

METHODS OF COLLECTING PRIMARY DATA

1. **Questionnaire** :-

In this method to pre-printed list of questions arranged in sequence is used to elicit response from the informant.

2. **Interview** :

This is a method in which the investigator and the respondent meet and questions raised are answered and recorded. this method is adopted when personal opinion or view point are to be gathered as a part of data.

3. **Observation:**

A method which requires familiarity and experience, in this method the observer applies his sense organs to note down whatever that he could observe in the field and relate these data to explain some phenomena.

4. **Feedback** In the case of some of the consumer goods, the supplier or the manufacturer send the product along with a pre-paid reply cover in which questions on the product and its usage are raised and the customer is required to fill it up and send.

5. **Sales force opinion**

The sales representatives visit the distributor or the retailers shop to note down the detail of stock movement, availability of items etc which give valuable information.

6. **Schedule**

This method of data collection is very much like the questionnaire with little difference which lies in the fact that schedules are being filled in by the enumerators who are specially appointed for the purpose.

7. **Warranty Card**

Warranty Card are usually postal sized card which are used by dealers of consumer durables to collect information regarding their products. The information sought is printed in the form of question on the warranty cards which is placed insided the package along with the product with a request to the consumer to fill in the card and post it back to the dealer.

8. **Distributor or store Audit**

Distributors get the retail stores audited through salesman and use such information to estimate market size, market share, seasonal purchasing pattern & so on.

9. **Pantry Audit**

Pantry audit technique is used to estimate consumption of the basker of goods at the consumer level. The investigators stay at the consuming point and observe the purchasing behavior or the people like price response, quality consciousness, response to price & incentive schemes, who take buying decision, credit facility required.

10. **Consumer Panel** It refers to an arrangement with select consumers to maintain details of their consumption behavior in their diaries based on these recorded information, useful first hand information is collected about the product & behavior of the consuming public.

11. **Collection through mechanical devices** The use ofmechanical devices has been widely made to collect information by way of indirect means. Eye camera, pupilometric camera, psychgalvanameter, motion picture camera and audiometer etc are principal devices, commonly used for the purpose for collecting the required information.
12. **Projective technique**

This technique is adopted to study the consumers through various methods like recalling advertisement theme, story completion tests, quizzes, thematic appreciation tests etc. Through this technique it is possible to compile information to be used as the basis for projecting the demand for the product at different points of time.

i. **Word association test**

In this the respondent asked to mention the first word that comes to mind, without thinking as the interviewer reads out each word from a list.

j. **Sentence Completion test** In this informant may asked to complete a sentence analysis of replies from the same informant reveals his attitude toward that subject and the combination of these attitudes of all the sample members is then taken to reflect the views of the population.

k. **Story Completion Test**

It is an step further, where in the researcher may contrive stories instead of sentences and ask the informant to complete them.

l. **Verbal Projection Test**

These are the test where in the respondent is asked to comment on or explain what other people do.

m. **Pictorial Technique** *

Thematic Apperception Test:

It consist of a set of pictures that are shown to respondents who are asked to describe what they think the pictures represent.

- **Rosenzweig Test :**

  This test uses a cartoon format wherein we have a series of cartoons with words inserted in balloon's above. The respondent is asked to put his own words in an empty balloon space provided for the purpose in the picture.
- **Rorschach Test** It consists of ten cards having prints of ink blots. The respondents are asked to describe what they perceive in such inkblot, and responses are interpreted on the basis of pre-determined psychological framework.
- **Holtzman Inkblot Test** It consists of 48 inkblot cards, which are based on color movement, shading and other facts involved in inkblot perception.
- **Tomkins- Horn Picture Arrangement Test** It consist of twenty five plates each containing three sketches that may be arranged in different ways to portray a sequence of events. The respondent is asked to arrange them in a sequence.
- **Play Technique** In this the respondents are asked to act out a situation in which they have been assigned various roles. The researcher may observe such traits as hostility, dominance, sympathy prejudice or the absence of traits.
- **Quizzes, tests & examination** This is also a technique of extracting information regarding specific ability of candidates indirectly. Through this, the memorizing and analytical ability of candidates.
- **Sociometry** It is a technique for describing the social relationship among individual in a group. It attempts to describe attraction or repulsions between individual by asking them to indicate whom they would choose or reject in various situations.

13. **In-depth Interview**

These are those interview that are designed to discover underlying motives and desires and are often used in motivational research. Such interview are held to explore needs, desires and feelings of respondents.

14. **Content Analysis**

It consists of analyzing the contents of documentary materials scuah as books, magazines, newspapers and the content of other verbal materials which can be either spoken or printed.

LECTURE NO THREE

OBSERVATION METHOD

It may be defined as "sensible application of sense organs in understanding less explained or unexplained phenomena". Using the sense organs, one could see and understands things. Whenever a researcher is unable to compile information through any other method, then he has to effectively apply his sense organs to observe and explain. So it may be said that observation involves recording of information applying visual understanding backed by alert sense organs.

Types

1. **Structured Observation**

When observation takes place strictly in accordance with a plan or a design prepared in advance, it is called structured observation. In such a type the observer decided what to observe what to focus on, who are all to be observed etc.

2. **Unstructured Observation**

In this type of observation there is no advance designing of what, how, when, who etc of observation. The observer is given the freedom to decide on the spot, to observe everything that is relevant.

3. **Participant Observation** In this, the observer is very much present in the midst of what is observed. He is physically present on the spot to observe and not influencing the activities. It will help him to continuously observe and not everything that is happening around him.

4. **Non Participant Observation**

In this observer remains detached from whatever is happening around and does involve himself in any activities taking place. He is present only to observe and not to take part in the activities.

5. **Controlled Observation**

In this case, the observer performs his work in the environment or situation, which is very much planned or designed or set.

6. **Uncontrolled Observation** The observer is at freedom to observer whatever is taking place around him in the natural set up.

MERITS:-

1. The scope for bias is very much minimized.
2. The current scenarios in which anything is happening, notices & explained.
3. As there is no need to get any reply or details from the respondent observation does not required any co-operation of the respondents.
4. This is a fairly reliable method.
5. Whenever respondent are illieterate or incapable of answering any question it is only method of data collection available.

LIMITATION:

1. This is a relatively costly method of data collection, because the observer has to be present on the spot to observer whatever is happening.

2. Training an observer is the additional cost to be incurred.]
3. The scope for the biases of the observe interfering in what is observed and understood is high.
4. It could be noticed that what is observed may bring out only part of the facts.
5. It may not be possible to observe what is targeted.
6. There is a lot of scope for the observer to get distracted by function.
7. The observer can effectively establish link among whatever he has observed to give a meaningful interpretation.

INTERVIEW METHOD : It involves direct or indirect meeting of the respondent by the researcher. The researcher determines the questions to be raised at the time of interview and then elicit the response for them. The reply given is either written down in a notebook or recorded in audio or videocassette.

TYPES OF INTERVIEW

1. **Direct Interview**

In this type of interview, the interviewer and the interviewee meet personally either with prior appointment or not. This method requires a interviewer to ask questions in a face to face contact to the other person or persons.

a. **Structured Interview**

In this type of interview the person collecting information decided in advance the nature, scope, questions to be asked the persons to be contacted etc in advance. At the time of interview no deviation is made from the questions to be asked.

b. **Unstructured Interview** In this type of interview, interview is conducted on the spot without any preparation or advance information to the respondent. It does not follow a system of pre-determined questions standardized techniques of recording information. The interviewer has much freedom to ask in case of need supplementary questions or at time he may omit certain question of the situation so required.

c. **Focused Interview** In this type of interview the object of the interviewer is to focus the attention of the respondent on a specific issue or point. The interviewer has the freedom to plan the interview and conduct it they way wants it. The interviewer on the spot decides all the question sequence, wording of questions etc.

d. **Clinical Interview** The clinical interview is concerned with broad underlying feeling a motivations or with the course of individuals life experience.

e. **Non-Directive** In this interviewer's function is simply to encourage the respondent to talk about the given topic with a bare minimum of direct questioning.

f. **Telephonic Interview**

This method of collecting information consists in contacting respondent on telephone itself. It is not a very widely used method but play, important part in industrial survey. There is no scope for physical presence of both the partial to the interview.

Merits :

1. Interview enables personal contact with which factual information could be obtained.
2. The interviewer can guide the respondent to understand the question and suitably rephrase or modify the question.
3. The non response in this category of data collection is low
4. Spontaneous reply of the respondent can be obtained which would truly reflect their opinion.
5. Interviewer has the flexibility to handle the interview to collect relevant information.
6. The interviewer can combine observation with interview so that a lot of additional information about the environment, nature, behavior and attitude of the respondent could also be noted.
7. The interviewer can be persuasive to obtain the response of the respndent while this may not be possible in the case of questionnaire method of data collection.
8. The interviewer can adopt himself better by using the language with which he can reach the respondents better and the educational level of the respondent.

9. it is also possible to obtain personal information which will not be revealed through questionnaire.

Demerits:

1. This method presupposes the existence of rapport between the respondent and the interviewer.
2. It is costly method of data collection, as the interviewer should be trained, oriented and supported.
3. The time taken for covering a large sample of respondents is more than what it is under questionnaire method.
4. It is possible for a respondent to conceal his real opinion or views and so genuine data may not be available.
5. The interviewer may also be biased and thereby his bias may influence the interview outcome.
6. Interview method requires an elaborate organizational arrangement.
7. Sometimes this method cannot be followed as it would require fixing up appointment, specifying the questions that are to be answered duration of interview, the person interviewing the organizational background, the purpose of interview etc. Inspite of providing all these information it may not be possible to get an appointment to conduct the interview.

HOW TO MAKE INTERVIEW SUCCESSFUL?

1. The interviewer should be carefully selected.
2. The interviewer should be trained properly.
3. Different methods of obtaining the response from the informants have to be explored and the interviewer should be trained in all these aspects.
4. Unless the interviewer is experienced he would not be able to conduct the interview properly. But without conducting interview he cannot be experience co care, should be taken while selecting this method of data collection.
5. Honesty and integrity of the interviewer determine the outcomes of the interview so the qualities of the interviewer should be objectively studied.
6. The interviewer should be fully equipped to clarify any questions raised by the informant.
7. The interviewer must first create a report with the respondent and ensures presence of cordial atmosphere to conduct the interview.
8. Qualities like courteousness , politeness, friendliness, conversational, unbiased are all necessary to make the interview successful.
9. The interviewer should avoid showing his reaction to the response of the respondent as otherwise the replies given may be biased.
10. The interviewer should be alert and intelligent with presence of mind to keep the interview focused on the subject matter.

LECTURE NO FOUR

QUESTIONNAIRE

A questionnaire is te sheets of paper containing questions relating to certain specific aspect regarding which the researcher collects the data. The questionnaire is given to the informant or respondent to be fitted up. This method of data collection is quite popular, particularly in case of big enquiries.

Merits:

1. It involves lesser cost as questionnaire could be send by post to a wide area.
2. It does not interfere with the respondent while answering the question.
3. The bias of the investigator is completely eliminated.
4. Respondents are given sufficient time to fill up the questionnaire.
5. If respondents cannot be reached personally, questionnaire is the alternative method available.
6. This method is useful when the sample size is very large.
7. if the questionnaire is designed properly with instructions then the training, supervising and controlling the investigators is saved.
8. Confidentiality is ensured as the respondents directly send the filled up questionnaire to the researcher.

Demerits:

1. It is always found that the response rate in questionnaire is very poor compared to using schedules.
2. Bias of the respondent cannot be determined easily.
3. Only if the respondent is educated questionnaire could be used for collecting information.
4. Follow up of non-response or unfilled questionnaire only adds to the cost and time.
5. There is no scope for giving any clarification to the respondent in case of need.
6. Accuracy of response cannot be ensured.
7. A lot of care is required to design and structure a questionnaire. Hence unless a scholar is good at drafting a questionnaire, this method cannot be adopted for data collection.

TYPES OF QUESTIONNAIRES

1. **Structured Questionnaire**

   It pose definite, concrete and preordained questions. Additional questions may be thought of and asked only when some clarification is needed or additional information is sought from the respondent. Answers to these question are normally very precise without any vagueness & ambiguity.

2. **Closed Form Questionnaire**

   Questions are set in such a manner that leaves only a few alternatives answers.
3. **Open Ended Questionnaire**

   Here the respondent has the choice of using his own style. Diction, expression of language, length and perception. The respondent are not restricted, his replies to the questions, and his answers may be free and spontaneous
4. **Unstructured Questionnaire**

   These contain a set of questions that are not structured in advance. It gives sufficient scope for a variety of answers. It is used mainly for conduction interview. Its merit is flexibility. It aims to secure the maximum possible information from the respondent.
5. **Pictorial Questionnaire**

   In a pictorial questionnaire alternative answer in the form of pictures are given and the respondent is required to tick the picture concerned to indicate his selection. This type of questionnaire is useful for illiterate and less knowledgeable respondent.

GUIDELINES OF QUESTIONNAIRE

The 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 aspect of a questionnaire.

1. **General Form**

   The questionnaire can either be structured or unstructured questionnaire. The form of the question may be either closed or open, but should be stated in advance and not constructed during questioning. The question is presented with exactly the same wording and in the same order to all respondents.
2. **Question Sequence**

   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 question that are easiest to answer being put in the beginning. The opening questions should be such to arouse human interest after that questions that are really vital to the research problem and a connecting thread should run through successive questions.

3. **Question formulation and Wording**:

   Questions should be constructed with a view to their forming a logical plan. The questions can be of any forms like :-

   i. **Multiple Choice**

It refers to one which provides several set alternatives for its answer.

ii. **Dichotomous**

It refers to one which offers the respondent a choice between only two alternatives, and reduces the issue to its simplest terms.

iii. **Close End Question**:

It refers to those questions in which the respondent is given a limited number of alternative responses from which he is to select the one that most closely matches his/ her opinion or attitude.

iv. **Open Ended Question**

It refers to a quesdtion that has no fixed alternatives to which the answer must conform.

v. **Direct Question**

They explicitly ask for the desired data.

vi. **Indirect Data**

It refers to those whose responses are used to indicate or suggests data about the respondent other than the actual facts given in the answer.

vii. **Checklists**

It is simply a statement on a problem followed by a series of answers from which the respondent can choose. A single questionnaire may contain all type of questions. Researcher must pay proper attention to the wordings of questions since reliable and meaningful returns depend on it to a large extent. Simple words which are familiar to all respondent should be employed. Words with ambiguous meanings must be avoided.

ESSENTIALS OF A GOOD QUESTIONNAIRE:

1. It should be comparatively short and simple.
2. Questions should proceed in logical sequence moving from easy to more difficult questions.
3. Personal and intimate questions should be left to the end.
4. Technical terms and vague expressions capable of different interpretations should be avoided in a questionnaire.
5. Questions affecting the sentiments should be avoided.
6. Adequate space for answers should be provided in the questionnaire to help editing and tabulation.
7. It should be attractive looking.
8. The quality of the paper, along with its colour, must be good so that is may attract the attention of recipients.
9. The first part of the questionnaire should specify the object or purpose for which the information is required.
10. It should not force the respondent to recall from his memory anything to answer.
11. If there I is instruction, it should be given separately specifying the question number and the related instructions.
12. It should not require any referencing before replying.
13. Repetition of questions should be eliminated.
14. Questions which cross check the response, could be built in to the questionnaire.

Construction of questionnaire:

1. The researcher must keep in view the problem he is to study for it provides the starting point for developing the Questionnaire/Schedule. He must be clear about the various aspects of his research problem to be dealt with in the course of his research project.

2. Appropriate form of questions depends on the nature of information sought, the sampled respondents and the kind of analysis intended. The researcher must decide whether to use closed or open-ended question. Questions should be simple and must be constructed with a view to their forming a logical part of a well thought out tabulation plan. The units of enumeration should also be defined precisely so that they can ensure accurate and full information.

3. Rough draft of the Questionnaire/Schedule is prepared, giving due thought to the appropriate sequence of putting questions. Questionnaires or schedules previously drafted (if available) may as well be looked into at this stage.
4. Researcher must invariably re-examine, and in case of need may revise the rough draft for a better one. Technical defects must be minutely scrutinised and removed.
5. Pilot study should be undertaken for pre-testing the questionnaire. The questionnaire may be edited in the light of the results of the pilot study.
6. Questionnaire must contain simple but straight forward directions for the respondents so that they may not feel any difficulty in answering the questions.

Validation of questionnaire:

Validation is "The process of establishing that a method is sound." Validation involves establishing that the instrument produces data that are reliable and true. There are a number of ways to define this, some of which outlined below.

Reliability: the degree to which a questionnaire will produce the same result if administered again, or the "test-retest" concept. It is also a measure of the degree to which a questionnaire can reflect a true change.

Validity: the degree to which a questionnaire reflects reality. There are a number of different facets to validity. Internal validity: the degree to which questions within an instrument agree with each other, i.e., that a subject will respond to similar questions in a similar way. It also affects the likelihood of producing false positives and false negatives.

External validity: the ability to make generalizations about a population beyond that of the sample tested.

Sensitivity: The degrees to which the instrument can identify a true positive, e.g., accurately identify a person who does have the condition.

Specificity: similar to sensitivity, this is the degree, to which the instrument can identify a true negative, e.g., correctly identify the people who do not have the disease. Sensitivity and specificity are another side of the coin from internal validity.

Statistical validity: this is related to internal validity, and assesses whether the differences in the questionnaire results between patient groups can appropriately be subjected to statistical tests of significance.

Longitudinal validity: whether a questionnaire returns the same results in a given population over time, assuming all else remains equal Linguistic validity: whether the wording of the questionnaire is understood in the same way by everyone who completes it.

Discriminant validity: the ability of the questionnaire to detect true differences between groups, and detect no difference when there isn't one.

Construct validity: the ability of a measure to assess correctly a particular cause and effect relationship between the measure and some other factor.

LECTURE NO FIVE

Questionnaire Vs Schedule

Basis	Questionnaire	Schedule
Usage	Respondent himself records the answers obtained.	Researcher/ enumerator records the answers obtained.
Cost	Relatively cheaper as it is sent by mail to the targeted respondent.	Costlier, as the investigator has to be appointed, trained and meet every informant at the latter's place.
Coverage	Wide coverage possible as it can be sent to any place by post	Relatively limited coverage as the investigator cannot be sent to every place.

Degree of Freedom	Less all the respondents, do not respondent	Relatively better as the investigator guides the respondents in understanding the questions in right context.
Quality of response	Not good, as the respondent answers the questions the way it understood.	Relatively better as the investigator guides the respondents in understanding the questions in right context
Identify of respondent	It is not known clearly who answered the questionnaire and this in turn might affect accuracy information obtained.	It is clearly known, as the enumerator himself elicits the information so the accuracy of information is more.
Time Taken for reply	It cannot be established as the respondent may reply at his convenience.	It is possible to plan the enquiry & depute the investigators accordingly & collect information within a targeted time
Personal contact	It is completely absent and to that extent there is to no scope for giving any clarification to respondents.	It is absolutely possible and so the quality of response is better. The investigator can understand the questions clearly.
Sample Coverage	It is possible to cover a wide range of sample elements as the questionnaire is only sent by post.	This is not possible as the investigator has to personally contact each respondent.
Pre-condition for use	The respondent should be a literate and co-operative	The literacy status of the respondent is not a limitation. The investigator can explain the question & obtain the response.
Accuracy of Information	It is not likely to be high, as it depends on the structure of the questionnaire itself	Relatively accuracy is better in this method as the investigator can determine the accuracy on the field and adopt appropriate methods to ensure accuracy.
Presentation requirement	Questionnaire should be designed properly and made attractive to encourage the respondent to fill it.	No such requirements is a condition
Scope for application of other methods of data collection.	This is not possible as the questionnaire is sent to the respondent.	There is a lot of scope for the investigator to apply observation method or interview method of data collection along with the use of schedules.
Field control & testing.	This is not possible as the questionnaire is filled by the respondent himself	There is good scope for controlling editing and monitoring information on the field itself
Bias in information collected	There is no way to test the extent of bias of the information given by the respondent.	If the investigator is trained and experienced then there is very little scope for bias in information content.

Survey Vs Observation:

Observational Study - In an observational study, the sample population being studied is measured, or surveyed, as it is. The researcher observes the subjects and measures variables, but does not influence the population in any way or attempt to intervene in the study. There is no manipulation by the researcher. Instead, data is simply gathered and correlations are investigated. Since observational studies do not control any variable, the results can only allow the researcher to claim association, not causation (not a cause-and-effect conclusion).

Surveys - Surveys are one form of an observational study, since the researchers do not influence the outcomes. Statistical surveys collect information from a sample group to learn about the entire population. A survey may focus on opinions or factual information depending upon the purpose of the study. Surveys may involve answering a questionnaire or being interviewed by a researcher. The U.S. Census is a type of survey.

Survey Vs Experiment

Meaning	Survey refers to a technique of gathering information regarding a variable under study, from the respondents of the population.	Experiment implies a scientific procedure wherein the factor under study is isolated to test hypothesis.
Used in	Descriptive Research	Experimental Research
Samples	Large	Relatively small
Suitable for	Social and Behavioral sciences	Physical and natural sciences
Example of	Field research	Laboratory research

LECTURE NO SIX

SAMPLING

Sampling Plan:

A sampling plan is a term widely used in research studies that provide an outline on the basis of which research is conducted. It tells which category is to be surveyed, what should be the sample size and how the respondents should be chosen out of the population.

Sampling plan is a base from which the research starts and includes the following three major decisions:

1. What should be the Sampling unit i.e. choosing the category of the population to be surveyed is the first and the foremost decision in a sampling plan that initiates the research? e.g. In the case of Banking industry, should the sampling unit consist of current account holders, saving account holders, or both? Should it include male or female account holders? These decisions once made the then sampling frame is designed to give everyone in the target population equal chance of being sampled.
2. The second decision in sampling plan is determining the size of the sample i.e. how many objects in the sample is to be surveyed. Generally, "the larger the sample size, the more is the reliability" and therefore, researchers try to cover as many samples as possible.

3. The final decision that completes the sampling plan is selecting the sampling procedure i.e. which method can be used such that every object in the population has an equal chance of being selected. Generally, the researchers use the probability sampling to determine the objects to be chosen as these represents the sample more accurately.

Population :

Is defined as the aggregate of units from which a sample is chosen. If a forest area is divided into a number of compartments and the compartments are the units of sampling, these compartments will form the population of sampling units.

Sampling units: The population is thus sub-divided into suitable units for the purpose of sampling andthese are called sampling units. They are administrative units or natural units like topographical sections and subcompartment.

Sampling Frame : A list of sampling units will be called a 'frame'. A population of units is said to be finite if the number units in it is finite.

Sample : One or more sampling units selected from a population according to some specified procedure will constitute a sample.

Sampling Intensity :Intensity of sampling is defined as the ratio of the number of units in the sample to the number of units in the population.

Parameter :A function of the values of the units in the population will be called a parameter. The population mean, variance, coefficient of variation, etc., are examples of population Parameters

Sampling variance : The difference between a sample estimate and the population value is called the sampling error of the estimate, but this is naturally unknown since the population value is unknown.

Standard error of an estimator :The square root of the sampling variance of an estimator is known as the standard error of the estimator. The standard error of an estimate divided by the value of the estimate is called relative standard error which is usually expressed in percentage.

Accuracy usually refers to the size of the deviations of the sample estimate from the mean m= E (t) obtained by repeated application of the sampling procedure, the bias being thus measured by m-q .

LECTURE NO SEVEN

Determinants optimal sample size:

(i) Nature of universe: Universe may be either homogenous or heterogeneous in nature. If the items of the universe are homogenous, a small sample can serve the purpose. But if the items are heterogeneous, a large sample would be required. Technically, this can be termed as the dispersion factor.

(ii) Number of classes proposed: If many class-groups (groups and sub-groups) are to be formed, a large sample would be required because a small sample might not be able to give a reasonable number of items in each class-group.

(iii) Nature of study: If items are to be intensively and continuously studied, the sample should be small. For a general survey the size of the sample should be large, but a small sample is considered appropriate in technical surveys.

(iv) Type of sampling: Sampling technique plays an important part in determining the size of the sample. A small random sample is apt to be much superior to a larger but badly selected sample.

(v) Standard of accuracy and acceptable confidence level: If the standard of accuracy or the level of precision is to be kept high, we shall require relatively larger sample. For doubling the accuracy for a fixed significance level, the sample size has to be increased fourfold.

(vi) Availability of finance: In practice, size of the sample depends upon the amount of money available for the study purposes. This factor should be kept in view while determining the size of sample for large samples result in increasing the cost of sampling estimates.
(vii) Other considerations: Nature of units, size of the population, size of questionnaire, availability of trained investigators, the conditions under which the sample is being conducted, the time available for completion of the study are a few other considerations to which a researcher must pay attention while selecting the size of the sample.

PILOT STUDY:

It is a process of testing the questionnaire before it is finalized, the questionnaire before it is finalized, that is after the questionnaire is drafted, to decide whether it is comprehensive or not, it is used with a few respondents.

Their responses are studied to determine the need for restructuring the questionnaire, re-sequencing the questions, addition or deletion of questions, giving more instructions for filing up etc can also be decided. It will bring to light the weaknesses of the questionnaire.

LECTURE NO EIGHT

TYPES OF SAMPLING Techniques

Sampling techniques are classified into two broad categories of Probability samples or Non- Probability samples.

I Probability Sampling Technique

Probability samples are characterised by the fact that, the sampling units are selected by chance. In such case, each member of the population has a known, non-zero probability of being selected. However, it may not be true that all sample would have the same probability of selection, but it is possible to say the probability of selecting any particular sample of a given size. It is possible that one can calculate the probability that any given population element would be included in the sample. This requires a precise definition of the target population as well as the sampling frame.

Probability sampling techniques differ in terms of sampling efficiency which is a concept that refers to trade off between sampling cost and precision. Precision refers to the level of uncertainty about the characteristics being measured. Precision is inversely related to sampling errors but directly related to cost. The greater the precision, the greater the cost and there should be a tradeoff between sampling cost and precision. The researcher is required to design the most efficient sampling design in order to increase the efficiency of the sampling. Probability sampling techniques are broadly classified as simple random sampling, systematic sampling, and stratified sampling.

- **Simple Random Sampling**

This is the most important and widely used probability sampling technique. They gain much significance because of their characteristic of being used to frame the concepts and arguments in statistics. Another important feature is that it allows each element in the population to have a known and equal probability of selection. This means that every element is selected independently of every other element. This method resembles lottery method where a in a system names are placed in a box, the box is shuffled, and the names of the winners are then drawn out in an unbiased manner. Simple random sampling has a definite process, though not, so rigid. It involves compilation of a sampling frame in which each element is assigned a unique identification number. Random numbers are generated either using random number table or a computer to determine which elements to include in the sample. For example, a researcher is interested in investigating the behavioural pattern of customers while making a decision on purchasing a computer. Accordingly, the researcher is interested in taking 5 samples from a sampling frame containing 100 elements. The required sample may be chosen using simple random sampling technique by

arranging the 100 elements in an order and starting with row 1 and column 1 of random table, and going down the column until 5 numbers between 1 and 100 are selected. Numbers outside this range are ignored. Random number tables are found in every statistics book. It consists of a randomly generated series of digits from 0 – 9. To enhance the readability of the numbers, a space between every 4 digit between every 10 row is given.

The researcher may begin reading from anywhere in the random number table, however, once started the researcher should continue to read across the row or down a column. The most important feature of simple random sampling is that it facilitates representation of the population by the sample ensuring that the statistical conclusions are valid

- **Systematic sampling**

Employs a simple rule of selecting every kth unit starting with a number chosen at random from 1 tokas the random start. Let us assume that Nsampling units in the population are numbered 1 toN. To select a systematic sample of nunits, we take a unit at random from the first kunits and then every kth sampling unit is selected to form the sample. The constant kis known as the sampling intervaland is taken as the integer nearest to N / n, the inverse of the sampling fraction.

- **Stratified Sampling**

Stratified sampling is a two-way process. It is distinguished from the simple random sampling and systematic sampling, in that:

a) It requires division of the parent population into mutually exclusively and exhaustive subsets;
b) A simple random sample of elements is chosen independently from each group or subset.

Therefore, it characterises that, every population element should be assigned to one and only Stratum and no population elements should be omitted. Next, elements are selected from each stratum by simple random sampling technique. Stratified sampling differs from quota sampling in that the sample elements are selected probabilistically rather than based on convenience or on judgmental basis.

Strata are created by a divider called the stratification variable. This variable divides the population into strata based on homogeneity, heterogeneity, relatedness or cost. Sometimes, more than one variable is used for stratification purpose. This type of sampling is done in order to get homogenous elements within each strata and, the elements between each strata should have a higher degree of heterogeneity. The number of strata to be formed for the research is left to the discretion of the researcher, though, researchers agree that the optimum number of strata may be 6.

The reasons for using stratified sampling are as follows:

a) It ensures representation of all important sub-populations in the sample;
b) The cost per observation in the survey may be reduced;
c) It combines the use of simple random sampling with potential gains in precision
d) Estimates of the population parameters may be wanted for each sub-population and;
e) Increased accuracy at given cost.

- **Multistage sampling**

Multi-stage sampling (also known as multi-stage cluster sampling) is a more complex form of cluster sampling which contains two or more stages in sample selection. In simple terms, in multi-stage sampling large clusters of population are divided into smaller clusters in several stages in order to make primary data collection more manageable. It has to be acknowledged that multi-stage sampling is not as effective as true random sampling; however, it addresses certain disadvantages associated with true random sampling such as being overly expensive and time-consuming.

- **Cluster Sampling:**

cluster sampling is a sampling method in which the entire population of the study is divided into externally homogeneous, but internally heterogeneous, groups called clusters. Essentially, each cluster is a mini-representation of the entire population.

Use of the Probability Sampling Method

There are multiple uses of the probability sampling method. They are:

- **Reduce Sample Bias:** Using the probability sampling method, the bias in the sample derived from a population is negligible to non-existent. The selection of the sample largely depicts the understanding and the inference of the researcher. Probability sampling leads to higher quality data collection as the population is appropriately represented by the sample.
- **Diverse Population:** When the population is large and diverse, it is important to have adequate representation so that the data is not skewed towards one demographic. For example, if Square would like to understand the people that could their point-of-sale devices, a survey conducted from a sample of people across US from different industries and socio-economic backgrounds, helps.
- **Create an Accurate Sample:** Probability sampling helps the researchers plan and create an accurate sample. This helps to obtain well-defined data.

LECTURE NO NINE

Non-probability Sampling Methods

Non-probability sampling does not involve random selection. It involves personal judgement of the researcher rather than chance to select sample elements. Sometimes this judgement is imposed by the researcher, while in other cases the selection of population elements to be includes is left to the individual field workers. The decision maker may also contribute to including a particular individual in the sampling frame. Evidently, non probability sampling does not include elements selected probabilistically and hence, leaves an degree of „sampling error" associated with the sample.

Sampling error is the degree to which a sample might differ from the population. Therefore, while inferring to the population, results could not be reported plus or minus the sampling error. In non-probability sampling, the degree to which the sample differs from the population remains unknown However, we cannot come to a conclusion that sampling error is an inherent of non probability sample.

Non-probability samples also yield good estimates of the population characteristics. Since, inclusion of the elements in the sample are not determined in a probabilistic way, the estimates obtained are not statistically projectable to the population.

The most commonly used non-probability sampling methods are convenience sampling, judgment sampling, quota sampling, and snowball sampling.

- **Convenience Sampling**

Convenience samples are sometimes called accidental samples because the elements included in the sample enter by accident". It is a sampling technique where samples are obtained from convenient elements. This refers to happening of the element at the right place at the right time, that is, where and when the information for the study is being collected. The selection of the respondents is left to the discretion of the interviewer. The popular examples of convenience sampling include (a) respondents who gather in a church (b) students in a class room (c) mall intercept interviews without qualifying the respondents for the study (d) tear-out questionnaire included in magazines and (e) people on the street. In the above examples, the people may not be qualified respondents, however, form part of the sample by virtue of assembling in the place where the researcher is conveniently placed. Convenience sampling is the least expensive and least time consuming of all sampling techniques. The disadvantage with convenience sampling is that the researcher would have no way of knowing if the sample chosen is representative of the target population.

- **Judgment Sampling**

This is a form of convenience sampling otherwise called as purposive sampling because the sample elements are chosen since it is expected that they can serve the research purpose. The sample elements are chosen based on the judgment that prevails in the researcher's mind about

the prospective individual. The researcher may use his wisdom to conclude that a particular individual may be a representative of the population in which one is interested. The distinguishing feature of judgment sampling is that the population elements are purposively selected. Again, the selection is not based on that they are representative, but rather because they can offer the contributions sought. In judgement sampling, the researcher may be well aware of the characteristics of the prospective respondents, in order that, he includes the individual in the sample. It may be possible that the researcher has ideas and insights about the respondent‟s requisite experience and knowledge to offer some perspective on the research question.

- **Quota Sampling**

Quota sampling is another non-probability sampling. It attempts to ensure that the sample chosen by the researcher is a representative by selecting elements in such a way that the proportion of the sample elements possessing a certain characteristic is approximately the same as the proportion of the elements with the characteristic in the population. Quota sampling is viewed as two-staged restricted judgemental sampling technique. The first stage consists of developing control categories, or quotas, of population elements. Control characteristics involve age, sex, and race identified on the basis of judgement. Then the distribution of these characteristics in the target population is determined. For example, the researcher may use control categories in that, he/she intends to study 40% of men and 60% of women in a population. Sex is the control group and the percentages fixed are the quotas. In the second stage, sample elements are selected based on convenience or judgement. Once the quotas have been determined, there is considerable freedom to select the elements to be included in the sample. For example, the researcher may not choose more than 40% of men and 60% of women in the study. Even if the researcher comes across qualified men after reaching the 40% mark, he/she would still restrict entry of men into the sample and keep searching for women till the quota is fulfilled.

- **Snowball sampling**

This is another popular non-probability technique widely used, especially in academic research. In this technique, an initial group of respondents is selected, usually at random. After being interviewed, these respondents are asked to identify others who belong to the target population of interest. Subsequent respondents are selected based on the information provided by the selected group members. The group members may provide information based on their understanding about the qualification of the other prospective respondents. This method involves probability and non-probability methods. The initial respondents are chosen by a random method and the subsequent respondents are chosen by non-probability methods.

Use of the Non-Probability Sampling Method

There are multiple uses of the non-probability sampling method. They are:

- **Create a hypothesis:** The non-probability sampling method is used to create a hypothesis when limited to no prior information is available. This method helps with immediate return of data and helps to build a base for any further research.
- **Exploratory research:** This sampling technique is widely used when researchers aim at conducting qualitative research, pilot studies or exploratory research.
- **Budget and time constraints:** The non-probability method when there are budget and time constraints and some preliminary data has to be collected. Since the survey design is not rigid, it is easier to pick respondents at random and have them take the survey or questionnaire.

	Probability Sampling Methods	**Non-Probability Sampling Methods**
Definition	Probability Sampling is a sampling technique in which sample from a larger population are chosen using a method based on the theory of probability.	Non-probability sampling is a sampling technique in which the researcher selects samples based on the subjective judgment of the researcher rather than random selection.

Alternatively Known as	Random sampling method.	Non-random sampling method
Population selection	The population is selected randomly.	The population is selected arbitrarily.
Market Research	The research is conclusive in nature.	The research is exploratory in nature.
Sample	Since there is method to deciding the sample, the population demographics is conclusively represented.	Since the sampling method is arbitrary, the population demographics representation is almost always skewed.
Time Taken	Take a longer time to conduct since the research design defines the selection parameters before the market research study begins.	This type of sampling method is quick since neither the sample or selection criteria of the sample is undefined.
Results	This type of sampling is entirely unbiased and hence the results are unbiased too and conclusive.	This type of sampling is entirely biased and hence the results are biased too rendering the research speculative.
Hypothesis	In probability sampling, there is an underlying hypothesis before the study begins and the objective of this method is to prove the hypothesis.	In non-probability sampling, the hypothesis is derived after conducting the research study.

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UNIT II

UNIT II RESEARCH DESIGN AND MEASUREMENT 12

Research design – Definition – types of research design – exploratory and causal research design – Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and scaling – Different scales – Construction of instrument – Validity and Reliability of instrument.

CO-PO AND BLOOMS TAXONOMY

Lecture No	Concept	CO	PO	PSO	Blooms Taxonomy
1	Research design – Definition	CO2	1,2,3,4,5	1,2	K1, K2
2	Types of research design – exploratory and causal research design	CO2	1,2,3,4,5	1,2	K1, K2,K3
3	Descriptive and experimental design – different types of experimental design	CO2	1,2,3,4,5	1,2	K1, K2, K3
4	Validity of findings – internal and external validity	CO2	1,2,3,4,5	1,2	K1, K2, K3
5	Variables in Research	CO2	1,2,3,4,5	1,2	K1, K2,K3
6	Measurement and scaling	CO2	1,2,3,4,5	1,2	K1, K2,K3,K4
7	Different scales	CO2	1,2,3,4,5	1,2	K1, K2,K3,K4
8	Construction of instrument	CO2	1,2,3,4,5	1,2	K5,K6
9	Validity and Reliability of instrument.	CO2	1,2,3,4,5	1,2	K3, K4,K5

LECTURE NO ONE

MEANING OF RESEARCH DESIGN:

"A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure." In fact, the research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data.

- What is the study about?
- Why is the study being made?
- Where will the study be carried out?
- What type of data is required?
- Where can the required data be found?
- What periods of time will the study include?
- What will be the sample design?
- What techniques of data collection will be used?
- How will the data be analysed?
- In what style will the report be prepared?

Keeping in view the above stated design decisions; one may split the overall research design into the following parts:

- The sampling design which deals with the method of selecting items to be observed for the given study
- The observational design which relates to the conditions under which the observations are to be made;
- The statistical design which concerns with the question of how many items are to be observed and how the information and data gathered are to be analysed; and
- The operational design which deals with the techniques by which the procedures specified in the sampling, statistical and observational designs can be carried out.

From what has been stated above, we can state the important features of a research design as under:

- It is a plan that specifies the sources and types of information relevant to the research problem.
- It is a strategy specifying which approach will be used for gathering and analysing the data.
- It also includes the time and cost budgets since most studies are done under these two constraints.

- The observational design which relates to the conditions under which the observations are to be made;
- The statistical design which concerns with the question of how many items are to be observed and how the information and data gathered are to be analysed; and
- The operational design which deals with the techniques by which the procedures specified in the sampling, statistical and observational designs can be carried out.

In brief, research design must, at least, contain—

(a) a clear statement of the research problem;

(b) procedures and techniques to be used for gathering information;
(c) the population to be studied; and
(d) methods to be used in processing and analysing data.

LECTURE NO TWO

Types of Research Design:

There are different types of research designs. They may be broadly categorized as:

(1) Exploratory Research Design;
(2) Descriptive and Diagnostic Research Design; and
(3) Hypothesis-Testing Research Design.

1. Exploratory Research Design:

The Exploratory Research Design is known as formulative research design. The main objective of using such a research design is to formulate a research problem for an in-depth or more precise investigation, or for developing a working hypothesis from an operational aspect. The major purpose of such studies is the discovery of ideas and insights. Therefore, such a research design suitable for such a study should be flexible enough to provide opportunity for considering different dimensions of the problem under study. The in-built flexibility in research design is required as the initial research problem would be transformed into a more precise one in the exploratory study, which in turn may necessitate changes in the research procedure for collecting relevant data. Usually, the following three methods are considered in the context of a research design for such studies. They are (a) a survey of related literature; (b) experience survey; and (c) analysis of 'insight-stimulating' instances.

2. Descriptive and Diagnostic Research Design:

A Descriptive Research Design is concerned with describing the characteristics of a particular individual or a group. Meanwhile, a diagnostic research design determines the frequency with which a variable occurs or its relationship with another variable. In other words, the study analyzing whether a certain variable is associated with another comprises a diagnostic research study. On the other hand, a study that is concerned with specific predictions or with the narration of facts and characteristics related to an individual, group or situation, are instances of descriptive research studies. Generally, most of the social research design falls under this category. As a research design, both the descriptive and diagnostic studies share common requirements, hence they are grouped together. However, the procedure to be used and the research design need to plan carefully. The research design must also make appropriate provision for protection against bias and thus maximize reliability, with due regard to the completion of the research study in an economical manner. The research design in such studies should be rigid and not flexible. Besides, it must also focus attention on the following:

a) Formulation of the objectives of the study,
b) Proper designing of the methods of data collection,
c) Sample selection,
d) Data collection,
e) Processing and analysis of the collected data, and
f) Reporting the findings.

3. Hypothesis-Testing Research Design:

Hypothesis-Testing Research Designs are those in which the researcher tests the hypothesis of causal relationship between two or more variables. These studies require procedures that would not only decrease bias and enhance reliability, but also facilitate deriving inferences about the causality. Generally, experiments satisfy such requirements. Hence, when research design is discussed in such studies, it often refers to the design of experiments.

LECTURE NO THREE

EXPERIMENTAL RESEARCH DESIGN

Experiment is a study in which the investigator manipulates or varies one or more variables and measures other variables. In other words It is a process of manipulating one variable in a controlled environment while holding all other variables constant in order to establish a casual relationship.

All experiment involve three basic component.

1. Variable manipulated in a experiment are referred to as the independent variable or test units.
2. The actual alteration is called the treatment.
3. The actual variable chosen to measure the subject response are known as dependent variables.

The result of the treatment is measured on dependent variable and these results of the treatment are given a variety of names ie outcome , observation change ,effect etc.

Advantage:

1. The researcher can manipulates the independent variable
2. Control group serves as a comparison to assess the existence and potency of the manipulation.
3. The contamination from extraneous variable can be controlled more effectively.
4. The convenience and cost of experimentation are superior to other methods.
5. The experimenter can assemble combination of variables for testing .
6. Repeating an experiment with different subject group and condition is possible.
7. Researcher can use naturally occurring events.

Disadvantages:

1. The laboratory experiment is artificial
2. Generalisation from non-probability samples can poses problems.
3. The experimentation can outrun the budget.
4. It is mostly effectively targeted at present or immediate future problems.
5. It is concerned with the study of people.
6. There is limits to the types of manipulation and control that are ethical.

CONDUCTING AN EXPERIMENT:

1. **Select relevant Variable**

   In this step researcher will a) Select variable that are the best operational concepts. b) Determine how many variables to test c) Select or design appropriate measures for them.

2. **Specify the level of the treatment**:

   The treatment levels of the independent variables are the distinctions the researcher makes between different aspects of the treatment condition.

3. **Control the experimental Environment:**

At this research concerned with environment control, holding constant the physical environment of the experiment. The introduction of the experiment to the subjects and the instruction would likely be videotaped for consistency. The arrangement of the room , the time of administration the experimenter's contract with the subjects and so forth must all be consistent across each administration of the experiment.

4. **Choose the experimental design:**

The experimental design are unique to the experimental. They serve as positional and statistical plans to designate relationships between experimental treatment and the experimenter's observations or measurement points in the temporal scheme of the study. The design strengthen the generalizability of results beyond the experimental setting

5. **Select and assign the subjects:**

The subject selected for the experiment should be representative of the population to which the researcher wishes to generalize. The researcher first prepares a sampling frame and then assigns the subject for the experiment to groups using a randomization technique. If randomization is used those assigned to the experimental group are likely to be similar to those assigned to the control group. Random assignment to the group is required to make the group as comparable as possible with respect to the dependent variable.

6. **Pilot test –revise and test**:

Pilot testing is intended to reveal errors in the design and improper control of extraneous or environmental conditions. Pretesting the instrument permits the researcher to revise scripts ,look for control problems with laboratory conditions and scan the environmental for factor that might confound the results.

7. **Analyse the data**:

If adequate planning and pretesting have occurred the experimental data will take an order and structure uncommon to surveys and unstructured observational studies. Researcher has several measurement and instrument options with experiment. Among them are

1) Observational technique and coding schemes
2) Paper and pencil tests
3) Self report instrument with open or dosed questions
4) Scaling technique
5) Physiological measure

PRINCIPLES OF EXPERIMENTAL DESIGN

a) Principle of Replication :

According to this principle the experiment should be repeated more than once. So each treatment is applied in many experimental units instead of one. By this statistical accuracy of the experiment can be increased. This aims for increase in accuracy with which effects and interactions can be estimated.

b) Principle of Randomisation

It provides protection, against the effect of extraneous factors in experiment. This principle indicates that we should design or plan the experiment in such a way that the variations caused by extraneous factors can all be combined under the general heading of chance.

c) Principal Of local control

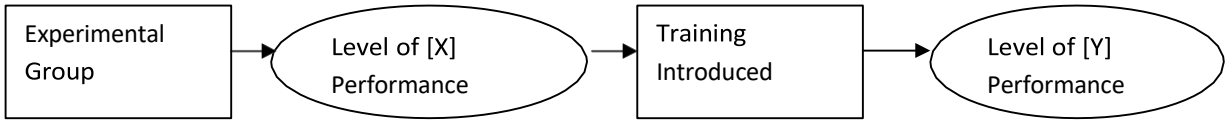
Under this method we first divide the whole unit into several homogenous parts , known as blocks and then each such block is divided into parts equal to the number of treatment. Then the treatment are randomly assigned to these parts of the block.

TYPES OF EXPERIMENTAL DESIGN

I - Informal experimental design

1) Before and after without control design

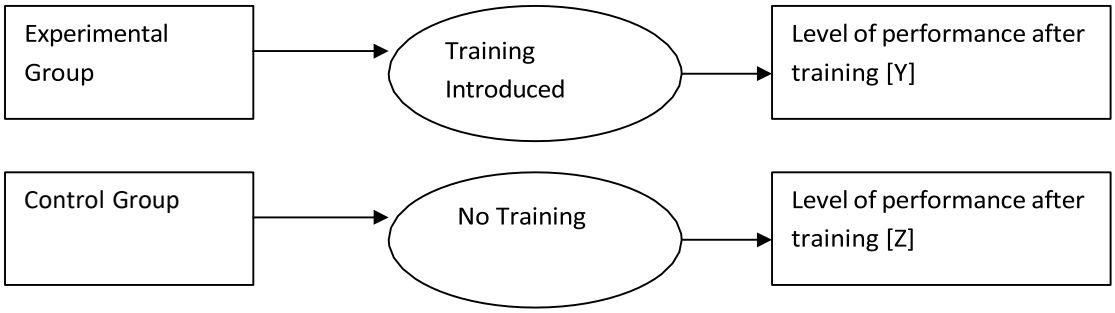
In this design a single test group or area is selected and the dependent variable is measured before the introduction of the treatment. The treatment is then introduced and the dependent variable is measured again after the treatment has been introduced.



Training Effect = Y- X

2) After – Only with control design

In this design two group or areas are selected and the treatment is introduced into the test area only. The dependent variable is then measured in both the areas at the same time. Treatment impact is assessed by subtracting the value of the dependent variable is then measured in both the areas at the same time. Treatment impact is assessed by subtracting the value in the test area.

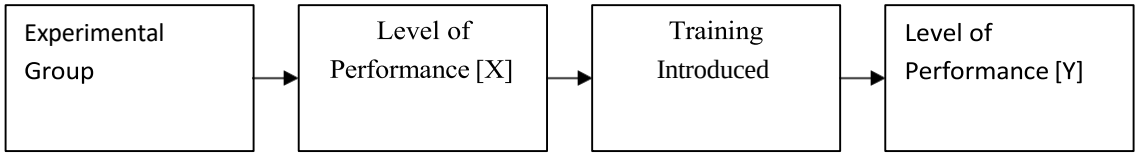


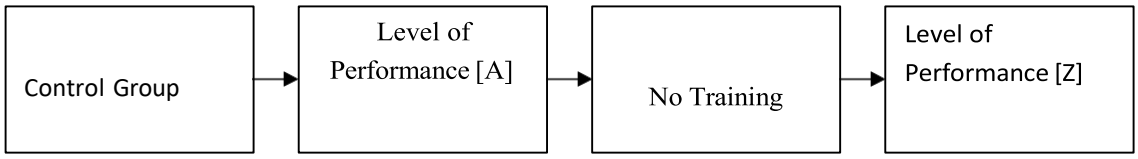
Training Effect = Y- Z

3) Before and After with control design

In this design two areas are selected and the dependent variable is measured in both the areas for an identical time period before the treatment. The treatment is then introduced into the test area only, and the dependent variable is measured in both for an identical time period after the introduction of the treatment. The treatment effect is determined by subtracting the change in the dependent variable in the control area from the change in the dependent variable in the test area.

Time Period – I **Time Period - II**





Training Effect [Y-X] – [Z-A]

II Formal Experimental Design

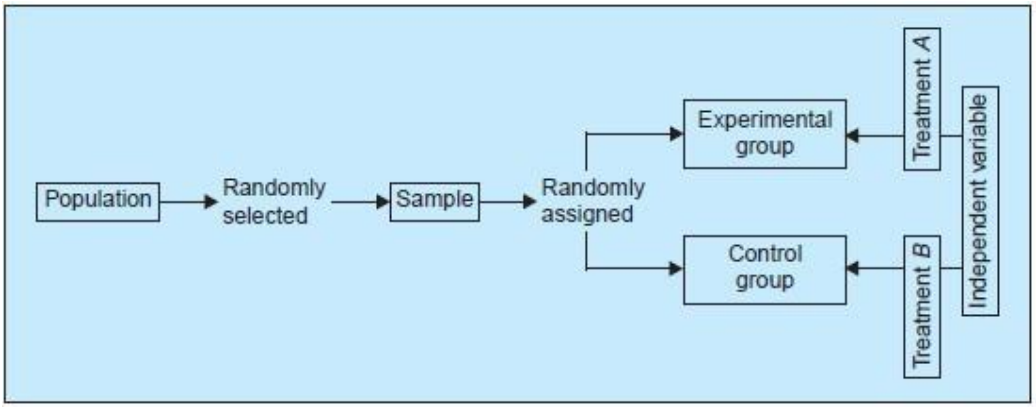
4) Completely Randomized design

In this design the subjects are randomly assigned to experimental treatments. It involves two basic principle , ie principle of replication and principle of randomization of experimental designs.

a) **Two group simple randomization design**

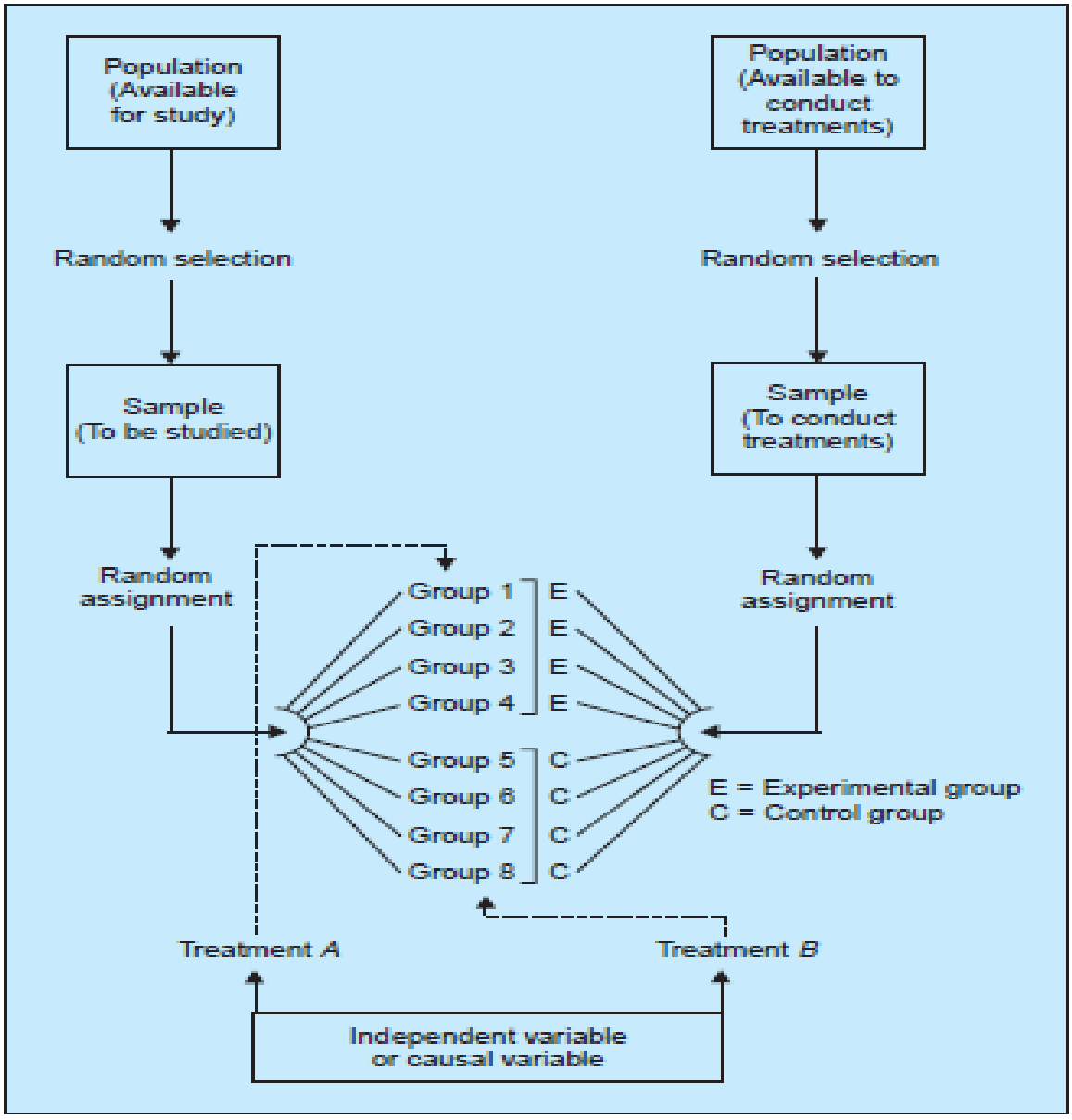
In this design all the population is defined and then from population a sample is selected randomly. Then the samples are randomly assigned to the experimental and control groups. The two groups ie experimental & control , of such a design are given different treatments of the independent variable. This design is common in behavioural sciences.

It is simple & randomize the differences among the sample items. But this does not control extraneous variable.



b) Random replication design :

In previous design extraneous variable was not controlled . But in this method the effect of such variable are minimized by providing a number of repetitions for each treatment. Each repetition is technically called a replications. In this design sample is taken randomly from the population available to conduct experiments and randomly assigned to four experimental & four control groups. Generally equal number of items are put in each group so that the size of the group is not likely to affect the results of the study. Due to repetitions the results are more reliable and population differences is also reduced as it is randomized.



5) Randomized Block design

It is an improvement over the completely randomized design. In this local control can be applied along with other principles of experimental design. The subjects are divided groups known as blocks. , within each group the subjects are relatively homogeneous in respect to some selected variable. The number of subjects in a given block would be equal to the number of treatments and one subject in each block would be randomly assigned to each treatment. In general blocks are the level at which we hold the extraneous factor fixed. So that its contribution to the total variability of data can be measured. The main feature of the R.B. design is that in this each treatment appears the same number of times in each block.

Randomized Block Design:

Student	Very Low I.Q A	Very Low I.Q B	Very Low I.Q C	Very Low I.Q D	Very Low I.Q E
Form 1					
Form 2					
Form 3					
Form 4					
Form 5					

6) Latin Squares design

It is used in agricultural research. For eg an experiment has to be made through which the effects of five different varieties of fertilizers on the yield of a certain crop say wheat is to be judged. In such case the varying fertility of the soil in different blocks in which the experiment has to be performed must be taken into consideration otherwise the results obtained may not be very dependable because the output happens to be the effect not only of fertilizers, but it may also be the effect of fertility of soil , varying seeds. To overcome such difficulties the L.S design is used when there are two major extraneous factors such as the varying soil fertility & varying seeds.

The merit of this design is it enables differences in fertility gradients in the field to be eliminated in comparision to the effects of different varieties of fertilizers on the yield of the crop. But it has a limitation , that there is no interation between treatments and blocking factors and it requires rows & columns to be equal

	I	II	III	IV	V
X1					
X2					
X3					
X4					
X5					

Fertility Level

7) Factorial Design

It is used in experiment where the effects of varying than one factor be determined.

a) Simple factorial Designs;

It is also termed as a two –factor factorial design. In this design the extraneous variable to be controlled by homogeneity is called the control variable and the independent variable , which is manipulated is called the experimental variable. Then there are two experimental variable and two levels of the control variable. Subjects are assigned at random to each treatment just like Random design. Means of different cells represent the mean scores for the dependent variable. The column means represent the effect for treatments without taking in account of control variable. The row means represent the effect for levels without regard to treatment. Thus we can study the main effect of treatments as well as the main effect of levels. It is also possible to examine the interactions between treatment and levels, whether they are independent of each other nor they are not so.

Training

Control Intelligence	Treatment A	Treatment B	Row Mean
Level I	155	23.3	19.4
Level II	35.8	30.2	33.0
Column Mean	256	26.7	

Training

Control Intelligence	Treatment A	Treatment B	Row Mean
Level I	10.4	20.6	15.5
Level II	30.6	40.4	35.5
Column Mean	20.5	80.5	

b) Complex Factorial design:

Experiment with more than two factors at a time involve the use of complex factorial design. A design which considers three or more independent variables simultaneously is called a complex factorial design. When three factors with one experimental variable having two treatments and two control variable each one of which having two levels , the design used will be termed complex factorial design. In this method it is possible to determine the main effect for three variables ie one experimental and two control variables. The researcher can also determine the interactions between each possible pair of variables.

		Experimental Variable			
		Treatment A		Treatment B	
		C.V. 2 Level 1	C.V. 2Level 2	C.V. 2 Level 1	C.V. 2 Level 2
Control Variable	Level I				
	Level II				

LECTURE NO FOUR

Validity refers to the extent to which the conclusions drawn from the are true experiment

I- Internal validity :

Refers to the extend to which the research design accurately identifies casual relationship.

a) History

When extraneous factors that enter the experiment process between the first and later manipulation affect measure of the dependent variable.

b) Maturation :

Changes in the dependent variable based on the natural function of time and not attributed to any specific event.

c) Testing

When learned understanding gained from the first treatment and measure of the dependent variable distort future treatment and measurement activities.

d) Instrumentation :

Contamination from changes in measurement processes observation technique and measuring instruments

e) Selection Bias:
Contamination created by inappropriate selection or assignment process of test subject to experimental treatment groups

f) Statistical Regression:
Contamination created when experiment group are selected on the basis of their extreme response or scores.

g) Mortality :
Contamination due to changing the composition of the test subjects in the experiment.

h) Ambiguity :
Contamination from unclear determination of cause effect relationship

II - <u>External Validity</u> :

Refer to the extent to which a casual relationship found in a study can be expected to be true for the entire target population.

a) Treatment Vs Treatment
When test subject in different treatment groups are exposed to different amount of manipulations.

b) Treatment Vs Testing
When the premeasurement process sensitizes test subject to respond in an abnormal manner to treatment manipulation.

c) Treatment Vs Selection
Generalising the results to other categories of people beyond those used in the experiment

d) Treatment Vs Setting
Generalising the results to other environment beyond the one used in the experiment.

e) Treatment Vs History
Using the existing functional relationship to predict future phenomenon outcomes.

III - <u>Construct Validity</u>

Refers to the extent to which the variables under investigation are completely and accurately identified prior to hypothesizing any functional relationships.

a) Inadequate pre-operationalization of variable
Contamination due to inadequate understanding of the complete make-up of the independent and dependent variable included in the experimental design.

b) Mano operation bias
Contamination created by using only one method to measure the outcome of the dependent variable.

c) Mano-method bias
Contamination due to assessing multi-attribute treatment manipulation using single item measuring instrument.

d) Hypothesis –guessing
Contamination by test subject believing they know the desired functional relationship relationship prior to the manipulation treatment.

e) **Evaluation Apprehension**:
Contamination caused by test subjects being fearful that their actions or response will become known to others.

f) **Demand Characteristic**:

Contamination created by test subjects trying behind the experiment thus abnormal socially acceptable responses or behaviour.

g) **Diffusion Of treatment**

Contamination due to test subject discussing the treatment and measurement activities with individual yet to receive the treatment.

LECTURE NO FIVE

VARIABLE is a measurable characteristic that varies. It may change from group to group, person to person, or even within one person over time. There are six common variable types:

DEPENDENT VARIABLES

Show the effect of manipulating or introducing the independent variables. For example, if the independent variable is the use or non-use of a new language teaching procedure, then the dependent variable might be students' scores on a test of the content taught using that procedure. In other words, the variation in the dependent variable depends on the variation in the independent variable.

INDEPENDENT VARIABLES

Are those that the researcher has control over. This "control" may involve manipulating existing variables (e.g., modifying existing methods of instruction) or introducing new variables (e.g., adopting a totally new method for some sections of a class) in the research setting. Whatever the case may be, the researcher expects that the independent variable(s) will have some effect on (or relationship with) the dependent variables.

INTERVENING VARIABLES

. . . refer to abtract processes that are not directly observable but that link the independent and dependent variables. In language learning and teaching, they are usually inside the subjects' heads, including various language learning processes which the researcher cannot observe. For example, if the use of a particular teaching technique is the independent variable and mastery of the objectives is the dependent variable, then the language learning processes used by the subjects are the intervening variables.

MODERATOR VARIABLES

. . . affect the relationship between the independent and dependent variables by modifying the effect of the intervening variable(s). Unlike extraneous variables, moderator variables are measured and taken into consideration. Typical moderator variables in TESL and language acquisition research (when they are not the major focus of the study) include the sex, age, culture, or language proficiency of the subjects.

CONTROL VARIABLES

Language learning and teaching are very complex processes. 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.

EXTRANEOUS VARIABLES

. . . are those factors in the research environment which may have an effect on the dependent variable(s) but which are not controlled. 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 factor. If they cannot be controlled, extraneous variables must at least be taken into consideration when interpreting results.

LECTURE NO SIX

MEASUREMENT AND SCALING

The word scale or scaling is generally used for indicating measurements or measuring something. Many aspects of social phenomena like emotion, attitude, faiths etc. are not measurable directly. They are not quantitative in nature. In social phenomena there are two types of variables quantitative and qualitative. Measurement or scaling implies conversion of qualitative data into quantitative data and then measuring them. Various kinds of statistical measurements are used for this purpose. Scaling is an attempt to bring about greater accuracy which is desired in both physical and social sciences.

Essentials of Scaling (Criteria for Good Scaling)

- Continuum means judging the scalability of the phenomenon under study.
- Reliability means that it should consistently produce the same result when applied to the same design.
- Validity implies correct measurement. A scale is valid if it measures correctly what is expected to measure.
- weighting items means proper weights are to be provided to the attributes involved in the study because they are not of equal importance.
- Equality of units is a desirable characteristic but not essential for sound scientific procedure. In order to make the units equal, sometimes subtraction or addition can be made.

MEASUREMENT SCALES:

The most widely used classification of measurement scales are: (a) nominal scale; (b) ordinal scale; (c) interval scale; and (d) ratio scale.

(a) 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. The scale 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.

(b) 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. 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. 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. 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. 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-parametric methods.

(c) Interval scale: 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 arbitrary point..

(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 centimetre 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 interval scale. Ratio scale represents the actual amounts of variables. Measures of physical dimensions such as weight, height, distance, etc. are examples. Multiplication and division can be used with this scale but not with other scales mentioned above. Geometric and harmonic means can be used as measures of central tendency and coefficients of variation may also be calculated

What is the Validity of a Study?

Internal Validity – The degree to which changes in the dependent variable are affected by the manipulated independent variable. Maintaining high internal validity means controlling for all other independent variables other than the one(s) being studied

External Validity – The degree to which the results of a study can be generalized to the "real world". Factors that negatively affect external validity also negatively affect the generalizability of the results

Instrument Validity

Does an instrument measure what it is supposed to measure? Four types of instrument validity are as follows:

– Construct
– Criterion related
– Content
– Inter-rater / Intra-rater

LECTURE NO SEVEN

Scaling Techniques :

I - Rating scale:

It involves qualitative description of a limited number of aspects of a thing or of traits of a person. Here we judge an object in absolute terms against some specified criteria There is no rules with points of scales ,in practice 3 to 7 points scales are generally used. There are various types of rating scale;

a) Simple category scale :

It has two responses eg YES, NO. This scale is particularly useful for demographic question or where dichotomous response is adequate.

b) Multiple Choice – Single

When there are multiple options for the respondent and only one answer is sought this scale is preferred.

c) Multiple Choice – Multiple response scale

It allows the respondent to select one or more alternatives from multiple choices.

e) **Likert Scale** –

It is a mostly used summated rating scale. It consists of statements that express either a favorable or unfavorable attitude toward the object of interest. The respondent is asked to agree or disagree with each statement. Each response is given a numerical score to reflect its degree of attitude favorableness and the scores may be totaled to measure the respondent's attitude. This data provides interval data.

f) Semantic differential

It helps to measure the psychological attitude. It is used in marketing problems, political issues, and personalities. This method consist of bipolar rating scales, usually with seven points by which one or more respondents rate one or more concepts on each scale item. It produces interval data. The total set of response provides a comprehensive picture about the respondent rating and object which is measured.

g) Numerical Scale

It has equal intervals that separate their numeric scale points. The verbal statement serve as the labels for the extreme points. It is often five point scale . The scale provides absolute & relative measure of the subject.

h) Multiple rating scale:

It is similar to numerical scale, but differs in two ways 1) It accepts a circled response from the rater 2) The layout allows visualization of the results. The advantage is that a mental map of the respondent evaluation is evident to both the rater and the researcher. This scale produces interval data.

i) Fixed sum scale

In this scale two categories are presented that must sum to 100. up to 10 categories can be used. The advantage is it's compatibility. It provides continuous data. The scale is used to record to attitudes , behaviour and behavioural intent.

j) Graphic rating scale:

It was created to enable researcher to discern fine differences. It uses pictures , icons or other visuals to communicate with the respondents.

II Ranking Scales

In this the subject directly compares two or more objects and makes choices among them. The respondents were asked to select one as best or most preferred.

a) Paired –comparison

In this respondent can express attitudes clearly by choosing between two objects.

b) **Forced Ranking Scale**:

The list of objects are ranked relative to each other .This method is faster than paired comparisons and is usually easier and more motivating to the respondent.

c) Comparative Scales

Another version of the preceding scale would label the categories "excellent" ,"very good" , "Good", "fair" and "poor". Thereby eliminating the implicit comparison. The problem with comparative scale is that the reference point is unclear and different reference points or standards.

LECTURE NO EIGHT

In research while measuring attitudes of the people we generally follow the technique of preparing the opinonnaire (attitude scale) in such a way that the score of the individual responses assigns him a place on a scale. In this respondent express his opinion on various statements. While developing such statement the researcher must note the following points;

1) That the statement must elicit responses which are psychologically related to the attitude being measured.
2) That the statements need be such that they discriminate not merely between extremes of attitude but also among individual who differ slightly.

DIFFERENT SCALES FOR MEASURING ATTITUDES OF PEOPLE

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

1. Arbitrary Scale;

It is developed on ad hoc basis and are designed largely through the researcher's own subjective selection of items. The researcher select few statement or item which he believes are appropriate to a given topic and it is include in measuring instrument.. Then people are asked to check in a list for their opinion.

Merits:

1. It is easy to develop quickly with less expense.
2. It can be designed highly specific and adequate
3.

Demerits ;

1. It is not reliable
2. It rely on researcher's insight and competence.

2. Differential scale (Thustone –type scale)

It is associated with differential scale which have been developed using consensus scale approach. In this selection is made by panel of judges

The procedure is

1. The researcher gather a large number of statements
2. The statements are submitted to panel of judges.
3. Each judge is request to arrange in position according to opinion.
4. Each judge is request to place the statement in first, second groups etc according to his favorableness.
5. In case of disagreement between the judges in assigning a position to an item that item is discarded.
6. A final selection of statements is then made .
7. The position of statements on the scale is determined by judges.

Merits

1. It appropriate when we measure single attitude.
2. It is very reliable method

Demerits

1. It is costly method
2. Judge own attitude may reflect in arrangement

3. Summated Scale (Likert Scale)

It developed by utilizing the item analysis approach wherein in 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.

Procedure:

1. Researcher collect a number of statements relevant to the attitude being studied.
2. A trial test should be made with small group of people
3. The response to various statements are scored in such a way that a response of most favorable attitude is given the highest score of 5, and the most unfavorable attitude is given the lowest score of 1.
4. Then the total score of each respondent is obtained by adding his scores for separate statements.
5. Then arrange these scores & find out with those statements which have a high discriminating power. This way we determine which statement consistently co relate with high favorability & which with low favorability.
6. Only those statements that correlate with total test, should be retained in the final statement. And others must be removed.

Merits:

1. It is easy to construct in comparison to differential scale.
2. It is more reliable.
3. Each statement in this is given a test for discriminating ability, so it permits the use of only those statements that have direct relationship to the attitude being studied.
4. We can study how responses differ between people & how response differ between stimuli.

5. It takes less time to construct.

Demerits:

1. In this method we can examine whether respondents are more or less favorable to the topic, but we can't tell how much or less they are.
2. The interval between strongly agree & agree may not be equal to the interval between agree & undecided.
3. Often the total score of an individual respondent has little clear meaning since the given score can be secured by a variety of answer pattern.

4. Cumulative scale or scalogram:

It consists of a series of statements to which a respondents expresses his agreement or disagreement. The special feature of this scale is that statements in it form a cumulative series.. The individual score is worked out by counting the number of points concerning number of statement he answered favorably. The major scale of this type of cumulative scales is the gutt man's scalogram. The scalogram refers to the procedure for determining whether a set of items form a unidimensional scale. A scale is said to be unidimensional if response fall into a pattern in extreme and also less extreme points.

Procedure;

1. The layout in clear terms the issue we want to deal in our study.
2. Develop a number of items relating the issue and to eliminate by inspection the items that are irrelevant or those that happen to be extreme items.
3. Pre-test the items whether the issue at hand is scalable. The respondent are asked to record their opinion on all items ranging from 'strongly agree to strongly disagree. The score like 5 -1 was assigned. If there is 5 items in all , total, score can be from 75- 15.
4. Respondent opinionnaires are then arrayed according to total score for analysis and evaluation. If the responses of an item form a cumulative scale, its response category scores should decrease in an orderly fashion. After analyzing the preset results , a few items may be chosen.
5. Then total scores for the various opininnoires and to rearray them to reflect any shift in order resulting from reducing the items.

Merits;

1. It assures that only a single dimension of attitude is measured.
2. Researcher's subjective judgment is not allowed to creep in the development of scale since the scale is determined by the replies of respondent.
3. It can be appropriately be used for personal ,telephone or mail surveys.

Demerits:

1. It is very tedious & complex in preparation.
2. Conceptually is more difficult in comparison to other scaling methods.
3. It very a reliable source for assessing attitudes of persons towards complex objects.

5. Factor Scales:

It is developed on the basis of intercorrelations of items which indicate the degree of interdependence. It include a variety of technique that have been developed for two problem.

1) How to deal with the universe of content that is multidimensional.
2) How to uncover underlying dimension that have not been identified.

An important factor scale is semantic differential and multidimensional scaling.

a) Semantic differential scale:

It is an attempt to measure the psychological meanings of an object to an individual.

b) Multidimensional scaling

It is characterized as a set of procedures for portraying perceptual or affective dimension of substantive interest. It is used when all the variables are to be analysed are happened to be independent. Through MDS techniques one can represent geometrically the locations and interrelationship among a set of points.

Merits:

1. It is used in psychological survey.
2. It is used to measure the perceptual structure of a set of stimuli and cognitive processes underlying the development of this structure.
3. It is an important measurement tool for attitude.

Demerits:

1. It is complicated in calculation.

It is laborious in collection of data & analysis.

LECTURE NO NINE

"Validity refers to the extent to which a test measures what we actually wish to measure. Reliability has to do with the accuracy and precision of a measurement procedure ... Practicality is concerned with a wide range of factors of economy, convenience, and interpretability ..." We briefly take up the relevant details concerning these tests of sound measurement.

1. Test of Validity*

Validity is the most critical criterion and indicates the degree to which an instrument measures what it is supposed to measure. Validity can also be thought of as utility. In other words, validity is the extent to which differences found with a measuring instrument reflect true differences among those being tested. But the question arises: how can one determine validity without direct confirming knowledge? The answer may be that we seek other relevant evidence that confirms the answers we have found with our measuring tool. What is relevant, evidence often depends upon the nature of the research problem and the judgement of the researcher. But one can certainly consider three types of validity in this connection: (i) Content validity; (ii) Criterion-related validity and (iii) Construct validity.

(i) Content validity is the extent to which a measuring instrument provides adequate coverage of the topic under study. If the instrument contains a representative sample of the universe, the content validity is good. Its determination is primarily judgemental and intuitive. It can also be determined by using a panel of persons who shall judge how well the measuring instrument meets the standards, but there is no numerical way to express it.

(ii) Criterion-related validity relates to our ability to predict some outcome or estimate the existence of some current condition. This form of validity reflects the success of measures

used for some empirical estimating purpose. The concerned criterion must possess the following qualities:

- Relevance: (A criterion is relevant if it is defined in terms we judge to be the proper measure.)
- Freedom from bias: (Freedom from bias is attained when the criterion gives each subject an equal Opportunity to score well.)
- Reliability: (A reliable criterion is stable or reproducible.)
- Availability: (The information specified by the criterion must be available.)

In fact, a Criterion-related validity is a broad term that actually refers to

(i) Predictive validity and

(ii) Concurrent validity.

The former refers to the usefulness of a test in predicting some future performance whereas the latter refers to the usefulness of a test in closely relating to other measures of known validity. Criterion-related validity is expressed as the coefficient of correlation between test scores and some measure of future performance or between test scores and scores on another measure of known validity.

(iii) Construct validity is the most complex and abstract. A measure is said to possess construct validity to the degree that it confirms to predicted correlations with other theoretical propositions. Construct validity is the degree to which scores on a test can be accounted for by the explanatory constructs of a sound theory. For determining construct validity, we associate a set of other propositions with the results received from using our measurement instrument. If measurements on our devised scale correlate in a predicted way with these other propositions, we can conclude that there is some construct validity. If the above stated criteria and tests are met with, we may state that our measuring instrument is valid and will result in correct measurement; otherwise we shall have to look for more information and/or resort to exercise of judgement.

2. Test of Reliability

The test of reliability is another important test of sound measurement. A measuring instrument is reliable if it provides consistent results. Reliable measuring instrument does contribute to validity, but a reliable instrument need not be a valid instrument. For instance, a scale that consistently overweighs objects by five kgs., is a reliable scale, but it does not give a valid measure of weight. But the other way is not true i.e., a valid instrument is always reliable. Accordingly reliability is not as valuable as validity, but it is easier to assess reliability in comparison to validity. If the quality of reliability is satisfied by an instrument, then while using it we can be confident that the transient and situational factors are not interfering.

Two aspects of reliability viz., stability and equivalence deserve special mention. The stability aspect is concerned with securing consistent results with repeated measurements of the same person and with the same instrument. We usually determine the degree of stability by comparing the results of repeated measurements. The equivalence aspect considers how much error may get introduced by different investigators or different samples of the items being studied. A good way to test for the equivalence of measurements by two investigators

is to compare their observations of the same events. Reliability can be improved in the following two ways:

(i) By standardising the conditions under which the measurement takes place i.e., we must ensure that external sources of variation such as boredom, fatigue, etc., are minimised to the extent possible. That will improve stability aspect.

(ii) By carefully designed directions for measurement with no variation from group to group, by using trained and motivated persons to conduct the research and also by broadening the sample of items used. This will improve equivalence aspect.

3. Test of Practicality

The practicality characteristic of a measuring instrument can be judged in terms of economy, convenience and interpretability. From the operational point of view, the measuring instrument ought to be practical i.e., it should be economical, convenient and interpretable. Economy consideration suggests that some trade-off is needed between the ideal research project and that which the budget can afford. The length of measuring instrument is an important area where economic pressures are quickly felt. Although more items give greater reliability as stated earlier, but in the interest of limiting the interview or observation time, we have to take only few items for our study purpose. Similarly, data-collection methods to be used are also dependent at times upon economic factors. Convenience test suggests that the measuring instrument should be easy to administer. For this purpose one should give due attention to the proper layout of the measuring instrument. For instance, a questionnaire, with clear instructions (illustrated by examples), is certainly more effective and easier to complete than one which lacks these features. Interpretability consideration is especially important when persons other than the designers of the test are to interpret the results. The measuring instrument, in order to be interpretable, must be supplemented by

(a) detailed instructions for administering the test;

(b) scoring keys;

(c) evidence about the reliability and

(d) guides for using the test and for interpreting results.

&&&&&&&&&&&&&&&&

UNIT IV

UNIT III- DATA PREPARATION AND ANALYSIS

Data Preparation – editing – Coding –Data entry – Validity of data – Qualitative Vs Quantitative data analyses – Applications of Bivariate and Multivariate statistical techniques, Factor analysis, Discriminant analysis, Cluster analysis, Multiple regression and Correlation, Multidimensional scaling – Conjoint Analysis – Application of statistical software for data analysis.

CO-PO AND BLOOMS TAXONOMY

Lecture No	Concept	CO	PO	PSO	Blooms Taxonomy
1	Data Preparation editing – Coding, Data entry – Validity of data	CO4	1,2,3,4,5	1,2	K1, K2
2	Qualitative Vs Quantitative data analyses	CO4	1,2,3,4,5	1,2	K1, K2,K3
3	Bivariate analysis, Multivariate statistical techniques	CO4	1,2,3,4,5	1,2	K1, K2, K3,K4,K5
4	Factor analysis– Discriminant analysis	CO4	1,2,3,4,5	1,2	K1, K2, K3,K4,K5,K6
5	cluster analysis –	CO4	1,2,3,4,5	1,2	K1, K2,K3,K4
6	Multiple Regression And Correlation	CO4	1,2,3,4,5	1,2	K1, K2,K3,K4,K5,K6
7	Multidimensional Scaling	CO4	1,2,3,4,5	1,2	K1, K2,K3,K4
8	Multidimensional Scaling	CO4	1,2,3,4,5	1,2	K2,K3 K5,K6
9	Application of statistical software for data analysis	CO4	1,2,3,4,5	1,2	K2,K3, K4,K5

LECTURE NO ONE

Data Preparation:

The data, after collection, has to be processed and analysed in accordance with the outline laid down for the purpose at the time of developing the research plan. This is essential for a scientific study and for ensuring that we have all relevant data for making contemplated comparisons and analysis. Technically speaking, processing implies editing, coding, classification and tabulation of collected data so that they are amenable to analysis. The term analysis refers to the computation of certain measures along with searching for patterns of relationship that exist among data-groups. Thus, "in the process of analysis, relationships or differences supporting or conflicting with original or new hypotheses should be subjected to statistical tests of significance to determine with what validity data can be said to indicate any conclusions".

Processing stages

There are four important stages in the processing of data. They are;

1. Editing

As soon as the researcher receives the data, he should screen it for accuracy. Editing is the process of examining the data collected through various methods to detect errors and omissions and correct them for further analysis. Though editing, it is ensured that the collected data are accurate, consistent with other facts gathered, uniformly entered and well arranged so that further analysis is made easier.

Practical guidelines for editing

While editing care has to be taken to see that the data are as accurate and complete as possible.

The following points are to be noted;

1. The editor should familiarize with the copy of instructions given to the interviewers.
2. The original entry, if found incorrect, should not be destroyed or erased. On the other hand, it should be crossed out in such a manner that it is still eligible.
3. Any, modification to the original entry by the editor must be specifically indicated.
4. All completed schedules must bear signature of the editor and the date.
5. Incorrect answer to the questions can be corrected only if the editor is absolutely sure of the answer, otherwise leave it as such.
6. Inconsistent, incomplete or missing answers should not be used.
7. Sere that all numerical answers are converted to same units.

2. Coding

Coding is the process by which r response categories are summarized by numerals or other symbols to carry out subsequent operations of data analysis. This process of assigning numerals or symbols to the responses is called coding. It facilitates efficient analysis of the collected data and helps in reducing several replies to a small number of classes which contain the critical information required for analysis. In general it reduces the huge amount of information collected in to a form that is amenable to analysis.

Steps in coding

1. Study the answers carefully.
2. Develop a coding frame by listing the answers and by aligning codes to each of them.
3. Prepare a coding manual with the detail of variable names, codes and instructions.
4. If the coding manual has already been prepared before the collection of the data, make the required additions for the open ended and partially coded questions.

Coding rules:

1. Give each respondent a code number for identification.
2. Provide code number for each question.
3. All responses including 'don't know', 'no opinion'. Etc is to be coded.
4. Assign additional codes to partially coded questions.

3. Classification

Classification is the process of reducing large mass of data in to homogeneous groups for meaningful analysis. It converts data from complex to understandable and unintelligible to intelligible forms. It divides data in to different groups or classes according to their similarities and dissimilarities. When the data are classified, they give summary of whole information.

Objectives of classification

1. To organize data in to concise, logical and intelligible form.
2. To take the similarities and dissimilarities s between various classes clear.
3. To facilitate comparison between various classes of data.
4. To help the researcher in understanding the significance of various classes of data.
5. To facilitate analysis and formulate generalizations.

Types of classification

A. Classification according to external characteristics

In this classification, data may be classified either on geographical basis or periodical basis.

Classification on geographical basis

In this type of classification, the data that are collected from different places are placed in different classes.

Classification on periodical basis (chronological classification)

In this type of classification, the data belonging to a particular time or period are put under one class. This type of classification is based on period.

B. Classification according to internal characteristics

Data may be classified either according to attributes or according to the magnitude of variables

Classification according to Attributes

In this type data are classified on the basis of some attributes an characteristics.

Simple Classification

If the classification is based on one particular attribute only it is called simple classification. Eg; classification on the basis of sex.

Manifold Classification

If the classification is based on more than one or several attributes it is called manifold or multiple classifications. In this data are classified in several groups.

C. Classification according variables

Here the data are classified to some characteristics that can be measured. Data are classified on the basis of quantitative characteristics such as age, height; weight etc. quantitative variables are grouped in to two:

a) Discrete variable

If the variables can take only exact value, it is called discrete variable.

b) Continuous variable

The variables that can take any numerical value within a specified range are called continuous variable.

Characteristics of an ideal classification

1. Unambiguity- Classification should be unambiguous. The various classes should be defined properly.
2. Stable- it should not change from enquiry to enquiry
3. Flexibility- classification should have the capacity of adjustment to new situations and circumstances.
4. Homogeneity- each class should contain homogenous items.
5. Suitability- it should be suitable to objects of any statistical enquiry.
6. Exhaustiveness- there should be no item which does not find a class.

4. Tabulation

Tabulation is the next step to classification. It is an orderly arrangement of data in rows and columns. It is defined as the "measurement of data in columns and rows". Data presented in tabular form is much easier to read and understand than the data presented in the text the main purpose of tabulation is to prepare the data for final analysis. It is a stage between classification of data and final analysis.

Objectives of Tabulation

1. To clarify the purpose of enquiry
2. To make the significance of data clear.
3. To express the data in least possible space.
4. To enable comparative study.
5. To eliminate unnecessary data
6. To help in further analysis of the data.

Types of Tables

 Simple Table

Here the data are presented only for one variable or characteristic. Any frequency distribution of a single variable is simple table

 Complex table

In complex table, two or more characteristics are shown. If the study is related to more than two variables, it is called multivariate analysis. They may be of the following tables.

(a) One- way table

In this type of table, data of only one characteristic will be shown. It means that when one type of information is secured about different groups or individuals, it can be displayed with the help of one- way table

(b) Two- way table

When mutually related attributes of a phenomenon are to be displayed, two way tables are used. In other words, this table shows two types of characteristics.

(c) Three-way table

It displays three types of attributes. It is used when three inter- related or mutually related attributes or characteristics of a phenomenon are to be displayed,.

(d) Manifold tables

When information about different mutually attributes or characteristics of a phenomenon are to be displayed, manifold table is used. Such tables display information about various characteristics or attributes.

Parts of a statistical table

Following are the important parts of a statistical table.

1. Title of the table

The title of the table is placed above the table. If there are more than one table in a research, each should bear a number for easy reference.

2. Caption or title of the column

It is also termed as "box head". There may be sub- captions under the main caption.

3. Stub (row heading)

Stub refers to the title given to rows

4. Body (main data)

This is the main body of information needed for the research work.

5. End note (foot note)

This is placed below the table to convey the expansions of abbreviations to caption, stub or main body.

6. Source note

If the table is based on outside information, it should be mentioned in the source note below.

LECTURE NO TWO

Tests of Sound Measurement:

Sound measurement must meet the tests of validity, reliability and practicality. In fact, these are the three major considerations one should use in evaluating a measurement tool. "Validity refers to the extent to which a test measures what we actually wish to measure. Reliability has to do with the accuracy and precision of a measurement procedure ... Practicality is concerned with a wide range of factors of economy, convenience, and interpretability ..."1 We briefly take up the relevant details concerning these tests of sound measurement.

1. Test of Validity

Validity is the most critical criterion and indicates the degree to which an instrument measures what it is supposed to measure. Validity can also be thought of as utility. In other words, validity is the extent to which differences found with a measuring instrument reflect true differences among those being tested. But the question arises: how can one determine validity without direct confirming knowledge? The answer may be that we seek other relevant evidence that confirms the answers we have found with our measuring tool. What is relevant, evidence often depends upon the nature of the research problem and the judgement of the researcher. But one can certainly consider three types of validity in this connection: (i) Content validity; (ii) Criterion-related validity and (iii) Construct validity.

(i) Content validity is the extent to which a measuring instrument provides adequate coverage of the topic under study. If the instrument contains a representative sample of the universe, the content validity is good. Its determination is primarily judgemental and intuitive. It can also be determined by using a panel of persons who shall judge how well the measuring instrument meets the standards, but there is no numerical way to express it.

(ii) Criterion-related validity relates to our ability to predict some outcome or estimate the existence of some current condition. This form of validity reflects the success of measures used for some empirical estimating purpose. The concerned criterion must possess the following qualities:

Relevance: (A criterion is relevant if it is defined in terms we judge to be the proper measure.)

Freedom from bias: (Freedom from bias is attained when the criterion gives each subject an equal opportunity to score well.)

Reliability: (A reliable criterion is stable or reproducible.)

Availability: (The information specified by the criterion must be available.)

In fact, a Criterion-related validity is a broad term that actually refers to (i) Predictive validity and (ii) Concurrent validity. The former refers to the usefulness of a test in predicting

some future performance whereas the latter refers to the usefulness of a test in closely relating to other measures of known validity. Criterion-related validity is expressed as the coefficient of correlation between test scores and some measure of future performance or between test scores and scores on another measure of known validity.

(iii) Construct validity is the most complex and abstract. A measure is said to possess construct validity to the degree that it confirms to predicted correlations with other theoretical propositions. Construct validity is the degree to which scores on a test can be accounted for by the explanatory constructs of a sound theory. For determining construct validity, we associate a set of other propositions with the results received from using our measurement instrument. If measurements on our devised scale correlate in a predicted way with these other propositions, we can conclude that there is some construct validity. If the above stated criteria and tests are met with, we may state that our measuring instrument is valid and will result in correct measurement; otherwise we shall have to look for more information and/or resort to exercise of judgement.

2. Test of Reliability

The test of reliability is another important test of sound measurement. A measuring instrument is reliable if it provides consistent results. Reliable measuring instrument does contribute to validity, but a reliable instrument need not be a valid instrument. For instance, a scale that consistently overweighs objects by five kgs., is a reliable scale, but it does not give a valid measure of weight. But the other way is not true i.e., a valid instrument is always reliable. Accordingly reliability is not as valuable as validity, but it is easier to assess reliability in comparison to validity. If the quality of reliability is satisfied by an instrument, then while using it we can be confident that the transient and situational factors are not interfering.

Two aspects of reliability viz., stability and equivalence deserve special mention. The stability aspect is concerned with securing consistent results with repeated measurements of the same person and with the same instrument. We usually determine the degree of stability by comparing the results of repeated measurements. The equivalence aspect considers how much error may get introduced by different investigators or different samples of the items being studied. A good way to test for the equivalence of measurements by two investigators is to compare their observations of the same events. Reliability can be improved in the following two ways:

(i) By standardising the conditions under which the measurement takes place i.e., we must ensure that external sources of variation such as boredom, fatigue, etc., are minimised to the extent possible. That will improve stability aspect.

(ii) By carefully designed directions for measurement with no variation from group to group, by using trained and motivated persons to conduct the research and also by broadening the sample of items used. This will improve equivalence aspect.

3. Test of Practicality

The practicality characteristic of a measuring instrument can be judged in terms of economy, convenience and interpretability. From the operational point of view, the measuring instrument ought to be practical i.e., it should be economical, convenient and interpretable. Economy consideration suggests that some trade-off is needed between the ideal research project and that which the budget can afford. The length of measuring instrument is an important area where economic pressures are quickly felt. Although more items give greater reliability as stated earlier, but in the interest of limiting the interview or observation time, we have to take only few items for our study purpose. Similarly, data-collection methods to be used are also dependent at times upon economic factors. Convenience test suggests that the measuring instrument should be easy to administer. For this purpose one should give due attention to the proper layout of the measuring instrument. For instance, a questionnaire, with

clear instructions (illustrated by examples), is certainly more effective and easier to complete than one which lacks these features. Interpretability consideration is especially important when persons other than the designers of the test are to interpret the results. The measuring instrument, in order to be interpretable, must be supplemented by (a) detailed instructions for administering the test; (b) scoring keys; (c) evidence about the reliability and (d) guides for using the test and for interpreting results.

Qualitative Vs Quantitative Data:

Qualitative Data refers to the data that provides insights and understanding about a particular problem. It can be approximated but cannot be computed. Hence, the researcher should possess complete knowledge about the type of characteristic, prior to the collection of data.

The nature of data is descriptive and so it is a bit difficult to analyze it. This type of data can be classified into categories, on the basis of physical attributes and properties of the object. The data is interpreted as spoken or written narratives rather than numbers. It is concerned with the data that is observable in terms of smell, appearance, taste, feel, texture, gender, nationality and so on. The methods of collecting qualitative data are:

Focus Group
Observation
Interviews
Archival Materials like newspapers.

Definition of Quantitative Data

Quantitative Data, as the name suggests is one which deals with quantity or numbers. It refers to the data which computes the values and counts and can be expressed in numerical terms is called quantitative data. In statistics, most of the analyses are conducted using this data.

Quantitative data may be used in computation and statistical test. It is concerned with measurements like height, weight, volume, length, size, humidity, speed, age etc. The tabular and diagrammatic presentation of data is also possible, in the form of charts, graphs, tables, etc. Further, the quantitative data can be classified as discrete or continuous data. The methods used for the collection of data are:

Surveys
Experiments
Observations and Interviews

Differences between qualitative and quantitative data are discussed below:

1. The data type, in which the classification of objects is based on attributes (quality), is called qualitative data. The type of data which can be counted and expressed in numbers and values is called quantitative data.
2. The research methodology is exploratory in qualitative data, i.e. to provide insights and understanding. On the other hand, quantitative data is conclusive in nature which aims at testing a specific hypothesis and examines the relationships.
3. The approach to inquiry in the case of qualitative data is subjective and holistic whereas quantitative data has an objective and focused approach.
4. When the data type is qualitative the analysis is non-statistical. As opposed to quantitative data which uses statistical analysis.
5. In qualitative data, there is an unstructured gathering of data. As against this, data collection is structured in quantitative data.
6. While qualitative data determines the depth of understanding, quantitative data ascertains the level of occurrence.

7. Quantitative data is all about 'How much or how many'. On the contrary, qualitative data asks 'Why?'
8. In qualitative data the sample size is small and that too is drawn from non-representative samples. Conversely, the sample size is large in quantitative data drawn from the representative sample.
9. Qualitative data develops initial understanding, i.e. it defines the problem. Unlike quantitative data, this recommends the final course of action.

LECTURE NO THREE

Bivariate and Multivariate statistical techniques:

There are several methods of applying the two techniques, but the important ones are as under: In case of bivariate population: Correlation can be studied through (a) cross tabulation; (b) Charles Spearman's coefficient of correlation; (c) Karl Pearson's coefficient of correlation; whereas cause and effect relationship can be studied through simple regression equations.

In case of multivariate population: Correlation can be studied through (a) coefficient of multiple correlation; (b) coefficient of partial correlation; whereas cause and effect relationship can be studied through multiple regression equations.

1. Bivariate Analysis

Definition:

Analyzes the relationship between two variables. It helps in understanding correlation, association, or causal relationships.

Common Bivariate Techniques:

Technique	Variables	Type of Data	Purpose
Correlation (Pearson/Spearman)	2 continuous	Interval/Ratio	Measures strength & direction of association
T-test	1 categorical (2 groups), 1 continuous	Nominal & Interval	Compares means between two groups
Chi-square test	2 categorical	Nominal	Tests independence between variables
Simple Linear Regression	1 independent, 1 dependent	Continuous	Predicts dependent variable from independent

Example:

- Correlation between advertising budget and sales revenue.
- T-test to compare employee satisfaction between male and female employees.

2. Multivariate Analysis

Definition:

Involves three or more variables simultaneously. It helps identify patterns, clusters, or predictive models.

Common Multivariate Techniques:

Technique	Use Case	Variables	Purpose
Multiple Regression	Prediction	1 DV, multiple IVs (continuous)	Predicts outcome from multiple predictors
Logistic	Classification	1 categorical DV, multiple	Predicts binary outcomes

Technique	Use Case	Variables	Purpose
Regression		IVs	
Factor Analysis	Data reduction	Multiple continuous	Identifies underlying constructs
Cluster Analysis	Segmentation	Multiple continuous/categorical	Groups similar cases/objects
Discriminant Analysis	Classification	1 categorical DV, continuous IVs	Predicts group membership
MANOVA	Group comparison	Multiple DVs	Tests mean differences across groups on several DVs

Example:

- Multiple Regression: Predicting sales based on price, promotion, and distribution.
- Factor Analysis: Reducing 20 questionnaire items into 4 latent constructs like service quality, responsiveness, etc.
- Cluster Analysis: Segmenting consumers into behavior-based groups.

Differences: Bivariate vs. Multivariate

Feature	Bivariate	Multivariate
No. of Variables	2	3 or more
Complexity	Simple	Complex
Objective	Relationship between two variables	Understand patterns among many variables
Example	Correlation between income & education	Segmenting market based on multiple traits

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✓Application in Business Research

- Market segmentation (Cluster)
- Consumer behavior modeling (Factor/Regression)
- HR analytics (MANOVA, T-test)
- Risk analysis (Logistic Regression)

LECTURE NO FOUR

Factor analysis:

Basic concepts in factor analysis

The following are the key concepts on which factor analysis is based.

Factor:

A factor plays a fundamental role among a set of attributes or variables. These variables can be filtered down to the factor. A factor represents the combined effect of a set of attributes. Either there may be one such factor or several such factors in a real life problem based on the complexity of the situation and the number of variables operating.

Factor loading:

A factor loading is a value that explains how closely the variables are related to the factor. It is the correlation between the factor and the variable. While interpreting a factor, the absolute value of the factor is taken into account.

Communality:

It is a measure of how much each variable is accounted for by the underlying factors together. It is the sum of the squares of the loadings of the variable on the common factors. If A,B,C,… are the factors, then the communality of a variable is computed using the relation

h2 = (The factor loading of the variable with respect to factor A) 2 +
(The factor loading of the variable with respect to factor B) 2 +
(The factor loading of the variable with respect to factor C) 2 + …..

Eigen value:

The sum of the squared values of factor loadings pertaining to a factor is called an eigen value. It is a measure of the relative importance of each factor under consideration.

Total Sum of Squares (TSS)

It is the sum of the Eigen values of all the factors.

Application of Factor Analysis:

1. Model Building for New Product Development:

As pointed out earlier, a real life situation is highly complex and it consists of several variables. A model for the real life situation can be built by incorporating as many features of the situation as possible. But then, with a multitude of features, it is very difficult to build such a highly idealistic model. A practical way is to identify the important variables and incorporate them in the model. Factor analysis seeks to identify those variables which are highly correlated among themselves and find a common factor which can be taken as a representative of those variables. Based on the factor loading, some of variables can be merged together to give a common factor and then a model can be built by incorporating such factors. Identification of the most common features of a product preferred by the consumers will be helpful in the development of new products.

2. Model Building for Consumers:

Another application of factor analysis is to carry out a similar exercise for the respondents instead of the variables themselves. Using the factor loading, the respondents in a research survey can be sorted out into various groups in such a way that the respondents in a group have more or less homogeneous opinions on the topics of the survey. Thus a model can be constructed on the groups of consumers. The results emanating from such an exercise will guide the management in evolving appropriate strategies towards market segmentation.

Merits: The main merits of factor analysis can be stated thus:

(i) The technique of factor analysis is quite useful when we want to condense and simplify the multivariate data.

(ii) The technique is helpful in pointing out important and interesting, relationships among observed data that were there all the time, but not easy to see from the data alone.

(iii) The technique can reveal the latent factors (i.e., underlying factors not directly observed) that determine relationships among several variables concerning a research study. For example, if people are asked to rate different cold drinks (say, Limca, Nova-cola, Gold Spot and so on) according to preference, a factor analysis may reveal some salient characteristics of cold drinks that underlie the relative preferences.

(iv) The technique may be used in the context of empirical clustering of products, media or people i.e., for providing a classification scheme when data scored on various rating scales have to be grouped together.

Limitations: One should also be aware of several limitations of factor analysis. Important ones are as follows:

(i) Factor analysis, like all multivariate techniques, involves laborious computations involving heavy cost burden. With computer facility available these days, there is no doubt that factor analysis has become relatively faster and easier, but the cost factor continues to be the same i.e., large factor analyses are still bound to be quite expensive.

(ii) The results of a single factor analysis are considered generally less reliable and dependable for very often a factor analysis starts with a set of imperfect data. "The factors are nothing but blurred averages, difficult to be identified."4 To overcome this difficulty, it has been realised that analysis should at least be done twice. If we get more or less similar results from all rounds of analyses, our confidence concerning such results increases.

(iii) Factor-analysis is a complicated decision tool that can be used only when one has thorough knowledge and enough experience of handling this tool. Even then, at times it may not work well and may even disappoint the user.

LECTURE NO FIVE

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.

Steps: In general, cluster 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 judgemental and are devoid of statistical inferences. For problems concerning large number of variables, various cut-and try methods have been proposed for locating clusters. McQuitty has specially developed a number of rather elaborate computational routines* for that purpose. In spite of the above stated limitation, cluster analysis has been found useful in context of market research studies. Through the use of this technique we can make segments of market of a product on the basis of several characteristics of the customers such as personality, socio-economic considerations, psychological factors, purchasing habits and like ones.

Cluster analysis is a technique used to group a set of objects in such a way that objects in the same group (called a *cluster*) are more similar to each other than to those in other groups.

Types of Clustering Methods:

1. Partitioning Methods:
    - Example: K-Means, K-Medoids
    - Split data into *k* non-overlapping subsets (clusters).
    - Assumes the number of clusters is known.
2. Hierarchical Clustering:
    - Agglomerative (bottom-up) or Divisive (top-down).
    - Produces a tree-like diagram (*dendrogram*).
    - No need to pre-specify number of clusters.
3. Density-Based Methods:
    - Example: DBSCAN, OPTICS
    - Forms clusters based on areas of high density.
    - Good for discovering clusters of arbitrary shape and noise.
4. Model-Based Clustering:
    - Example: Gaussian Mixture Models (GMM)
    - Assumes data is generated from a mixture of underlying probability distributions.
5. Grid-Based Methods:
    - Example: STING, CLIQUE
    - Divide space into grid cells and form clusters based on density.

Key Concepts:

- Distance Measures:
    - Euclidean, Manhattan, Cosine similarity, Jaccard index, etc.
- Centroid:
    - The center point of a cluster (used in K-means).
- Inertia (Within-Cluster Sum of Squares):
    - A measure of cluster compactness. Lower is better.
- Silhouette Score:
    - Ranges from -1 to 1. Higher values indicate better clustering.

Choosing the Number of Clusters:

- Elbow Method: Plot WCSS vs number of clusters and look for the "elbow".
- Silhouette Analysis: Measures how similar an object is to its own cluster vs others.
- Gap Statistic: Compares performance with a null reference distribution.

Strengths of Cluster Analysis:

- Works without labeled data.
- Can reveal hidden structures.
- Useful in many domains (e.g., market segmentation, bioinformatics, image processing).

Limitations:

- Sensitive to the choice of features and scaling.
- Some methods require pre-specifying number of clusters.
- Not all methods handle noise/outliers well.
- Cluster shapes and sizes can vary, which some algorithms can't handle well.

Applications:

- Customer segmentation
- Anomaly detection
- Document or image classification
- Genomic data analysis
- Social network analysis

LECTURE NO SIX

Multidimensional Scaling:

Multidimensional scaling (MDS) allows a researcher to measure an item in more than one dimension at a time. The basic assumption is that people 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.

There are several MDS techniques (also known as techniques for dimensional reduction) often used for the purpose of revealing patterns of one sort or another in interdependent data structures. If data happen to be non-metric, MDS involves rank ordering each pair of objects in terms of similarity. Then the judged similarities are transformed into distances through statistical manipulations and are consequently shown in n-dimensional space in a way that the interpoint distances best preserve the original interpoint proximities. After this sort of mapping is performed, the dimensions are usually interpreted and labeled by the researcher.

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.... MDS provides a mechanism for determining the truly salient attributes without forcing the judge to appear irrational."6 With MDS, one can scale objects, individuals or both with a minimum of information. The MDS analysis will reveal the most salient attributes which happen to be the primary determinants for making a specific decision.

LECTURE NO SEVEN

Multivariate analysis (MVA) is a statistical approach used to examine the relationships among three or more variables simultaneously. It's used when data has multiple dependent and/or independent variables.

Objectives:

- Understand patterns and relationships among variables.
- Reduce data dimensionality.
- Make predictions or classifications.
- Control for confounding variables.

Types of Multivariate Analysis:

1. Multiple Regression Analysis
   - Predict one continuous dependent variable using multiple independent variables.
   - Equation:
     $Y=\beta0+\beta1X1+\beta2X2+\cdots+\betanXn+\epsilonY = \beta_0 + \beta_1X_1 + \beta_2X_2 + \dots + \beta_nX_n + \epsilonY=\beta0+\beta1X1+\beta2X2+\cdots+\betanXn+\epsilon$
2. Multivariate Analysis of Variance (MANOVA)
   - Extension of ANOVA when there are multiple dependent variables.
   - Tests whether the vector of means differs across groups.
3. Principal Component Analysis (PCA)
   - Used for dimensionality reduction.
   - Transforms correlated variables into a smaller number of uncorrelated components (principal components).
4. Factor Analysis
   - Identifies latent variables (factors) that explain correlations among observed variables.
5. Canonical Correlation Analysis (CCA)
   - Explores the relationships between two sets of variables.
6. Discriminant Analysis
   - Classifies observations into groups using multiple predictors.
     - Linear Discriminant Analysis (LDA)
     - Quadratic Discriminant Analysis (QDA)

7. Cluster Analysis *(linked but unsupervised)*
   - Groups observations based on similarity across multiple variables.
8. Correspondence Analysis
   - Used for analyzing categorical data in a contingency table.

Assumptions in Multivariate Techniques:
- Linearity
- Multivariate normality
- Homogeneity of variance-covariance matrices
- Independence of observations
- No or minimal multicollinearity

Applications:
- Social sciences (e.g., psychological testing)
- Finance (e.g., risk modeling)
- Marketing (e.g., consumer segmentation)
- Biological sciences (e.g., gene expression analysis)

Tools & Software:
- R: stats, psych, factoextra, MASS
- Python: scikit-learn, statsmodels, pingouin
- SPSS, SAS, MATLAB, Stata

LECTURE NO EIGHT

Multidimensional Scaling (MDS) is a set of data analysis techniques that display the structure of distance-like data as a geometrical picture. It helps visualize similarities or dissimilarities between pairs of objects.

Objectives of MDS:
- Represent objects as points in a low-dimensional space.
- Preserve the distances or dissimilarities as faithfully as possible.
- Enable visualization of complex, high-dimensional data.

Types of MDS:
1. Metric MDS:
   - Assumes that dissimilarities are on an interval or ratio scale.
   - Attempts to preserve the actual distance magnitudes.
2. Non-metric MDS:
   - Only assumes the rank order of dissimilarities matters.
   - Uses monotonic transformation to match distances to ranks.
3. Classical MDS (Torgerson Scaling):
   - Based on eigenvalue decomposition of a similarity matrix.
   - Equivalent to Principal Coordinates Analysis (PCoA).

Key Concepts:
- Dissimilarity Matrix:
  - An n×nn \times nn×n matrix where each element represents the distance or dissimilarity between object pairs.
- Distance Measures:
  - Euclidean, Manhattan, correlation distance, etc.
- Stress Function:
  - A measure of how well the MDS solution matches the original dissimilarities.
  - Lower stress = better fit.

  Common stress formula (Kruskal's Stress):

  Stress=∑i<j(dij−d^ij)2∑i<jdij2\text{Stress} = \sqrt{ \frac{\sum_{i<j} (d_{ij} - \hat{d}_{ij})^2}{\sum_{i<j} d_{ij}^2 }Stress=∑i<jdij2∑i<j(dij−d^ij)2

- Dimensionality:
  - MDS reduces data to 2D or 3D for easier interpretation.

Steps in Performing MDS:

1. Start with a dissimilarity matrix (input).
2. Choose number of dimensions kkk (typically 2 or 3).
3. Compute a configuration of points in kkk-dimensional space.
4. Evaluate the stress or goodness-of-fit.
5. Interpret the spatial map (clusters, distances).

Applications:

- Psychology: Mapping perceptions or preferences.
- Marketing: Brand positioning, product perception.
- Sociology: Analyzing social distances.
- Bioinformatics: Genetic or expression data relationships.

Advantages of MDS:

- No need for metric data (non-metric MDS).
- Can handle various types of distance data.
- Produces interpretable visual representations.

Limitations:

- Sensitive to input dissimilarities.
- Interpretation of axes is not automatic.
- Computationally intensive for large datasets.
- Requires subjective decisions (e.g., number of dimensions).

Software Tools:

- R: cmdscale(), isoMDS() (from MASS), smacof
- Python: sklearn.manifold.MDS, scikit-learn
- SPSS, MATLAB, JMP, SAS

LECTURE NO NINE

Application of Statistical Software for Data Analysis

Statistical software plays a critical role in analyzing quantitative and qualitative data in academic, industrial, and business research. These tools enhance accuracy, efficiency, and interpretability of data, aiding in evidence-based decision-making.

Key Applications:

1. Data Management
   - Software: SPSS, R, Python (Pandas), Stata
   - Function: Organize, clean, code, and manage large datasets efficiently.
   - Example: Removing missing values, merging datasets, creating new variables.
2. Descriptive Statistics
   - Software: Excel, SPSS, SAS
   - Function: Summarize data using mean, median, mode, standard deviation, frequency distributions.
   - Example: Analyzing customer age and income distribution in a marketing survey.
3. Inferential Statistics
   - Software: R, SPSS, STATA, Python (SciPy/StatsModels)
   - Function: Hypothesis testing (t-tests, chi-square, ANOVA), confidence intervals, regression analysis.
   - Example: Testing the effect of training programs on employee productivity.
4. Regression and Predictive Modeling
   - Software: R, Python (scikit-learn), SAS, Minitab
   - Function: Linear/logistic regression, time-series forecasting, machine learning.

- Example: Predicting sales based on advertising expenditure and market trends.

5. Visualization
   - Software: Tableau, R (ggplot2), Python (Matplotlib/Seaborn), Excel
   - Function: Create graphs, dashboards, and interactive plots.
   - Example: Visualizing stock market trends or demographic data for policy analysis.
6. Multivariate Analysis
   - Software: SPSS, R, SAS
   - Function: Factor analysis, cluster analysis, discriminant analysis.
   - Example: Segmenting customers based on buying behavior.
7. Qualitative Data Analysis
   - Software: NVivo, MAXQDA, Atlas.ti
   - Function: Coding and thematic analysis of interview transcripts or open-ended survey responses.
   - Example: Analyzing customer feedback to improve product quality.

Benefits of Using Statistical Software

- Accuracy: Reduces human errors in calculations.
- Speed: Handles large datasets and complex calculations quickly.
- Reproducibility: Scripts and codes can be saved and reused.
- Visualization: Enhances interpretation through dynamic charts.

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JEPPIAAR
ENGINEERING COLLEGE

DEPARTMENT OF MANAGEMENT STUDIES

I YEAR / II SEMESTER

MB25CO8: BUSINESS RESEARCH METHODS

UNIT 1 – NOTES

Faculty In charge

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Regulation 2021

UNIT I

UNIT I INTRODUCTION **10**

Business Research – Definition and Significance – the research process – Types of Research – Exploratory and causal Research – Theoretical and empirical Research – Cross – Sectional and time – series Research – Research questions / Problems – Research objectives – Research hypotheses – characteristics – Research in an evolutionary perspective – the role of theory in research.

CO-PO AND BLOOMS TAXONOMY

Lecture No	Concept	CO	PO	PSO	Blooms Taxonomy
1	Business Research – Definition and Significance	CO1	1,2,3,4,5	1,2	K1, K2
2	The research process	CO1	1,2,3,4,5	1,2	K2,K3
3	Types of Research Exploratory and causal Research	CO1	1,2,3,4,5	1,2	K2, K3
4	Theoretical and empirical Research	CO1	1,2,3,4,5	1,2	K2, K3
5	Types of Research – Cross –Sectional and time – series Research	CO1	1,2,3,4,5	1,2	K2, K3
6	Research questions / Problems	CO1	1,2,3,4,5	1,2	K3.K4,K5,K6
7	Research objectives	CO1	1,2,3,4,5	1,2	K3.K4,K5,K6
8	Research hypotheses – characteristics	CO1	1,2,3,4,5	1,2	K3.K4,K5,K6
9	Research in an evolutionary perspective	CO1	1,2,3,4,5	1,2	K2
10	The role of theory in research	CO1	1,2,3,4,5	1,2	K2

LECTURE NO ONE

Business Research – Definition:

The Advanced Learner's Dictionary of Current English lays down the meaning of research as "a careful investigation or inquiry especially through search for new facts in any branch of knowledge." Redman and Mory define research as a "systematized effort to gain new knowledge."

Features of Research:

- It means the discovery of new knowledge
- Is essentially an investigation
- Is related with the solution of a problem
- It is based on observation or experimental evidences.
- It demands accurate observation or experimentation.
- In research, the researchers try to find out answers for unsolved questions
- It should be carefully recorded and reported

Purpose / Aims / Objectives of Research

1. To find out the truth which is hidden and which has not been discovered so far.
2. Aims at advancing systematic knowledge and formulating basic theories about the forces influencing the relation between groups as well as those acting on personality development and is adjustment with individuals.
3. Try to improve tools of analysis or to test these against the complex human behaviour and institutions.
4. To understand social life and thereby to gain a greater measure of control over social behaviour.
5. To provide an educational program in the accumulated knowledge of group dynamics, in skills of research, in techniques of training leaders and in social action.

Criteria of Good Research:

Whatever may be the types of research works and studies, one thing that is important is that they all meet on the common ground of scientific method employed by them. One expects scientific research to satisfy the following criteria:

1. The purpose of the research should be clearly defined and common concepts be used.
2. 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.
3. The procedural design of the research should be carefully planned to yield results that are as objective as possible.
4. The researcher should report with complete frankness, flaws in procedural design and estimate their effects upon the findings.
5. 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.
6. 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.

7. Greater confidence in research is warranted if the researcher is experienced, has a good reputation in research and is a person of integrity.

Qualities of a good research

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.

Motivation in research:

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

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

However, this is not an exhaustive list of factors motivating people to undertake research studies. Many more factors such as directives of government, employment conditions, curiosity about new things, desire to understand causal relationships, social thinking and awakening, and the like may as well motivate (or at times compel) people to perform research operations.

Limitations of Research

- It is based on sample & sampling research lacks the complete accuracy.
- Long time is required in the research procedures.
- Difficult to evaluate the economic benefits derived from the research.
- Trained personnel and a lot of time are required for research.
- Lack of adequate knowledge of research.
- Conclusions in research are based upon data collected. Therefore when the data collected are not valid or adequate, the conclusion will not be conclusive or appropriate.
- Research results in theory

- Activities in a society are influenced by various internal and external factors Small organizations cannot afford to have research on various issues. Many people in society depend on customs, traditions, routines and practices for taking decision; instead of going for research.
- Research is usually based on sample studies. But in many cases samples are not true representatives. Therefore the research reports based on these samples may not be accurate.

Significance of research:

(a) To those students who are to write a master's or Ph.D. thesis, research may mean careerism or a way to attain a high position in the social structure;

(b) To professionals in research methodology, research may mean a source of livelihood;

(c) To philosophers and thinkers, research may mean the outlet for new ideas and insights;

(d) To literary men and women, research may mean the development of new styles and creative work;

(e) To analysts and intellectuals, research may mean the generalisations of new theories.

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

PROBLEMS ENCOUNTERED BY RESEARCHER IN INDIA:

- The lack of a scientific training in the methodology of research
- Insufficient interaction between the university research departments on the side and business establishments, governments department, and research institution on the other side.
- The business unit do not have confidence that the information supplied by them to researchers will be misused and so such they are often reluctant in supplying the needed information to researchers.
- Research studies overlapping one another are undertaken quite often for want of adequate information.
- There does not exist a code of conduct for researcher
- The difficult of adequate and timely secretarial assistance.
- Library management and functioning is not satisfactory at many place.
- There is also the problem that many of our libraries are not able to get copies of old and new Acts/ rules, reports and other government publications in time.
- There is also the difficulty of timely availability of published data.
- There may at times take place the problem of conceptualization.

HALLMARKS OF SCIENTIFIC RESEARCH

Purposiveness

- Research must be started with a definite, clear aim, objective and purpose.
- Research findings must be beneficial for organization.
- For example an increase in employee commitment will be beneficial for

Organization.It will translate into less turnover, less absenteeism, and increased performance levels

Rigor

- Rigor connotes carefulness during research.
- It also refers to degree of exactitude in research investigations.
- Chosen sample should be true representative of whole organization.
- Method adopted for collecting data should be appropriate.
- Research process should be free from personal and emotional biases.

Testability

- Testability refers that hypothesis must be testable.
- Hypotheses are tentative yet testable statements.
- They are derived from theory or theory based.
- It must be able to testify by applying certain statistical tests experimentally.

Replicability

- Results should be supported again and again when the same type of research is repeated in other similar circumstances.
- Replicability will gain confidence in the scientific nature of our research.
- Replicability brings exactitude and accuracy in research findings.

Precision and Confidence

- Precision refers to the closeness of the findings to reality.
- Precision reflects the degree of accuracy of the results .
- We ensures that our findings are close to reality.
- So that we can place reliance or confidence in the results.
- In social sciences confidence level is 95%.

Objectivity

- The conclusions drawn from information should be objective.
- The findings should be based on the facts .
- The more objective the interpretation of the data, the more scientific the research investigation becomes.

Generalizability

- Generalizability refers to the scope of applicability of the research findings in one organizational setting to other settings.
- The wider the range of applicability of the solutions generated by research, the more useful the research is to the users.

Parsimony

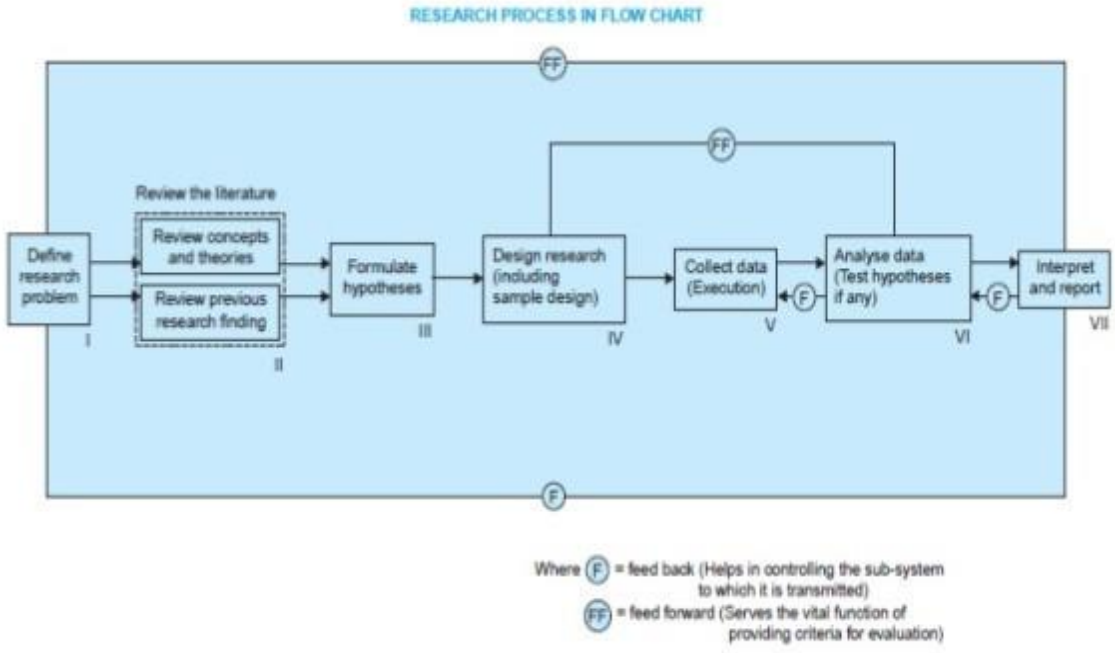
- Parsimony refers to simplicity in explaining the phenomena or problems that occur.
- It is Level of understanding in generating solutions for the problems.
- Economy in research models is achieved when we can build a lesser number of variables.
- Those variables would explain the variance far more efficiently than a complex set of variables.

LECTURE NO TWO

RESEARCH PROCESS:

Research process consists of a series of steps or actions required for effectively conducting research. The following are the steps that provide useful procedural guidelines regarding the conduct of research:

Research Process Flow Chart



1. Identifying, Evaluating and Formulating the Research Problems-:

After creating interest in a research work, a researcher has to think about formulating the problem related to his research work. Choosing a correct problem for study is the most important step in the entire research process. After selecting the problem, the researcher has to formulate the problem.

2. Extensive Literature Survey:-

Before formulating the research it is desirable that researcher examines all available literature, both conceptual and empirical. The conceptual literature is one which deals with concepts and theories. Empirical literature is that which contains studies made earlier and so it consists of many facts and figures observed in the earlier studies.

3. Writing a Primary Synopsis:-

After formulating the problems a brief summary of it should be written down. A research worker has to write a synopsis of the topic selected for research work mentioning the summary of what is going to be done under his research.

4. Indentifying and Labeling Variables: -

In any research the problem under study deals with relation between variables. The variables whose change has affected the other variable, is called independent variable. Therefore there is a cause and effect relation between the variables. The research problem must be formulated in such a manner that it highlights the nature, extent and implications of

relation existing between the variables. It is only through this process of establishing the effective relation between variables that meaningful conclusions are derived from the study.

5. Setting Up Of Hypothesis:

Specification of working hypothesis is a basic step in the research process. A hypothesis is a tentative conclusion logically drawn. The research work is conducted to test the truth of this hypothesis.

6. Preparing the Research Design:-

A research design is a plan that specifies the sources and types of information relevant to the research problem. It is a strategy which approach will be used for gathering and analyzing the data. It includes the time and cost budgets since most studies are done under these two constraints. A research design provides a rational approach to research enabling one to decide in advance what to do, how to do, in investigating the subjects.

7. Determining the Sample Design:-

A sample design is a definite plan determined before any data are actually collected for obtaining a sample from a given universe. Sample design refers to the technique or the procedure which the researcher would adopt in selecting some sampling units from the universe for drawing inferences about the universe. If the proper procedure is followed to select the sample, definitely the sample will give all dependable information.

8. Collecting of Data: -

There are several ways of collecting the appropriate data. Some of the methods of collecting primary data are (1) Observation method. (2) Direct personal interview method. (3) Telephone interview method. (4) Questionnaire method. (5) Schedule method. A choice of one of these methods.

9. Execution of the Project: -

The researcher has to see that the project is executed in a systematic manner and in time. He should make necessary preparations for successful conduct of the project.

10. Processing, Analysis and Interpretation of Data by Statistical Methods: -

The processing of data consists of classification, tabulation and coding. By classification and tabulation the unwieldy data can be condense into few manageable and purposeful groups and tables so that further analysis becomes simple. Coding converts the data into symbols and small figures so that the data can be dealt with in an easy manner. Editing improves the quality of the data since it is at this stage that data which is irrelevant can be dropped. Analysis and interpretation of data results in observation, analysis, conclusion, induction and deduction. For this various statistical measures are computed.

11. Testing of Hypothesis: -

Depending upon the nature of data and conclusions to be arrived one or two of these tests can be applied. Testing of hypothesis will results in either accepting or rejecting the hypothesis. Testing of hypothesis may prove or disprove a theory and a theory facilitates formulating of a further hypothesis. Testing of hypothesis will result in contribution to existing theory or the generation of a new theory.

12. Preparation of the Report or Thesis:-

A report is a detailed description of what has been done and how it has been done with respect to a particular area or topic. The report should contain the preliminary section, the main body and the end matter. The preliminary section contains only titles, data, acknowledgement foreword and table of contents. The important section of a report is its main body. It carries introduction, methodology, and statements of findings, conclusions and recommendations. The end matter includes appendix, literature selected and bibliography. The appendix includes letters, questions or other tools used. Bibliography is the list of books, journals. Reports, bulletins etc. used for reference.

LECTURE NO THREE

TYPES OF RESEARCH:

There are different types of research. The basic ones are as follows.

- **Applied research** : is also known as decisional research, use existing knowledge as an aid to the solution of some given problem or set of problems. An attempt to find a solution to an immediate problem encountered by a firm, an industry, a business organisation, or the society is known as applied research. Researchers engaged in such researches aim at drawing certain conclusions confronting a concrete social or business problem.
- **Fundamental research**, frequently called basic or pure research, seeks to extend the boundaries of knowledge in a given area with no necessary immediate application to existing problems. Researches relating to pure mathematics or concerning some natural phenomenon are examples
- **Futuristic research**: Futures research is the systematic study of possible future conditions. It includes analysis of how those conditions might change as a result of the implementation of policies and actions, and the consequences of these policies and actions.
- **Descriptive research** includes surveys and fact-finding enquiries of different kinds. It tries to discover answers to the questions who, what, when and sometimes how. Here the researcher attempts to describe or define a subject, often by creating a profile of a group of problems,people, or events. The major purpose of descriptive research is description of the state of affairs as it exists at present The term 'ex post facto research' is quite often used for descriptive research studies in social sciences and business research.
- **Explanatory research**: Explanatory research goes beyond description and attempts to explain the reasons for the phenomenon that the descriptive research only observed. The research would use theories or at least hypothesis to account for the forces that caused a certain phenomenon to occur.
- **Predictive research**: If we can provide a plausible explanation for an event after it has occurred, it is desirable to be able to predict when and in what situations the event will occur. This research is just as rooted in theory as explanation. This research calls for a high order of inference making. In business research, prediction is found in studies conducted to evaluate specific courses of action or to forecast current and future values.
- **Analytical research**: The researcher has to use facts or information already available, and analyse these to make a critical evaluation of the material.
- **Quantitative research**: Quantitative research is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity

LECTURE NO FOUR & FIVE

- **Cross-Sectional Design**
  A cross-sectional design is used for research that collects data on relevant variables one time only from a variety of people, subjects, or phenomena.A cross-sectional designs provides a snapshot of the variables included in the study, at one particular point in time.
- **Longitudinal:** A longitudinal design collects data over long periods of time. Measurements are taken on each variable over two or more distinct time periods. This allows the researcher to measure change in variables over time.
- **Fundamental:** Mainly concerns generalizations and formulation of a theory. In other words, "Gathering knowledge for knowledge's sake is termed 'pure' or 'basic' research" (Young in Kothari, 1988). Researches relating to pure mathematics or concerning some natural phenomenon are instances of Fundamental Research. Likewise, studies focusing on human behaviour also fall under the category of fundamental research.
- **Quantitative:** Quantitative research relates to aspects that can be quantified or can be expressed in terms of quantity. It involves the measurement of quantity or amount. Various available statistical and econometric methods are adopted for analysis in such research. Which includes correlation, regressions and time series analysis etc,.
- **Qualitative:** Qualitative research is concerned with qualitative phenomena, or more specifically, the aspects related to or involving quality or kind. For example, an important type of qualitative research is 'Motivation Research', which investigates into the reasons for certain human behaviour. The main aim of this type of research is discovering the underlying motives and desires of human beings by using in-depth interviews. The other techniques employed in such research are story completion tests, sentence completion tests, word association tests, and other similar projective methods. Qualitative research is particularly significant in the context of behavioural sciences, which aim at discovering the underlying motives of human behaviour.
- **Conceptual :**The research related to some abstract idea or theory is known as Conceptual Research. Generally, philosophers and thinkers use it for developing new concepts or for reinterpreting the existing ones.
- **Empirical:** Empirical Research, relies on the observation or experience with hardly any regard for theory and system. Such research is data based, which often comes up with conclusions that can be verified through experiments or observation. Empirical research is also known as experimental type of research, in which it is important to first collect the facts and their sources, and actively take steps to stimulate the production of desired information.
- **Time Series**

A Time Series research collects data on the same variable at regular intervals in the form of aggregate measures of a population. Time series designs are useful for:

  - establishing a baseline measure
  - describing changes over time
  - keeping track of trends
  - forecasting future (short term) trends

- **Historical research** is research involving analysis of events that occurred in the remote or recent past. Historical research can show patterns that occurred in the past and over time which can help us to see where we came from and what kinds of solutions we have used in the past. Understanding this can add perspective on how we examine current events and educational practices.

LECTURE NO FIVE

RESEARCH PROBLEMS

Refers to some difficulty which a researcher experiences in the context either a theoretical or practical situation and wants to obtain solution for the same

Characteristics of a Good Research Problem:

- **Clarity:** The problem should be clearly and concisely stated, leaving no room for ambiguity.
- **Significance:** The problem should address an important issue or contribute to the existing body of knowledge.
- **Feasibility:** The problem should be researchable within the available resources and time constraints.
- **Specificity:** The problem should be focused and well-defined, avoiding vague or overly broad statements.
- **Relevance:** The problem should be relevant to the researcher's field of study and have potential implications for practice or policy.

Types of Research Problems:

- **Theoretical:** These problems focus on advancing our understanding of fundamental concepts and theories.
- **Applied:** These problems seek to solve practical problems or address real-world challenges.
- **Descriptive:** These problems aim to describe a phenomenon or explore its characteristics.
- **Relational:** These problems investigate the relationships between different variables or phenomena.

Identifying Research Problems:

- **Literature Review:** Examining existing research can reveal gaps in knowledge or areas where further investigation is needed.
- **Observations:** Observing real-world situations or phenomena can spark ideas for research problems.
- **Discussions:** Talking to experts, colleagues, or community members can help identify relevant research problems.
- **Personal Experiences:** Reflecting on personal experiences or challenges can lead to the identification of research problems.

Formulating Research Problems:

- **Start with a broad area of interest:** Identify a general topic that you are passionate about or that is relevant to your field.
- **Narrow down the focus:** Refine your area of interest into a more specific and manageable research problem.
- **State the problem clearly:** Express the research problem in a concise and unambiguous statement.
- **Consider the scope:** Determine the boundaries of your research problem and what aspects you will focus on.

Evaluating Research Problems:

- **Is the problem clear and well-defined?**
- **Is the problem significant and relevant?**
- **Is the problem feasible to research?**
- **Is the problem original and novel?**
- **Does the problem align with your interests and expertise?**

By carefully considering these factors, researchers can identify and formulate research problems that are both meaningful and researchable, ultimately contributing to the advancement of knowledge and the solution of real-world problems.

Components of a Research Problem

- There must be an individual or a group which has some difficulty or the problem
- There must be some objectives to be attained at.
- There must be alternative means for obtaining the objectives one wishes to attain
- There must remain some doubt in the mind of a researcher with regard to the selection of alternatives
- There must be some environment to which the difficulty pertains

Steps in Research Problem

- Statement of the problem in a general way
- Understanding the nature of the problem
- Surveying the available literature
- Formulating the ideas through discussions
- Finalizing the research problem

LECTURE NO SEVEN

Research Question

Research questions are the driving force behind any research project. They are the specific questions that a researcher seeks to answer through their study. A well-crafted research question is essential for guiding the research process and ensuring that the study yields meaningful results.

Key Characteristics of a Good Research Question:

- **Clarity:** The question should be clearly and concisely stated, leaving no room for ambiguity.
- **Focus:** The question should be specific and well-defined, avoiding vague or overly broad statements.
- **Complexity:** The question should be complex enough to require investigation and analysis, rather than a simple yes or no answer.
- **Relevance:** The question should be relevant to the research topic and have potential implications for the field of study.
- **Feasibility:** The question should be researchable within the available resources and time constraints.

Types of Research Questions:

- **Descriptive:** These questions aim to describe a phenomenon or explore its characteristics.
- **Comparative:** These questions compare two or more groups or phenomena.
- **Correlational:** These questions investigate the relationships between different variables.
- **Causal:** These questions seek to determine cause-and-effect relationships.

Formulating Research Questions:

- **Start with a broad topic:** Identify a general area of interest or a research problem that you want to address.
- **Narrow down the focus:** Refine your topic into a more specific and manageable research question.
- **Consider the type of research:** Determine whether you will be conducting qualitative or quantitative research, as this will influence the type of research question you formulate.
- **Use question words:** Start your research question with words like "what," "how," "why," "when," or "where."
- **Be specific:** Clearly define the variables or phenomena you are interested in studying.
- **Consider the scope:** Ensure that your research question is feasible to answer within the available resources and time constraints.

Examples of Research Questions:

- **Descriptive:** What are the key characteristics of social media use among adolescents?
- **Comparative:** How does online learning compare to traditional classroom learning in terms of student outcomes?
- **Correlational:** Is there a relationship between social media use and mental health among young adults?
- **Causal:** Does exposure to violent video games increase aggression in children?

Evaluating Research Questions:

- **Is the question clear and focused?**
- **Is the question complex and researchable?**
- **Is the question relevant and significant?**
- **Is the question feasible to answer?**
- **Does the question align with the research topic and objectives?**

By carefully crafting well-defined research questions, researchers can ensure that their studies are focused, meaningful, and contribute to the advancement of knowledge in their respective fields.

LECTURE NO EIGHT

HYPOTHESIS:

"Hypothesis may be defined as a proposition or a set of propositions set forth as an explanation for the occurrence of some specified group of phenomena either asserted merely as a provisional conjecture to guide some investigation in the light of established facts" (Kothari, 1988). A research hypothesis is quite often a predictive statement, which is capable of being tested using scientific methods that involve an independent and some dependent variables. For instance, the following statements may be considered:

i. "Students who take tuitions perform better than the others who do not receive tuitions" or,

ii. "The female students perform as well as the male students".

These two statements are hypotheses that can be objectively verified and tested. Thus, they indicate that a hypothesis states what one is looking for. Besides, it is a proposition that can be put to test in order to examine its validity.

Role of Hypothesis:

- It guides the direction of the study
- It identifies facts that are relevant and those that are not
- It suggests which form of research design is likely to be most appropriate
- It provides a frame work for organising the conclusions that result

Different Types of Hypothesis:

- **Null Hypothesis** – it points out there is no difference between two populations in respect of same property.
- **Alternative Hypothesis-** when we reject the null hypothesis, we accept another hypothesis known as alternate hypothesis.
- **Descriptive Hypothesis** – Describing the characteristics of a variable (may be an object, person, organisation, event, and situation) • Eg. Employment opportunity of commerce graduates is more than the arts students.
- **Relational Hypothesis** – Establishes relationship between two variables. It may be positive, negative or nil relationship. Eg. High income leads to high savings
- **Causal Hypothesis** – The change in one variable leads to change in another variable i.e. Dependent and independent variables, one variable is a cause and the other one is the effect
- **Non-Directional Hypothesis**If the hypothesis simply predicts that there will be a difference between the two groups, then it is a. It is non-directional because it predicts that there will be a difference but does not specify how the groups will differ.
- **Directional Hypothesis** If, however, the hypothesis uses so-called comparison terms, such as "greater,""less,""better," or "worse," then it is a directional hypothesis. It is directional because it predicts that there will be a difference between the two groups and it specifies how the two groups will differ

Characteristics of Hypothesis:

A hypothesis should have the following characteristic features:-

- It should be clear and precise

- It should be capable of being tested
- It should be related to the body of the theory
- It should be related to the available techniques
- It should state relationship between variables
- It should be stated in simple terms
- It should be consistent with most known facts

Source of Hypothesis

Theoretical or conceptual frameworks

- Through a deductive approach these hypotheses are drawn from theoretical or conceptual frameworks for testing them.

Previous research

- Findings of the previous studies may be used for framing the hypotheses for another study.
- For example, in a small sample descriptive study, a researcher found that a number of patients admitted with coronary artery disease had increased body mass index.

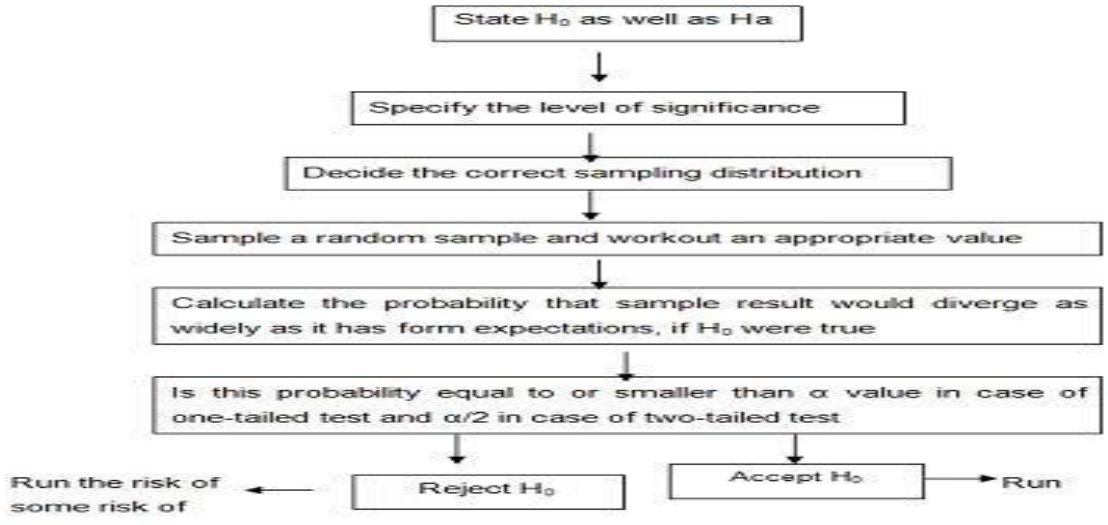
Real-life experiences

- Real-life experiences also contribute in the formulation of hypotheses for research studies.
- For example, Newton had a life-changing experience of the falling of an apple & formulated a hypothesis that earth attracts all the mass towards its centre, through several researchers were conducted before generating a law of central gravity.

Academic literature

- Academic literature is based on formal theories, empirical evidences, experiences, observation, & conceptualizations of academicians.These literatures may serve as good sources for formulating hypotheses for research studies

HYPOTHESIS TESTING:



AStatistical hypothesis Statistical hypothesisis a conjecture about a population parameter. This conjecture may or may not be true.The null hypothesisnull hypothesis, symbolized by H0, is a statistical hypothesis that states that there is no difference between a parameter and a specific value or that there is no difference between two parameters.

The alternative hypothesis alternative hypothesis, symbolized by H1, is a statistical hypothesis that states a specific difference between a parameter and a specific value or states that there is a difference between two parameters.

Testing Procedure:

1. The first step is to state the relevant null and alternative hypotheses. whether the alternative hypothesis can either be accepted or stays undecided as it was before the test.
2. The second step is to consider the statistical assumptions being made about the sample in doing the test; for example, assumptions about the statistical independence or about the form of the distributions of the observations.
3. Decide which test is appropriate, and stating the relevant test statistic.
4. Derive the distribution of the test statistic under the null hypothesis from the assumptions. For example, the test statistics may follow a Student's t distribution or a normal distribution.
5. The distribution of the test statistic partitions the possible values of T into those for which the null-hypothesis is rejected, the so called critical region, and those for which it is not.
6. Compute from the observations the observed value of the test statistic.
7. Decide to either fail to reject the null hypothesis or reject it in favour of the alternative. The decision rule is to reject the null hypothesis H0 if the observed value is in the critical region, and to accept or "fail to reject" the hypothesis otherwise.

Theory and Concept:

Theory is defined as a set of systematically interrelated concepts, definitions and propositions that are advanced to explain and predict a phenomenon. It may also specify causal relationship among variables. A theory is an integrated body of definitions, assumptions, and general propositions covering a given subject matter from which a comprehensive and consistent set of specific and testable principles can be deducted logically. This theory provides a basis for studying consumer behaviour and formulating appropriate marketing strategies.

Requisites (Criteria) of Theory

Theory starts out as ideas. The criteria to be met by the set of ideas are:

- They must be logically consistent.
- They must be interrelated.
- The statements must be exhaustive.
- The propositions should be mutually exclusive.
- They must be capable of being tested through research.

LECTURE NO NINE

Research in an evolutionary perspective

An evolutionary perspective in research involves applying the principles of evolutionary biology, particularly natural selection, to understand various phenomena. This approach assumes that many traits and behaviors have evolved over time to enhance survival and reproduction.

Key Concepts:

- **Natural Selection:** The process where traits that improve an organism's chances of survival and reproduction are more likely to be passed on to future generations.
- **Adaptation:** A trait that has evolved to serve a specific function, increasing an organism's fitness in its environment.
- **Evolutionary Psychology:** The study of how human behavior and cognition have evolved over time.

Applications in Research:

- **Human Behavior:** Understanding mate selection, cooperation, aggression, and other social behaviors through an evolutionary lens.
- **Mental Health:** Investigating the evolutionary roots of mental disorders and how they might have served adaptive functions in the past.
- **Culture:** Examining how cultural practices and beliefs evolve and spread, similar to biological traits.
- **Medicine:** Studying the evolution of diseases and antibiotic resistance to develop more effective treatments.

Examples:

- **Mate Selection:** Evolutionary psychology suggests that men and women have different preferences in mates due to their differing reproductive strategies.
- **Fear Response:** The fear response is thought to have evolved to help us avoid dangerous situations.
- **Language:** The capacity for language is considered a uniquely human adaptation that has facilitated complex communication and social interactions.

Criticisms and Considerations:

- **Just-So Stories:** Critics argue that some evolutionary explanations are speculative and lack empirical support.
- **Genetic Determinism:** There is concern that evolutionary perspectives might overemphasize genetic factors while neglecting environmental influences.

Overall, an evolutionary perspective offers a valuable framework for understanding the origins and functions of various traits and behaviors. However, it is essential to apply this approach with caution and consider alternative explanations.

LECTURE NO TEN

Role of Theory in Research

Interaction between theory and research is a continuous process of science leading to consolidation of existing knowledge and additions to it.

1. Theory provides significant guidelines for the empirical research by pointing to areas in which meaningful relationships are likely to be found. Theory narrows down range of facts to be studied. Theory provides the research a definite point of view helping him enquires into relationships between certain variables selected infinite array of variables. A theory provides fruitful hypotheses and new perspectives. It also points to gaps in our knowledge.
2. Theory increases the meaning of the findings of empirical research by helping us to perceive them as special cases of a set of abstract statements of relationships. Research findings will have meaning only when they are put into a theoretical perspective. Theory summarizes relationships amongst variables in a conceptual framework.
3. Proper linkage between theory and research findings provides a more secure ground for prediction about future events.
4. Research findings in theoretical framework provide a secure basis for drawing inferences about consequences in remote areas from the central area to which the findings relate.
5. Theory attests to the truth of research findings.
6. Theory helps in bridging the gaps in knowledge with intuition..

General Principles Regarding the Use of Theory in Research

1. Knowledge of the existing theory in one's area of research is essential for conducting research.

2. Concepts are crucial components of theory and so their clear definitions are essential to the designing of the study.

3. One should view theory as hypothetical proposition and not as conclusive fact.

4. One should pay attention to all odd and puzzling unexpected observations in one's research and enquire into them. They may be a source for new theoretical approaches.

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