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CENTRE FOR DISTANCE AND ONLINE EDUCATION

(CDOE)

MASTER OF COMMERCE

SEMESTER - III

CORE COURSE VIII : RESEARCH METHODOLOGY

(Candidates admitted from 2023- 2024 onwards

PERIYAR UNIVERSITY

CENTRE FOR DISTANCE AND ONLINE EDUCATION (CDOE)

M.Com 2023 -2024 onwards

CORE – VIII

RESEARCH METHODOLOGY

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23UPCOM3C08- RESEARCH METHODOLOGY

UNIT I- INTRODUCTION TO RESEARCH METHODOLOGY

Unit Objectives:

Human being is benefited by the research undertaken in various subjects. This unit covered the meaning and objectives of research; the research in Commerce and Management; types of research; review of literature; research process; and the methods of research. This unit also includes the meaning, advantages and disadvantages of case study method and survey method. The objectives of research are creating knowledge, describing characteristics, diagnosis of problem, testing relationship and welfare objective. The research in commerce and management is constantly done for effective and actionable decision-making.

Introduction:

The development of whole world is due to research in various fields of life. Human being is benefited by the research undertaken in various subjects. The human urge for new areas of knowledge has developed a sense for search and research in him. Every society or economy has serious social, economic and political problems. These problems need systematic, intelligent and practical solution. The business organizations have managerial problems which also require solutions. **The innovation is solution for many problems and it comes from the research**. However, what is the research that we have to understand.

Meaning of Research

As per dialect, research refers to a search for new knowledge. However it is systematic enquiry of a research topic. It is critical investigation of a phenomenon with specific objectives. We can understand the meaning of research with the help of definitions given by some thinkers. The characteristics of research clear us the meaning of research. Research brings improvement in practical life.

Redman and Morey has defined research briefly as ‘systematized effort to gain new knowledge.’

P. V. Young defined the research as ‘social research is the systematic method of discovering the new facts or verifying the old facts, their sequences, inter- relationship, causal explanations and the natural laws which govern them.’

D. Slesinger and M. Stephenson say ‘social research is manipulation of things, concepts or symbols for the purpose of generalizing to extend correct and verifying knowledge, whether that knowledge aids in the construction of a theory or in the practice of an art.’

Another definition of research is given by F. A. Ogg who says that ‘research may or may not come to success; it may or may not add anything to what is already known. It is sufficient that its objectives be new knowledge or at least a new mode or orientation of knowledge.’

Clifford Moody has given whole process of research in his definition, he says‘It comprises defining and redefining problems; formulating hypotheses or suggested solutions; collecting, organizing and evaluating data; making deductions and making conclusions; and at last carefully testing the conclusions to determine whether theyfit the formulated hypothesis.’

According to Webster’s International Dictionary, the research has been defined as ‘a careful and critical enquiry or examination in seeking facts or principles, diligent investigation in order to ascertain something.’

Francis Rummel says ‘Research is a careful inquiry or examination to discover new information or relationships and to expand and to verify existing knowledge.’

John W. Best says ‘Research may be defined as the systematic and objective analysis and recording of controlled observations that may lead to the developments of

generalizations, principles, or theories, resulting in prediction and possibly ultimate control of events.'

Kerlinger defines research as 'a systematic, controlled empirical and critical investigation of hypothetical propositions about the presumed relations among natural phenomena.'

DEFINITION

Research methodology is the systematic and structured process of planning, executing, and evaluating scientific research. It encompasses the techniques, procedures, and tools used to conduct research, ensuring that the findings are reliable, valid, and replicable. Research methodology involves various stages, including formulating research questions, designing the study, selecting appropriate methods for data collection and analysis, and interpreting results. It is essential for guiding researchers in achieving rigorous and credible outcomes in their investigations

Objectives of Research

The main objective of a research is to find out a truth which has not been yet discovered. The specific objectives are as follows:

1. ***Creating knowledge:*** Research is a process of gaining new knowledge. It is conducted to develop a new theory or to test an existing theory or to extend the existing knowledge. Research always contributes to the knowledge.
2. ***Describing characteristics:*** Research is also conducted to describe accuratelythe characteristics of a particular individual, situation or a group.
3. ***Diagnosis of problem:*** Research can be conducted to determine the frequency with which something occurs or with which it is associated with something else.
4. ***Testing relationship:*** Research is also conducted to test a hypothesis of causal relationship between variables.

5. ***Welfare objective:*** Research should have social objective for broader view of welfare of the society. It is always expected that research should be useful to the society at large. After solving any problem.

The objectives of research methodology can be summarized as follows:

1. Systematic Investigation: Research methodology aims to provide a systematic approach to conducting investigations. It involves defining clear research questions or objectives, choosing appropriate methods and procedures for data collection and analysis, and organizing the research process in a structured manner.
2. Ensuring Rigor and Validity: Methodology ensures that research is conducted with rigor, meaning that it is thorough, accurate, and precise. It helps in establishing the validity of research findings by ensuring that the methods used are appropriate for the research questions and that the data collected are reliable.
3. Facilitating Replicability: Good research methodology allows others to replicate or reproduce the study. By clearly documenting procedures, methods, and instruments used, researchers enable others to verify the findings and build upon the research.
4. Minimizing Bias: Research methodology includes strategies to minimize bias and ensure objectivity in data collection and analysis. This may involve using randomized sampling techniques, controlling variables, and employing statistical methods to reduce the impact of confounding factors.
5. Ethical Compliance: Methodology includes ethical considerations to ensure that research is conducted ethically and responsibly. This involves obtaining informed consent from participants, protecting their confidentiality, and ensuring that the research does not cause harm.
6. Optimizing Resource Utilization: A well-defined methodology helps researchers optimize the use of resources such as time, funding, and personnel. By clearly outlining procedures and protocols, researchers can efficiently conduct their studies and achieve meaningful results.

7. Improving Decision Making: Research methodology aims to provide reliable and valid data that can inform decision-making processes in various fields. By using rigorous methods, researchers contribute to the generation of evidence-based knowledge that can be used to address practical problems and challenges.

In essence, the objectives of research methodology are to guide researchers in conducting systematic, rigorous, and ethical investigations that contribute to the advancement of knowledge and understanding in their respective fields.

Characteristics of Research:

(1) Research is a systematic, objective and logical process.

(2) Research is a systematic and critical investigation.

(3) Research is a serious and rigorous process of analyzing data with specificpurpose.

(4) Research is a controlled activity.

(5) Research is a valid experience and provides verifiable evidences.

(6) Research should be relevant

MOTIVATIONS FO RESEARCH

Research is driven by several motivations, which can vary depending on the field, the researcher's interests, and the societal context. Here are some common motivations for conducting research:

Advancement of Knowledge: One of the primary motivations for research is to contribute new knowledge to a particular field or discipline. Researchers seek to uncover facts, test hypotheses, and explore theories that can expand understanding and contribute to the body of knowledge.

Problem Solving and Innovation: Research often aims to address practical problems or challenges. Whether in science, technology, medicine, or social sciences, researchers seek solutions that can improve processes, develop new technologies, or enhance policies.

Intellectual Curiosity: Many researchers are driven by a natural curiosity to explore unanswered questions or delve deeper into topics that intrigue them. This curiosity fuels their passion for discovery and drives them to pursue research endeavors.

Career Development: In academic and professional settings, research is often a key component of career advancement. Researchers may conduct studies to build their expertise, gain recognition in their field, and enhance their academic or professional credentials.

Impact on Society: Research can have significant societal impact by informing public policy, influencing social practices, or addressing pressing societal issues. Researchers may be motivated by a desire to contribute positively to their communities or to promote social justice and equity.

Personal Fulfillment: For many researchers, the process of conducting research and contributing to knowledge production is personally fulfilling. It provides a sense of accomplishment, satisfaction, and intellectual growth. Competitive Edge: In competitive fields, research can provide a competitive edge by generating novel ideas, securing funding, attracting collaborators, and enhancing institutional reputation.

Ethical Imperatives: Some research is motivated by ethical imperatives, such as investigating human rights abuses, promoting environmental sustainability, or addressing health disparities. Researchers may feel a moral obligation to conduct studies that contribute to social good.

Educational Purposes: Research plays a crucial role in education, both for educators and students. Educators conduct research to develop effective teaching methods or to contribute to their academic discipline, while students engage in research to deepen their understanding and develop critical thinking skills.

Commercial Potential: In applied research and industries, there is often a motivation to conduct research with potential commercial applications. Research and development efforts in these contexts aim to create new products, improve existing technologies, or explore market opportunities.

These motivations collectively drive the diverse landscape of research activities, shaping the questions researchers pursue, the methods they employ, and the impacts they hope to achieve.

MAINTAINING OBJRCTIVITY IN RESEARCH

Maintaining objectivity in research is crucial to ensure that the findings and conclusions are credible, unbiased, and trustworthy. Here are several key principles and practices that researchers can employ to maintain objectivity:

1. Awareness of Bias: Recognize personal biases, preconceptions, and assumptions that may influence the research process and findings. Being aware of these biases allows researchers to mitigate their impact on data collection, analysis, and interpretation.

2. Use of Standardized Procedures: Follow standardized procedures and protocols for data collection, measurement, and analysis. This helps minimize subjective interpretations and ensures consistency across different studies or researchers.

3. Research Design: Design studies carefully to minimize potential sources of bias. This includes randomizing participants, blinding researchers or participants when appropriate, and controlling variables that could affect outcomes.

4. Data Collection: Employ rigorous methods for data collection, such as using validated instruments, conducting pilot studies, and ensuring reliability and validity of measurements. Clearly document procedures to enhance transparency and reproducibility.

5. Data Analysis: Use appropriate statistical or qualitative analysis techniques to analyze data objectively. Avoid cherry-picking data or methods that could lead to biased interpretations. Peer review and consultation with colleagues can help ensure the robustness of analytical approaches.

6. Interpretation of Findings: Interpret findings objectively, considering alternative explanations and potential limitations of the study. Clearly distinguish between data-driven conclusions and interpretations that may be influenced by personal beliefs or agendas.

7. Peer Review and Collaboration: Seek peer review and collaborate with other researchers to validate findings and perspectives. Constructive criticism and feedback from peers can help identify and correct potential biases or errors.

8. Ethical Considerations: Adhere to ethical guidelines and principles, such as obtaining informed consent from participants, protecting confidentiality, and minimizing harm or discomfort. Ethical conduct supports the credibility and objectivity of research outcomes.

9. Transparency and Reporting: Transparently report research methods, procedures, and findings in publications or presentations. Describe limitations and potential biases openly to allow readers to assess the reliability and objectivity of the study.

10. Continuous Reflection: Continuously reflect on the research process and findings, considering how personal biases or external influences may have affected the study. Engaging in reflexivity can help researchers maintain objectivity and improve the quality of future research endeavors.

By consciously applying these principles and practices, researchers can enhance the objectivity of their research and contribute to the integrity and credibility of scientific knowledge.

CRITERIA OF GOOD RESEARCH

Good research is characterized by several key criteria that collectively contribute to its quality, reliability, and significance. Here are the criteria commonly used to assess the quality of research:

1. Relevance: The research should address a significant problem, question, or issue that is relevant to the field of study and has practical or theoretical implications. It should contribute to advancing knowledge or solving real-world problems.

2. Validity: Validity refers to the extent to which the research accurately measures or addresses what it intends to. Different types of validity include internal validity (extent to which the study accurately tests its hypotheses), external validity (extent to which findings can be generalized to other populations or settings), and construct validity (extent to which measures accurately represent theoretical constructs).

3. Reliability: Reliability relates to the consistency and repeatability of findings. A study is considered reliable if it produces consistent results when repeated under similar conditions or with similar methods. This includes consistency in data collection, analysis, and interpretation.

4. Rigor: Rigor refers to the meticulousness and thoroughness in conducting research. It involves using appropriate methodologies, adhering to standardized procedures, minimizing biases, and ensuring the robustness of data collection and analysis methods.

5. Transparency: Good research is transparent in its methods, procedures, and findings. Researchers should clearly document their methods, data sources, and analytical techniques to allow for replication and verification of results by others.

6. Generalizability: While not always applicable (especially in qualitative research), good research often aims for findings that can be generalized to broader populations or contexts. This requires careful sampling and consideration of external validity.

7. Ethical Considerations: Research should be conducted ethically, with respect for participants' rights, privacy, and well-being. Ethical conduct includes obtaining informed consent, minimizing risks, protecting confidentiality, and ensuring that potential benefits outweigh potential harms.

8. Impact: Good research has the potential to make a significant contribution to knowledge, practice, policy, or society. It may lead to new insights, innovations, or improvements in understanding that can benefit the academic community or wider society.

9. Clarity and Coherence: Research should be well-organized and clearly presented. This includes logical flow of ideas, clear writing, appropriate use of terminology, and effective communication of results and conclusions.

10. Critical Evaluation: Researchers should critically evaluate their own work, including acknowledging limitations, discussing alternative explanations, and considering implications for future research or applications. Critical reflection enhances the quality and credibility of research.

By adhering to these criteria, researchers can ensure that their research is rigorous, valid, ethical, and impactful, thereby contributing meaningfully to their field of study and beyond.

APPLICATION OF RESEARCH IN BUSINESS

Research plays a crucial role in various aspects of business, contributing to informed decision-making, strategic planning, innovation, and competitive advantage. Here are some key applications of research in business:

1. Market Research:
   - Purpose: Understand customer needs, preferences, and behaviors to develop products and services that meet market demands.
   - Methods: Surveys, focus groups, interviews, and data analysis.
   - Benefits: Helps businesses identify market opportunities, assess market size, segment markets, and develop effective marketing strategies.
2. Product Development and Innovation:
   - Purpose: Research informs the development of new products or improvements to existing products.
   - Methods: Concept testing, prototype development, customer feedback analysis.
   - Benefits: Ensures products align with customer preferences, addresses market gaps, and enhances competitiveness.
3. Strategic Planning:
   - Purpose: Research provides data and insights for formulating business strategies and plans.
   - Methods: Industry analysis, competitor analysis, SWOT analysis, trend analysis.
   - Benefits: Enables businesses to identify strategic priorities, allocate resources effectively, and capitalize on emerging trends or opportunities.
4. Operational Efficiency and Optimization:
   - Purpose: Research helps optimize business processes and operations.
   - Methods: Process analysis, performance metrics, benchmarking, operational research techniques.
   - Benefits: Improves efficiency, reduces costs, enhances productivity, and ensures effective resource allocation.
5. Customer Relationship Management (CRM):
   - Purpose: Research aids in understanding customer satisfaction, loyalty, and retention.
   - Methods: Customer surveys, feedback analysis, customer journey mapping.
   - Benefits: Enhances customer experience, informs customer service improvements, and strengthens customer relationships.

6. Financial Analysis and Decision-Making:

- Purpose: Research provides insights into financial performance, market trends, and investment opportunities.
- Methods: Financial modeling, ratio analysis, risk assessment.
- Benefits: Supports financial decision-making, such as investment decisions, budgeting, pricing strategies, and financial forecasting.

7. Human Resource Management:

- Purpose: Research helps in understanding employee satisfaction, engagement, and organizational culture.
- Methods: Employee surveys, focus groups, HR analytics.
- Benefits: Guides HR policies and practices, improves employee retention, and enhances organizational performance.

8. Risk Management:

- Purpose: Research assists in identifying and mitigating business risks.
- Methods: Risk assessment, scenario analysis, trend analysis.
- Benefits: Helps businesses anticipate and manage risks related to market changes, regulatory compliance, operational issues, and competitive threats.

9. Strategic Partnerships and Alliances:

- Purpose: Research supports decision-making in forming partnerships, collaborations, or alliances.
- Methods: Partner evaluations, market research, due diligence.
- Benefits: Facilitates strategic alliances that can lead to market expansion, technology acquisition, and shared resources or capabilities.

10. Ethical and Social Responsibility:

- Purpose: Research helps businesses understand societal expectations, ethical standards, and corporate social responsibility (CSR) issues.
- Methods: Stakeholder analysis, CSR audits, sustainability reporting.
- Benefits: Guides businesses in adopting ethical practices, enhancing reputation, and fostering sustainable business practices.

Overall, research in business is essential for generating insights, reducing uncertainty, and supporting evidence-based decision-making across all functional areas of an organization. It enables businesses to adapt to changing market conditions, innovate effectively, and maintain competitive advantage in a dynamic business environment

FORMULATING A RESEARCH PROBLEM

Formulating a research problem is a critical initial step in the research process, as it sets the stage for identifying the purpose, scope, and direction of the study. Here's a structured approach to formulating a research problem:

1. Identify a Broad Research Area:

- Start Broad: Begin by identifying a general area of interest or a topic that intrigues you. This could stem from your academic discipline, professional experience, current issues, or gaps in existing literature. - Example: Education, healthcare management, sustainable energy, consumer behavior, etc.

2. Conduct Preliminary Literature Review:

- Review Existing Literature: Conduct a preliminary review of literature related to your broad area of interest. This helps you understand what research has already been done, identifies gaps in knowledge, and informs potential research questions.

- Identify Gaps: Look for unanswered questions, conflicting findings, emerging trends, or areas where more research is needed.

3. Specify the Research Context:

- Narrow Down: Narrow your focus by specifying the context or setting within which you want to conduct your research. Consider factors such as geographic location, specific industry, target population, time frame, etc.

- Example: Higher education institutions in urban settings, healthcare practices in developing countries, renewable energy adoption in manufacturing industries, etc.

4. Formulate a Research Question: - State Clearly: Based on your identified research area, gaps in literature, and specific context, formulate a clear and concise research question. The question should be specific enough to guide your research efforts and provide a clear direction.

- Characteristics of a Good Research Question:
  - Focused: Clearly defines what you want to investigate.
  - Specific: Addresses a particular aspect of the broader topic.
  - Clear: Can be understood easily and is not ambiguous.
  - Feasible: Can be answered within the scope of available time, resources, and ethical considerations.
- Example: "How do financial incentives impact employee productivity in remote work settings?"

5. Consider the Significance and Purpose:
- Significance: Reflect on why your research question is important. Consider its potential contributions to theory, practice, policy, or societal impact. - Purpose: Determine the objective of your research. Are you aiming to explain a phenomenon, explore relationships, compare variables, predict outcomes, or evaluate interventions?
- Example: "This research aims to provide insights into effective strategies for enhancing productivity in remote work arrangements, contributing to both organizational management practices and employee well-being.

6. Refine and Define Scope:
- Refine: Refine your research question based on feedback, further literature review, and discussions with peers or mentors.
- Define Scope: Clarify the boundaries of your research in terms of what will be included and excluded. This helps in focusing your efforts and managing expectations.

7. Write a Research Problem Statement:
- Finalize: Synthesize the above elements into a clear and concise research problem statement. This statement should succinctly articulate the research question, its significance, and the context within which it will be explored.
- Example Problem Statement: "The purpose of this study is to investigate the impact of financial incentives on employee productivity in remote work settings within multinational corporations based in urban areas of developed countries."

By following these steps, you can effectively formulate a research problem that provides a solid foundation for planning and conducting your research study. Remember that the research problem should be meaningful, feasible, and aligned with both your interests and the needs of your field of study.

LITERATURE REVIEW

A literature review on research methodology encompasses a comprehensive examination of the methods, approaches, techniques, and philosophies used in conducting research across various disciplines. Here are key aspects typically covered in such a literature review:

1. Types of Research Methodologies:

- Quantitative Methods: Review of approaches such as experimental designs, surveys, correlational studies, and statistical analyses used to quantify variables and test hypotheses.- Qualitative Methods: Exploration of methodologies including ethnography, case studies, phenomenology, grounded theory, and content analysis, which focus on understanding meanings, experiences, and social phenomena.

- Mixed Methods: Analysis of studies combining quantitative and qualitative approaches to provide a more comprehensive understanding of research questions.

2. Research Design and Planning:

- Experimental Design: Examination of principles and considerations in designing experiments to establish causation.

- Survey Design: Review of best practices in constructing surveys, sampling techniques, and methods for ensuring reliability and validity.

- Case Study Design: Evaluation of case study methodologies, including single-case versus multiple-case designs and approaches to data collection and analysis.

3. Data Collection Methods:

- Primary Data Collection: Overview of methods such as interviews, focus groups, observations, and experiments used to gather original data directly from participants.

- Secondary Data Analysis: Exploration of techniques for analyzing existing datasets, archives, and documents to address research questions.

4. Data Analysis Techniques:

- Quantitative Analysis: Review of statistical methods including descriptive statistics, inferential statistics (e.g., t-tests, ANOVA, regression), and advanced techniques like structural equation modeling (SEM) and factor analysis.
- Qualitative Analysis: Examination of approaches such as thematic analysis, content analysis, discourse analysis, and narrative analysis used to interpret qualitative data.

5. Validity and Reliability:
- Internal Validity: Discussion of factors that influence the extent to which a study accurately measures the relationship between variables.
- External Validity: Exploration of the generalizability of research findings to other populations, settings, or contexts.
- Reliability: Analysis of methods for ensuring consistency and replicability of research findings.

6. Ethical Considerations:
- Informed Consent: Examination of principles and practices for obtaining voluntary participation and informed consent from research participants.
- Confidentiality and Privacy: Review of strategies for protecting participants' identities and sensitive information.
- Ethical Guidelines: Overview of ethical standards and regulations governing research involving human subjects, animals, or sensitive data.

7. Emerging Trends and Innovations:
- Technology in Research: Exploration of the impact of technology, such as big data analytics, machine learning, and online research platforms, on research methodologies.
- Interdisciplinary Approaches: Analysis of how research methodologies are evolving through interdisciplinary collaborations and integrations.

8. Critiques and Debates:
- Methodological Critiques: Discussion of limitations, biases, and challenges associated with different research methodologies.

- Debates in Research Practice: Examination of ongoing debates and controversies in research methodology, such as positivism versus interpretivism, and quantitative versus qualitative approaches.

9. Applications in Different Disciplines:

- Social Sciences: Review of methodologies used in psychology, sociology, anthropology, political science, economics, and other social science disciplines.
- Natural Sciences: Analysis of experimental methods, data collection techniques, and statistical analyses applied in biology, chemistry, physics, and environmental sciences.
- Humanities: Exploration of qualitative approaches used in history, literature, cultural studies, and philosophy.

10. Integration and Synthesis:

- Synthesizing Findings: Integration of findings from multiple studies to identify overarching trends, best practices, and areas for future research.
- Implications for Practice: Discussion of how insights from research methodology literature can inform and improve research practice in various fields.

A literature review on research methodology not only summarizes existing knowledge but also identifies gaps in understanding, informs methodological choices for new research, and contributes to the evolution of research practices across disciplines.

Review of literature is not mere reading of different resources. It is systematic process of reviewing scholarly written sources like books and research papers/articles published in journals etc. in the context of a particular research problem. Withdifferent purposes it is done which may include (a) to gain subject insight, (b) to be familiar with concepts relating to research problem, (c) to identify potential relationship between the variables, (d) to formulate hypothesis, (e) to identify methodology appropriate to research problem, (f) to check utility of data sources used by other researchers and (g) to learn how others have written their reports.

After formulating of the problem, researcher has to conduct an extensive review of literature related to the problem under study. This covers review of books, journals,

conference proceedings, government reports, published and unpublished studies and theses etc. Most important part of review of literature is the review of earlier studies on the similar topic or dimensions of research problem. We canunderstand there are two-folds of review of literature i.e. (i) review concepts and theories and (ii) review of previous research findings.

Review of literature is required to carried out at different stages of research with different purposes:

1. At the beginning of research, to identify and select research problem, the researcher has to review source materials, encyclopedia, reference books, bibliography of doctoral dissertations, databases, theses in selected disciplines. At this stage, review of literature is done for gaining preliminary orientation about research topic, gaining ideas of recent trends in the field of knowledge, knowing work already done and finding out research gap to avoid duplication.
2. When the research problem is formulated, the review of literature is made for becoming familiar with appropriate research methodology, tools and techniques relevant to the study. Hence, it is necessary to review previous studies in the field, journals published and unpublished theses etc.
3. At the stage of operational zing concepts, the researcher should review previous studies in the field, journals published and unpublished theses etc. It is needed to clarify the concepts and for knowing measurement techniques.
4. When the research proposal is prepared, reviews of literature include review of sources like illustrated books on research methodology and published and unpublished theses. It is required at this stage to develop alternative research designs and for formulating hypothesis and defining sample design etc.
5. At the stage of constructing data collection instrument, the researcher has to review the sources like illustrated books on research methodology and published

and unpublished theses and especially specimens of instruments and scales appended to theses etc. Such review is done for gaining thorough knowledge of tools and measurement techniques.

6. At the time of writing theoretical chapters in the research report, the researcher should review journals, reference books and reports on the subject matter etc. The purpose of review at this stage is to notes and complete bibliography.
7. When findings and conclusions are written at that time also review is useful to strengthen them or justifying them with references of previous studies and also justifying differences in the findings by specific reference.

By this discussion we can understand that the review of literature is not isolated part of research report however every part of research report is ornamented by glimpses of review of literature and their references either for comparison or justification.

Review of literature is systematic process of reviewing scholarly written sources like books and research papers/articles published in journals etc. in the context of a particular research problem. With different purposes it is done which may include (a) to gain subject insight, (b) to be familiar with concepts relating to research problem, (c) to identify potential relationship between the variables, (d) to formulate hypothesis, (e) to identify methodology appropriate to research problem, (f) to check utility of data sources used by other researchers and (g) to learn how others have written their reports. The research process consists of steps such as (a) defining the research problem, (b) review of literature, (c) developing the hypothesis, (d) formulating the research design, (e) determining sample design, (f) data collection, (g) data analysis, (h) testing of hypothesis, (i) interpretation and (j) preparing research report.

There are methods of research such as case study method, survey method,

historical method and experimental method etc. A case study is an in-depth comprehensive study of a person, a social group, an episode, a process, a situation, a programme, a community, an institution or any other social unit. Survey is the research method which is overlooking the phenomenon. It is common method of diagnosing and solving social problem. It is useful for method of social investigation which is confined to particular area. Under this method, data may be collected through observation, mailing questionnaire or interviewing. This is the method of gathering data from respondents thought to be representative of some population. Historical study is a study of past records and other information sources with a view to reconstructing the origin and development of an institution or a movement or a system and discovering the trends in the past. If researcher wants to assess the effect of independent variable on dependent variable by artificially controlling the effect of rest of the variables, it is experimental research.

1. **Research:** Research is the systematic method of discovering the new facts or verifying the old facts, their sequences, inter-relationship, causal explanations and the natural laws which govern them.'

2. **Pure or Basic Research:** Pure research is also called as basic research or fundamental research. Fundamental research may include (a) the research deals with natural phenomenon and (b) the research related to human behavior make generalization.

3. **Applied Research:** Applied research is the research which is to find out a solution for practical problem which is being faced by society or business etc.

4. **Descriptive Research:** Descriptive research is nothing but surveys and fact-finding enquiries which aims at description of the state of affairs.

5. **Analytical Research:** Analytical research is the research when the researcher uses facts and information already available and makes critical evaluation of the material.

6. **Review of Literature:** Review of literature is a systematic process of reviewing scholarly written sources like books and research papers/articles published in journals etc. in the context of a particular research problem.

7. **Case Study Method:** A case study is an in-depth comprehensive study of a person, a social group, an episode, a process, a situation, a programme, a community, an institution or any other social unit. Case study is the method which aims at studying deeply and thoroughly different aspects of a social unit. Case study method is a careful and complete observation of a social unit.

8. **Survey Method:** Survey is the research method which is overlooking the phenomenon. It is common method of diagnosing and solving social problem. It is useful for method of social investigation which is confined to particular area. Under this method, data may be collected through observation, mailing

questionnaire or interviewing.

9. **Historical Method:** Historical study is a study of past records and other information sources with a view to reconstructing the origin and development of an institution or a movement or a system and discovering the trends in the past.

10. **Experimental Method:** If researcher wants to assess the effect of independent variable on dependent variable by artificially controlling the effect of rest of the variables, it is an experimental research.

REASONS FOR REVIE

A review in the context of research can refer to different types of reviews, such as a literature review or a systematic review. Here are several reasons why reviews are conducted in research:

1. To Summarize Existing Knowledge:

- Literature Review: Aims to summarize and synthesize existing research and knowledge on a specific topic or research question. It provides a comprehensive overview of theories, findings, methodologies, and debates within a field.

2. To Identify Gaps in Knowledge:

- Identify Research Gaps: Reviews help researchers identify gaps or inconsistencies in the existing literature. These gaps highlight areas where further research is needed to address unanswered questions or to provide new perspectives.

3. To Inform Research Design and Methodology:

- Methodological Reviews: Focus on evaluating different research methods and approaches used in previous studies. They inform researchers about the strengths, weaknesses, and suitability of various methodologies for addressing specific research questions.

4. To Support Evidence-Based Decision Making:

- Systematic Reviews: Systematic reviews aim to provide an exhaustive summary of all available evidence on a specific research question. They use rigorous methods to locate, appraise, and synthesize relevant studies, providing a basis for evidence-based decision making in policy, practice, or further research.

5. To Validate and Verify Findings: - Replication Studies: Reviews may include replication studies that aim to validate or verify findings from previous research. Replication studies are important for confirming the reliability and robustness of research findings.

6. To Track Research Trends and Developments: Trend Analysis: Reviews can track research trends, emerging theories, methodologies, and innovations within a field. They provide insights into how research practices and priorities are evolving over time.

7. To Critique and Evaluate Theories or Models:

- Critical Reviews: These reviews critically evaluate theories, models, or conceptual frameworks used in research. They assess the strengths, weaknesses, and applicability of theoretical constructs in explaining phenomena or guiding research.

8. To Provide a Foundation for New Research:

- Conceptual Reviews: Conceptual reviews explore theoretical concepts, definitions, and frameworks relevant to a research topic. They lay the groundwork for new research by clarifying conceptualizations and proposing new theoretical perspectives.

9. To Inform Policy and Practice:

- Policy Reviews: Reviews may inform policy makers and practitioners by synthesizing evidence on the effectiveness of interventions, programs, or policies. They contribute to evidence-based decision making and implementation strategies.

10. To Contribute to Knowledge Synthesis and Integration:

- Integrative Reviews: Integrative reviews aim to synthesize diverse research findings, perspectives, and methodologies from multiple studies or disciplines. They provide a comprehensive understanding of complex phenomena and promote interdisciplinary collaboration.

In summary, reviews in research serve various purposes, from summarizing existing knowledge and identifying gaps to informing research design, validating findings, tracking trends, and influencing policy and practice. They are essential for advancing knowledge, improving research quality, and supporting informed decision-making across disciplines.

REFRENCE MANAGEMENT TOOL:

In research methodology, reference management tools play a crucial role in several key aspects of the research process. Here's how these tools are particularly useful in this context:

1. Literature Review: Reference management tools help researchers collect, organize, and annotate literature from various sources. This is essential for conducting a comprehensive literature review, as it allows researchers to systematically gather relevant studies and categorize them based on themes or topics.

2. Citation Management: Ensuring accuracy and consistency in citations is critical in research. Reference management tools automate the process of formatting citations according to different citation styles (APA, MLA, etc.), thereby saving researchers time and effort.

3. Version Control: Many reference management tools offer version control features, which help researchers keep track of different versions of their bibliographies and ensure they are using the most up-to-date references in their work.

4. Collaboration: Research often involves collaboration with peers and colleagues. Reference management tools with collaboration features allow researchers to share references, annotations, and bibliographies, facilitating teamwork and ensuring everyone is on the same page.

5. Integration with Writing: These tools integrate seamlessly with word processors like **Microsoft Word, Google Docs, and LaTeX**, enabling researchers to insert citations and automatically generate bibliographies as they write.

6. Organization and Search: Effective organization of references is crucial in research methodology. Reference management tools provide capabilities to categorize references into folders, add tags, and search through references based on keywords or metadata.

7. Access to Research Materials: Some advanced reference management tools provide direct access to research databases and library catalogs, allowing researchers to import references and full-text articles directly into their library.

Examples of reference management tools commonly used in research methodology include **Zotero, EndNote, Mendeley, RefWorks, and Citavi**. Researchers often choose tools based on their specific needs, such as platform compatibility, integration capabilities with other software, and the level of support for collaborative research workflows.

INDENTIFICATION OF RESEARCH GAPS

Identifying research gaps is a critical aspect of conducting scholarly research. It involves locating areas within a field or topic where there is a lack of sufficient knowledge, unanswered questions, contradictions, or inconsistencies in existing literature. Here are several approaches and strategies that researchers commonly use to identify research gaps:

1. Literature Review: A comprehensive literature review is essential for identifying gaps in existing research. By reviewing existing studies, researchers can pinpoint areas where studies are limited, conflicting findings exist, or where new developments suggest additional research is needed.
2. Conceptual Framework Analysis: Analyzing the theoretical frameworks and concepts used in existing studies can reveal gaps in how these frameworks are applied or areas where new theoretical approaches could contribute to understanding.
3. Critical Analysis of Existing Research: Critically evaluating the methodologies, assumptions, and limitations of existing studies can highlight areas where further research is warranted. Look for methodological weaknesses, unanswered research questions, or opportunities for improvement in study design.
4. Consultation with Experts: Discussing your research topic with peers, mentors, or experts in the field can provide insights into emerging trends, controversial issues, or areas where research efforts are lacking.
5. Review of Practical Applications: Consider practical applications or implications of existing research. Identify gaps where theoretical knowledge does not fully address practical challenges or where new research could lead to practical solutions.
6. Cross-disciplinary Perspectives: Exploring related disciplines or fields can uncover insights and approaches that have not yet been applied to your research topic. Cross-disciplinary research often reveals new perspectives and areas for investigation.
7. Analysis of Citations and Bibliographies: Pay attention to frequently cited works and influential studies within the literature. Identify gaps by noting which studies are frequently cited and which areas are less explored or cited less frequently.

8. Publication Trends and Emerging Topics: Monitor recent publications, conference proceedings, and trends in your field to identify emerging topics or areas where research is growing rapidly. These areas may present opportunities for innovative research.

9. Consideration of Societal or Policy Relevance: Evaluate how your research topic relates to societal issues, policy debates, or practical challenges. Identifying gaps that have real-world implications can underscore the importance of your research.

10. Gap Identification Frameworks: Some researchers use structured frameworks or models (e.g., SWOT analysis, PESTLE analysis) to systematically identify gaps in research. These frameworks help organize thoughts and ensure comprehensive coverage of potential gaps.

By using these approaches, researchers can effectively identify and articulate research gaps that justify the need for further investigation and contribute to advancing knowledge within their field.

FRAMING OF OBJECTIVES

Framing objectives in research methodology involves clearly defining the specific goals and outcomes that a researcher aims to achieve through their study. Well-defined research objectives provide a roadmap for conducting the research and help ensure that the study is focused and purposeful. Here's how to effectively frame objectives in research methodology:

1. Be Clear and Specific:

- Example: Instead of stating a broad objective like "To study the impact of climate change," specify the aspect you intend to investigate, such as "To assess the effects of rising temperatures on agricultural productivity in a specific region."

2. Link Objectives to Research Questions:

- Research objectives should align with your research questions. Each objective should correspond to a specific question that your study seeks to answer.

- Example: If your research question is "What are the factors influencing consumer purchasing decisions in the smart phone market?" Your objective could be "To identify and analyze the key factors influencing consumer choices in the smart phone market."

3. Consider SMART Criteria:

- Specific: Clearly define what you want to achieve.

- Measurable: Include criteria that can be used to measure your objectives.
- Achievable: Ensure that your objectives are feasible within the scope of your study.
- Relevant: Objectives should be relevant to your research topic and contribute to knowledge in your field.
- Time-bound: Specify the timeframe within which you aim to achieve each objective.- **Example:** "To investigate the relationship between social media usage and mental health among adolescents in the United States by conducting a survey of 500 participants within six months."

4. Hierarchy of Objectives:
- Consider organizing objectives hierarchically, with broader objectives leading to more specific ones. This helps maintain clarity and focus.
- Example: "To explore the historical evolution of artificial intelligence (AI) technologies (broad objective) and to analyze the ethical implications of AI in healthcare (specific objective)."

5. Align with Research Methodology:
- Your objectives should be achievable through the chosen research methodology (e.g., qualitative, quantitative, mixed-methods).
- Example: If you plan to use quantitative methods, your objectives should include measurable outcomes or variables that can be quantitatively analyzed.

6. Justify the Importance:
- Briefly justify why each objective is important and how it contributes to addressing the research gap or advancing knowledge in your field.

7. Review and Refine:
- Continuously review and refine your objectives as you progress through the research process. Objectives may evolve based on initial findings, literature review, or feedback from peers and mentors.

Example of Well-Framed Objectives:

- Objective 1: "To investigate the impact of social media advertising on consumer purchasing behavior among millennials in urban areas."

- Objective 2: "To compare the effectiveness of traditional marketing strategies versus digital marketing tactics in enhancing brand awareness among small businesses."

By following these guidelines, researchers can effectively frame objectives that guide their study, ensuring clarity, relevance, and alignment with the overall research methodology and goals.

Research in Commerce and Management

Research is backbone for all areas of business hence it is nothing but lifeline of business studies. The development of various disciplines of commerce and management is dependent on research. The research in commerce and management isconstantly done for effective and actionable decision-making. Most of the decisions require additional information or information evaluation, which is addressed by business research. There are different areas of business research which include:

1. Research in Human Resource Management and Organizational Behaviour
2. Research in Marketing Management
3. Research in Financial Management and Accounting
4. Research in Operations and Production Management and Supply Chain Management
5. Research in Entrepreneurship and business models etc.

Human Resource Management:

Fundamental research in human resource management and organizational behaviour can be applied by business organizations in their policies and programmes. It may cover topics like (a) performance management, leadership analysis, organizational climate and work environment studies, talent and aptitude analysisand management, (b) employee recruitment and selection, (c) organizational planning and development, (d) incentive and benefit studies, job analysis and performance appraisal, employee

benefits and reward analysis etc., (e) training and development gap analysis, impact and effectiveness of training.

Marketing Management:

Research in marketing management includes broader industry specific studies. Some market research agencies conduct such research and they are sold to business organizations to assist their business decisions. Research in marketing consists of: (a) market potential analysis, market segment analysis and demand estimation,(b) market structure analysis, (c) consumer and business trend analysis, (d) buying behaviour and customer satisfaction etc. Some organizations prefer to conduct the research by their own product development department or R and D department. Such department carries out research related to all 4Ps of marketing such as (i) product research, (ii) pricing research, (iii) promotional research and (iv) place research. Research in customer relation management, customer satisfaction and customer loyalty etc. is now significant research carried out in the scenario of increased competition.

Finance and Accounting:

Research in finance and accounting is vast area of business studies and significant in decision-making. It includes: (a) capital market research, market micro structure, corporate finance, (b) analysis of financial derivatives, (c) market-based accounting research, (d) earning management, (e) risk management, (f) auditing and accountability, (g) integrated financial reporting, (h) financial econometrics, (i) merchant banking and insurance, (j) economic value added, and (k) micro-finance, financial inclusion and financial literacy etc.

Operations and Production Management:

Research in operations and production management is highly focused and problem-specific. Such research areas consists of operation planning, demand forecasting and analysis, process planning, project management, maintenance management, logistics and supply chain management, inventory management, quality assurance, quality

control, total quality management and quality certification analysis etc.

Cross-functional and Multi-disciplinary Research:

Business research is not only confined to functional areas of management,however, cross-sectional and multi-disciplinary approach is always useful for businesses with considering changes in business environment. It requires research areas such as corporate social responsibility, corporate governance and ethics, technical support system, enterprise resource planning, knowledge management, data mining and warehousing and artificial intelligence and so on. Business environment is also integrated subject which carries out research on ecological and environmental analysis, legal analysis, human rights and discrimination studies etc

In this way, we can understand research in commerce and management in diverseareas with various purposes.

UNIT I

SELF ASSESMENT QUESTIONS

Answers for Check Your Progress

I. Choose the correct answer from the given options:

Check your progress-1:

(A) Fill in the blanks:

(a) is systematized effort to gain new knowledge.

(b) Research is a .....and critical investigation.

(c) Research is a .....experience and provides verifiable evidences.

(B) State whether the following statement is true or false

(a) Creating knowledge is one of the objectives of research.

(b) Describing characteristics is not the objective of any research.

Check your progress-2:

(A) State whether the following statement is true or false

(a) There is no any space for research in Commerce and Management.

(b) Most of the decisions require additional information or information evaluation, which is addressed by business research.

(c) Market potential analysis is made in the research of human resource management.

(d) Market micro-structure is studied in finance research.

(e) Process planning is the topic of operations management.

Exercise:

1. What is research? Describe the objectives of research.
2. Explain the types of research.
3. Explain the review of literature, in detail.
4. What is case study method? Describe its merits and demerits.
5. What is survey method? Describe its merits and demerits.
6. Write short notes:
   (a) Pure research
   (b) Historical research method
   (c) Research process
   (d) Experimental research method
   (e) Descriptive research

GLOSSARY

Research

A systematic investigation aimed at discovering new information or understanding existing phenomena.

Objectives

Specific goals that a research study aims to achieve, guiding the research process.

Motivations for Research

The driving factors behind conducting research, which may include curiosity, societal needs, or professional advancements.

Types of Research

Different classifications of research, including:

- **Basic Research**: Theoretical exploration aimed at gaining fundamental insights.
- **Applied Research**: Practical investigation focused on solving real-world problems.
- **Qualitative Research**: Exploratory research focused on understanding underlying reasons and motivations.
- **Quantitative Research**: Statistical analysis aimed at quantifying problems and identifying patterns.

Maintaining Objectivity in Research

Ensuring impartiality in the research process to avoid bias and maintain integrity in findings.

Criteria of Good Research

Key attributes that define quality research, including:

- Validity
- Reliability
- Relevance

- Objectivity
- Rigor

Applications of Research in Business

Utilization of research findings to inform decision-making, strategy development, market analysis, and innovation in business contexts.

Formulating a Research Problem

Identifying and defining the specific issue or question that the research will address.

Literature Review

A comprehensive survey of existing research relevant to the topic, identifying what is already known and what gaps exist.

Reasons for Review

- Gain insights from previous studies
- Identify research gaps
- Avoid duplication of effort
- Strengthen the research foundation

Reference Management Tools

Software and tools that help researchers organize and manage citations and references, such as Zotero, EndNote, or Mendeley.

Identification of Research Gap

The process of pinpointing areas within a field that lack sufficient exploration or understanding, indicating opportunities for further investigation.

Framing of Objectives

The articulation of specific, measurable goals that guide the research, often derived from the research problem and literature review.

Reference for further study:

- Kothari, C. R. and Garg, Guarav (2016). Research Methodology Methods and Techniques (Third Edition), New Age International Publishers, London.
- Krishnaswami, O. R. and Ranganathan, M. (2011). Methodology of Research inSocial Sciences, Himalaya Publishing House, Mumbai, Second edition, Sixth print.
- Redman LV &Mory AVH (1923) The Romance of Research, pp. 6-10.
- Young, P. V. (1953). *Scientific Social Surveys and Research.* New York: Pzentice-Hall Inc., 1949. 621 pages. Nursing Research, 2(2), 95.
- Slesinger, D. and Stephenson, M. (1930) The Encyclopaedia of Social Sciences. Vol.IX, MacMillan Publications.

UNIT II -Hypothesis Testing and Research Design

Unit Objectives

After studying this Unit you will be able to:

- Understand designing research protocol for research problem, the concept andtypes of hypothesis.
- Prepare research design.
- Explain types of research designs, types of hypothesis and types of sampling.
- Understand the sampling design and types of sampling methods.
- Find relationship between research question, hypothesis and objectives.
- Explain the process of formulation of hypotheses and do it in actual practice.

Research Process:

The research process consists of series of various actions, which are necessary to effective research work. The stages in research process are listed as, selecting research problems and stating of hypothesis, formulating of research design, collecting, analyzing and interpreting of data.

Research process is a cyclic and interlinked with different stages. It is series of actions or steps necessary to carry out research effectively. This research process consists of steps such as (a) defining the research problem, (b) review of literature, (c) developing the hypothesis, (d) formulating the research design, (e) determining sample design, (f) data collection, (g) data analysis, (h) testing of hypothesis, (i) interpretation and (j) preparing research report.

Defining research problem:

The first step of research process is defining research problem. The researcher has to identify and select the research problem. This stage answers about 'why' and 'what' research is to be conducted. When sales are dipping in a specific market, the marketer want to know why the sales are dipping in that market. Hence, the researcher should come from broader to narrow approach. Firstly, we can fix which is broader area, then identify topic and our research problem under this topic. When the researcher decides about research problem, he/she has some investigative

questions on which you decide the objectives of a particular research and we can write the statement of the research problem.

The problem has to be defined properly before research problem is taken for study. The issue for inquiry or investigation should be identified and specified in detail. Consequently it needs to define scope of the problem, justification of the problem and feasibility of the problem.

Review of literature:

Review of literature is done with specific purpose of getting basic idea and conceptual clarity about research problem, identifying theoretical gap and methodological gap. The repetition of the same research problem is not expected. The review of literature assists him in this respect. It is also useful in formulating hypothesis.

Research design is a blue print, a comprehensive and detailed document which facilitates research in systematic and scientific manner. The document is a detailed plan which answers every question arouses regarding research problem under study. Unlike while building a home one has a detailed plan on a paper (often called as blue print) and the home is build accordingly likewise the research design is a document carries every details of conduct of research which drives towards a plausible, applicable solution of a problem under study. The outcome of research always helps managers in decision making with substantial evidences of facts. See in our day to day life the activities we undertake we have planning. For a day away from home to picnic or trekking we have planning on a piece of paper, here we are taking of research which is expected to resolve a problem or help in decision making to undertake few future strategies. The document research design is also termed as research protocol.

Let’s understand the definition of research design.

Definition of Research Design:

Various authors have defined the concept research design, few definitions are mentioned below.

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 (Kothari & Garg, 2015)

"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". – (Selitiz, 1965)

"A Research Design is a master plan specifying the methods and procedures for collecting and analysis the needed information." (Zikmund, 2008)

"The planned sequence of the entire process involved in conducting a research study." Prof. Miller

“The design results from controlling general scientific model into variedresearch procedure.” (Young, 1939)

“A research design provides the framework to be used as a guide in collecting and analyzing data.”

“A research design is a logical and systematic planning and it helps directing a piece of research.” (Nargundkar, 2008)

From the above definitions we learn that

a. It is a systematic plan
b. It directs the entire research activity towards a specific point.
c. It provides a framework to researcher to act within
d. It specifies methods and procedures to conduct research
e. It laid down condition of collection and analysis of data.

In short, research design is systematic plan to find out the answer for a research question under study. The research design mainly has six components as depicted in the following figure.

Figure 1: Components of research design.

Invariably research design is expected to answer following WH questions.

What : What is the research problem under study?. What hypothesis put to test ? and hat are objectives of the study? .

Why : Why the study has been undertaken? What is the importance of study? In what way and to whom the studey is going to be benefited?

Which: Which data and findings to be consider for building suggestions/prescriptions and building models to solve the research problem.

Whom: Sampling esign. Whom to approach to get the variabels, to get the data? The experts and the samples.

When: When to conduct the study? Period of conduct of study.

How: Statistical D sign. Operational Design. Observational Design. How to implement the research design? this talks about implementation plan, opertional plan. How to investigate? How to collect the data? ow to analyse the data?

Source: (Composed by author)

While undertaking any research project students have to have above questions in the mind to answer. The thought process should revolve around these questions. This habit of thinking often around the questions would help to come out with quality research and quality project.

The question ‘what?’ answers the major issue that what researcher/student wants to do. The research problem is a set of questions to be answers. The answers to the question we do not know and need to find out with conducting research. The question ‘what?’ also set the hypothesis to test and laid down objectives of the study. Researcher gets the specific point to attain from answering this question ‘what?’

Now why to conduct this research? or why to undertake this research? The answer to this question narrates importance of research. And whom the research is going to be benefited? It means the number of stakeholders going to be benefited because of this research. And in what way the stakeholders are going to be benefited? The answer to why details the importance of research.

Which data and findings to be considered for building suggestions or prescriptions is answered by question which? Researcher collects the data on which the analysis of data is done. Analysis leads to some findings and findings leads to suggestions. The decision of appropriate scales, decision on acute variables to measure what we want to measure is important. Appropriateness of selection of variables and measurement scales only would help appropriate analysis and drawing findings.

Research design also narrates the period a study to be undertaken in detail. The studies in social sciences have time value. The social scenario may leads to different opinions as per the change in time. For instance the workers may have a certain opinion at the time economy going well towards their emoluments and facilities receive by employer. The same workers may have different opinion on the sameissue when the economy is in recession. The research work in financial management, stock market prices of shares, economics which are always time related. So the decision of when the research is to be undertaken or at what time frame the research has undertaken carries apex

importance.

The next question while preparing research design to ask is how to conduct the research. This question gathers the procedural stages of research design.

Every research design especially in social sciences has four important aspects as,

1. Sampling design
2. Observational design
3. Statistical design and
4. Operational design

Sampling design talks about the population, sampling unit, and overall sampling frame. Whom researcher is going to approach and ask for the information, data or opinion? How many individuals or organizations to approach are also decided in sampling design i.e. number of samples to be approached. The detailed discussion of sampling is done in the last section of this chapter only.

Observational design specifies conditions to observe, what to observe and note down. The observational design is more relevant to qualitative studies. But even in quantitative studies few qualitative observations plays role. For example, while studying labour welfare facilities in a factory it if often needs not to ask about availability of pure drinking water facilities, fire extinguisher, sufficient light arrangements and ventilation and the like. These aspects merely can be observed by researcher and utilized for data analysis. There are many aspects in quantitative research as well which instead asking needs to be observed and utilized during data analysis. A few research reports carry general observations or general findings. The general observations and findings are mentioned are the outcome of observational design.

Statistical design decides on processing and analytical tools of be applied on collected data. Various statistical tools are available viz. measures of central tendency, measures of dispersion, correction, regression and so. The very purpose of teaching these statistical tools to students is to make use of the same for better analysis of data and drawing meaning out of the analysis. The analysis, which is to be used for decision making. It is expected that students should practice using this in

the project report and make project enriched. At the time of research design researcher decides on data collection and select the tools to be used for data analysis.

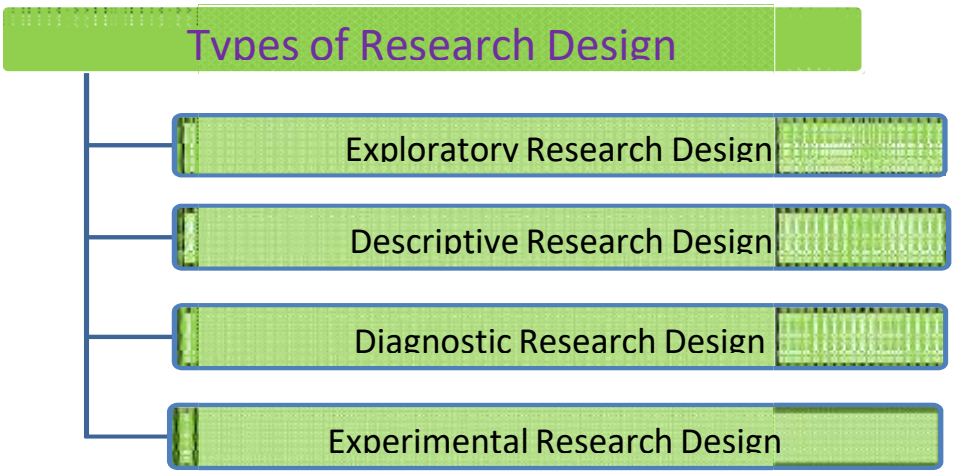
Operational design explains how the entire research design is to be executed. It is detailing of steps and procedure to execute the field work, data collection, data feeding and data analysis within a given resources especially time and money.

So, by this time you might have come to know how important these WH questions are.

Types of research designs:

There exist two basic research designs one is fundamental research also known as ideal or basic research and second is applied research also known as practical research.

Fundamental research meant to bring afloat the new facts which has not yet discovered by any one. The detailing of these facts and further probing into its relations with variables is basic task of fundamental research. Fundamental research



is a continuous process since there are many unexplored things in the nature and even many unexplored facts about human behavior as such. So till the existence of universe the fundamental research is warranted. We have very eminent research

institute dealing fundamental research, which is pride of India that is Tata Institute of Fundamental Research, Mumbai. (TIFR) are basically into basic science, technology and computers. Whereas applied research addresses real life problem.

The Knowledge contributed by fundamental research is bringing in use to resolve real life problems. Besides these two basic research designs we have following four research design to study.

Source: (figure composed by Authors)

Research designs mentioned above has a logical sequence.

To suffice newly evolved want, to answer newly evolved questions and to find out solutions to newly evolved problems, exploration is warranted.

The outcome of exploratory research is particularly in social sciences is the categories and variables which influenced human behavior in different capacities.

The different capacities mean, human as a social animal and human as a customer.

These Variables out of descriptive research and Exploration are enough to describe population using establishment of relationships is done using diagnostic done using experimental research design. Successful experimentation is then generalized to population as a solution to problem defined in exploratory research design. A cycle of proposing solution to a problem hence, begins at exploration and end up with experimentation.

1. Exploratory Research Design

Very meaning of exploration reveals to bring a float altogether new thing.

Exploratory research design is used to find the solution for new problems.

Definitions of exploratory research designs are,

Exploratory Research Design refers to, "Formulating a problem for more precise investigation or of developing the working hypothesis from an operational point of view." – (Kothari & Garg, 2015)

Exploratory Research Design refers to, "Conducted as a preliminary step to clarify and define the nature of a problem."- (G., 2013; Zikmund, 2008)

"A Flexible design which must provide opportunity for considering different aspects of the problems." –B.D.Kulkarni, D. (1996)

"It is systematic scientific and at times the only when through which a social scientists can check whether an idea, that sounds promising to him, has much appeal in reality or not." –Hasouneh, A. B. (2003)

Exploratory research manifest with something new in the domain knowledge. The exploration facilitates further thinking in different perspective. It may also facilitate the discussions and debates which are well explained and tested using descriptive research design.

Exploratory research design is very flexible because, it is very difficult to predict the time exploration would require and also difficult to limit the resources it requires. No one can guarantee of results out of exploratory research. We have heard Edison tried numerous to illuminate electrical bulb and he quote, “I have not **failed**. I've just found 10,000 ways that won't work.” Research scholar registered for degree does not deal with exploratory research since it is not sure when the research will complete? whether it will complete or not?

For example we have to develop a model depicting green buying behavior. That is a model depicts behavior of consumers towards purchasing the environment done using experimental research design. Successful experimentation is then generalized to population as a solution to problem defined in exploratory research design. A cycle of proposing solution to a problem hence, begins at exploration and end up with experimentation.

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For example we have to develop a model depicting green buying behavior. That is a model depicts behavior of consumers towards purchasing the environment. Friendly products/green products or we can say the products produced without hearting the environment. Now a day we are talking about sustainable businesses. And the sustainable businesses include care for an environment. Like organic vegetables, fruits etc. Now for the development of such models research need to find out the input variables, process variables i.e. buyers thinking process and output variables. Since every individual has their own thinking process and the behavior to reflect towards such products. Hence the study needs to probe into the psychological variables to construct the model. Since the model building involve psychological variables which are by nature very complex to understand. The mere development of theoretical model does not suffice purpose but the step ahead the model needs to put to test as well for its implementation. The successful testing of model gives inputs to the businesses dealing in green product.

Such studies which are not much addressed by researcher needs exploration and these are need to be addressed using exploratory research design.

3. Descriptive Research Design

Outcomes of exploratory research design are the inputs to the descriptive

research design which facilitates to check the scenario of variables manifested from exploratory study within the existing population.

Descriptive research design answers the question, what it is about. And it does not probe into the reasons behind the population scenario towards defined variables.
Definitions of descriptive research design are,

Descriptive Research Design refers to, "Which are concerned with describing the characteristics of a particular individual or of a group."- *Garg , C. R. (2014)*

"The Descriptive research designs enable researcher to describe or present pictures of a phenomenon or phenomena under investigation." –Hasouneh, A. B. (2003)

"The true beginning of scientific activity consists…describing phenomena and (Only) then in proceeding to group, clarify and correlate them..." –Bhandarkar, W. &. (1992).

Features of descriptive research design are,

- Descriptive research design meant to explain the population features with respect to phenomena under study. What it is?
- It has resource constraints especially time and money
- The design is rigid and does not allow many changes
- It brings in use descriptive statistical tools.

For example a study of investment pattern of people. Now this study studies merely the investment made by samples under study drawn from a specific defined population in different investment avenues. The study further may narrate the association of demographic profile with the investment made, such as, inclination of male and female samples towards investment. Or the inclination of different socio economic class towards investment in different avenues and the like. This study only describes the population under study about the investment pattern. The study does not necessarily explain the reasons behind the same.

4. Diagnostic Research Design

Variables well defined in descriptive research design are taken to find out its interrelations, dependability with gamut of variables and the like. The design used to

seek some sort of solution to the problem observed and under study. It purposefully establishes the relationships between variables to find out the extent of different variables are contributing to the existing problem and the like.

Definitions of research designs are,

Diagnostic Research Design refers to, "Determining the frequency with which something occurs or its association with something else." –*Garg , C. R. (2014)*

Diagnostic Research Design refers to, "Discovering what is happening, why is it happening and what can be done about." – *M.Ranganatham, D. O. (2005)*

"It is the most typical and simple problem solving strategy of the helper faced with problems and crises on the job." –B.D.Kulkarni, (1996)

"It may be concerned with discovering and testing whether certain variables are associated." –Bhandarkar, W. &. (1992)

"Diagnostic Research Design refers to scientific differentiation among various conditions or phenomena for the purpose of accurately classifying these conditions." - Hasouneh, A. B. (2003)

Above definitions concludes that diagnostic research design is used for problem solving using different inferential statistical tools.

Now for example continuing with the case we have seen above about study of investment pattern. If researcher studies the determinants of investment pattern then it requires diagnostic research design. Here researcher is finding the variables which are influencing the decisions behind investment and the investment in a specific investment avenue. The outcome of diagnostic research design could be a model for example regression model and the like. For a defined population under study we can state that the defined variables determine the investment in shares, mutual funds, bank FD etc. which ultimately help decision maker to decide upon the segment to target and focus advertising efforts.

5. Experimental Research Design

Experimentations are a base in physical sciences like chemistry, physics, botany and the like. In social sciences especially experimentations are now widely used to find out behavior of human being. In management human beings are considered as a

customer, consumer, employees, middlemen and the like. Studying behaviour of such human being under different circumstances is of use in decision making. Hence, management practitioners and researchers are using experimental research design.

For example, if a marketer shows a model of particular product which helps in the safeguard of your house and property in house like gold, silver and cash in your home. Looking towards the model which cost Rs. 2000/- and not more if marketer ask you being a sample, that after launching this product would you buy this? Almost 90% of samples would reply Yes!! they would buy it. When the product actually get launched in the market the sales does not turn out to 90% of targeted segment. Now the question is why it is so? It is because the circumstances marketer ask about possible purchase was different that the circumstances of actual purchase.

Say if I ask your opinion on a transaction happened with you, that on a retail counter you bought a product and paid the amount. Say a product priced Rs. 160/- you gave Rs. 200/- in return you get Rs. 50/- instead of Rs. 40/- what would you do? The general answer I will receive is rather almost all would reply that I will bring to the notice this fact and return Rs. 50/- for Rs. 40/- right? If it actually happens with you, what would be the scenario? The scenario would be different. Isn't it? So the point here is there is likely to be difference in opinion and actual act. What is more reliable for researcher to know is actual act. And measurement of actual act is at the core of experimental research.

Experimental research design necessarily follows a hypothesis and seeks relationship between two or more variables.

"More than a hundred ways of conducting such experiments and each these may be termed as a experimental design." -Donald Cambell & Julian Stanley

"Experimental research is designed to assess the effects of a particular variables on a phenomenon by keeping the other variables constant or controlled." – *M.Ranganatham, D. O. (2005)*

"In Experimental Design the researcher can often exert a great deal of control over extraneous variables and thus ensure that the stimuli in the experimental conditions are similar." – Hasouneh, A. B. (2003)

“Experimental method means those methods wherein researcher tests hypothesis of casual relationship between variables.” B.D.Kulkarni, D. (1996)

Experimental research design follows three basic principles

One is principle of randomization – it refers to selection of samples strictly on random basis to avoid possible biases.

Second is principle of replication – this means that experimentation should be repeated more times. This may bring afloat extraneous variables which has impact on results in experimentation.

Third principal is principal of local control- this refers to allow the indulgence of extraneous variables to play role in experimentation. This would allow researcher to know about extraneous variables which cause variability in measurement. Extraneous variables then are studies for its inclusion in experimentation to minimize experimental error.

The best example of experimental research design is Hawthorne experiment which details the illumination effect on the productivity of employee. In experimentation a single variable or set of variables play role of which the impact is measure. Necessarily in experimentation there likely to be two groups one is control group and second is experimental group. Say to test the effect of newly develop tablet which increases iron/calcium content in the body. One group of people can be given these tablets for a week and the changes into the iron/calcium content in the body are measures. This can be measured and analyzed in two ways. One is take the count before experiment i.e. giving the tablets and compare it with the post tablet consumption count. Second way it takes the count of iron/calcium of samples in control group and compare the count it with the people in experimental group who have consumed the tablet for a defined period.

In social sciences also we can have such experimentations. The English aptitude of entire class can be measured first. Then for half of the class a special coaching can be provided in an effort to increase the English aptitude. The students can be selected using random sampling technique to avoid biasness.

After completion of coaching of a defined period.Again the English aptitude for the entire class can be measures. The scores of students attending the coaching and the students who were not the part of such coaching can be compared. This testing will tell the impact of English coaching efforts. If significant difference found then it can be said that the coaching has leads to improve the aptitude of participants in the coaching class.

Features of Good Design

1. Reliability of data –good research design has more reliability of data collected. Reliability refers to correctness of opinions collected from samples.
2. Experimental error –repetitive execution of research design in different context if gives same results or similar results then it is considered to have less experimental error and treated to be a good research design.
3. Information yields – researchers requires more data and information to test hypothesis and suffice objectives effectively. The design which yields more data and information with shallow instrument termed to be a good research design.
4. Flexibility – it means the design should be able to consider many different aspects of a problem under study.
5. Economical –research design which consumes less resources especially money and time and provides maximum utility is considered to be economical research design.

Besides above mentioned points of features of good research design. Every practical research has sampling design, statistical design, observational design and operational design as their important components.

Invariably post graduate students at M.Com. MBA, PGDM program needs to undergo summer implant training. The research design mostly bring in use is descriptive research design and in rare cases diagnostic research design bring in use. Since the summer project has to be completed within some 50 to 60 days it is difficult to handle exploratory or experimental research design. The research protocol template given below is suitable to descriptive and diagnostic research design provides general guidelines and layout of points to be covered in research design

document. These points constitute the research design as well the same points constitute the chapter titled, 'Research Methodology' in the project report. Few of the points are exceptions at the M.Com. and MBA level viz. hypothesis and pilot testing. If any student is setting hypotheses to test and also conducting pilot testing then it is more appreciating work.

After finalizing the organization to work in for summer in-plant training, student has to decide on the research problem to be taken for study in consultation with project guide allotted to you and industry expert. In line with research problem follow the points given in the template below, student has to prepare a research proposal/project proposal. After finalization of research proposal/research protocol only the study has to be initiated.

How to Write a Research Protocol?
Research protocol is a document which describes scientific planning to conduct research. It is a blue print of research that directs researcher at every stage of research voyage. It talks about, what is the problem chosen for research? Where from the problem arises i.e. Source of research problem with support of a review, how the research problem is to be addressed i.e. methodology.
Contents of Research Protocol
Cover page: Contains title of the research, investigator's name and other details, affiliation, details of supervisor and the like. **Title to the Study:** It is short but inclusive, conveys the gist of research under study using technical

details mentioned in the scope of the study. It should give overall idea of research problem under study.

1. Introduction:

Explain in detail the background and context of research issues under consideration.

2. Social or Management Problem:

Here discuss the research problem in detail with the support of literature review. The crux of literature review should be supported in the discussion. On the basis of context and review of literature list down number of questions which are unanswered and still to be addressed to using research for scientific output. The outputs that can be generalize to the population. The entire discussion should pave the way towards finding research gap.

3. Statement of Research Problem:

From amongst the series of questions rose above in social or management problem **grouping on questions on the basis of similarity.** Prioritize these groups of questions. On the backdrop of resources available select an appropriate group of questions for research. Write the justification of selection and depict its importance. The detailing ends with title of research and justification of its suitability.

4. Hypothesis of the Study:

Hypothesis is **answer to the research question(s)** taken for study. Answer to the select category of research question(s) stated above in statement of research problem that are put to test.

5. Objectives of the Study:

These objectives are derived from hypothesis. Statements direct towards collection of data.

6. Scope of the Study:

Need to specify what geography to cover and taken for sampling? (Geographical scope) Which concepts the study revolves around? Are any new concepts under study? (Conceptual scope) Which analytical tools to be used for data analysis and testing of hypothesis? (Analytical scope) What period is to be considered for data collection (Historical/periodic scope) especially applicable to secondary source data?

Specific gender focused by research (Biological scope). Scope determines the context of application of research outcome.
7. Importance of the Study: Specify for whom? and to what extent the study is important to society, industry, organization (s), government and stakeholders. What are the possible outcomes of the study?

8. Research Methodology:

Research Design: Need to specify the research design adopted either, an Exploratory, descriptive, diagnostic or experimental.

Data Required: a list of data points require to test hypothesis and to suffice objectives is to be specified in details.

Data Sources: From a data list mentioned above few data points are to be gathered using secondary data sources and few are to be collected using primary data sources. Mention bifurcated list of data points to be sourced under heading primary data source and secondary data source clearly.

Instrument: Detailed description of data collection instrument used (questionnaire or schedule or observation sheet). Mention nature of schedule i.e. structured/unstructured, codified/non codified, closed ended/open ended. If instrument is structured then what are the structures and their titles. Which questions/variables every structure carries and how it is to be measured. Which scales are used dichotomous, interval scales (Five point likert type scale, seven point scale), ratio scales or mix of it? Open ended, close ended or mix of it.

Sampling: A justified description of nature of universe and population, probability/non probability method used for selection of samples, size of samples, sampling unit(s), statistical technique used for calculation of sample size, justification for the **representativeness and adequacy of samples.**

Data Analysis: Details of scheme of data analysis. Statistical tools to be used for data analysis. The descriptive statistical tools, inferential tools and statistics used for hypothesis testing. Any special tools used for model building viz. regression analysis, discriminant analysis, structural equation modeling and the like. Planningon scheme of data presentation.

into consideration by researcher.

Concepts Used: Detailing of concepts around which the research revolves. The new defined concepts or the concepts defined by researcher that formulates base for study. Or the concepts taken.

Pilot Testing: Planning of pilot testing or testings in case of series of pilots. Samples to be handled, reliability and validity analysis. Hypothesis testing. Statistical tools to be applied to pilot testing.

9. Organization of Research Report:

Narration on the articulation of report after completion with the help of different chapters. The description of chapter contents to be given.

Description of Annexure:

Bibliography/References: APA, MLA, Harward style.

Annexure: Planning of list to be enclosed in the support to main report.

Time Table: Detailed plan of action coupled with time frame. It is to be prepared in table format and carries four columns viz. serial number as first column, second column is period, third column is description of planned work corresponding to period and fourth column is remark/corrections/follow-up.

The documents ends with, Signature with name of research scholar and Signature with name of research supervisor. It also carries the place and date where the document is signed.

Since the research protocol is a planning it is to be written in future tense and after execution of same, the actual detailed implementation is to be written in present tense as initial chapter of research report which is generally titled as, 'Research Methodology' or Introduction to the Study'.

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Section –2

Hypothesis: Meaning and Types of Hypothesis, process of formulating hypothesis.

Meaning of Hypothesis:

Hypothesis is a central and focal point of any research; it is a supposition about desired results of research issues or research phenomenon under study. The research study, especially academic research centered on the hypothesis. Research begins with a problem or a question in the mind of researcher. The question arouses may be from the literature or from the observation of researcher. The answer given to the question using experience and knowledge is a statement of hypothesis. But all such answers cannot be termed as hypothesis. The answers which are trivial or but obvious are not hypothesis.

Say for eg. To a teacher if one asks where male students are intelligent or female students? Then the obvious answer to this question is female students are more intelligent than male students. Since, over a period of time it has been experienced and witnessed. And for this no research is required hence, the answer to this question is trivial statement and cannot be termed as hypothesis since it is not going to be contributed anything new into the existing theory. If a further question asked continuing with previous question that, if female are more intelligent then why male students are getting placed in the campus over female students? Now here there could be various answers to this question. One answer could be male students possess more employability skills compare to female students. Now this statement could be termed as hypothesis since, we do not have conclusive evidence to it. The evidences need to be gathered and put to test.

Hypothesis is a skeptical assumption about desire results. The answer given to a question by a person or research is correct from their perspectives. And also the person or researcher feels like that after testing their answer should hold true.

Definition of Hypothesis:

Various authors have defined the term hypothesis. Few of these definitions are presented here.

Hypothesis as a possible explanation of the phenomenon under observation …

Prof. C.T.Curien…….

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

"The guesses he (researcher) makes are the hypothesis which either solve the problem or guide him for further investigation." –Werkmeister

"Hypothesis as a testable statement of a potential relationship between two and more variable." – Mc Guigan.

Term hypothesis as a "Proposition, condition or principle which is assumed, perhaps without belief, in order to draw out it's logically consequences and by this method to test its accord with facts which are known or may be determined." - Webster's new international Dictionary of English language.

"Hypothesis is an explanation held after careful canvass of known facts, in full knowledge of other explanations that have been offered and with a mind open to change of view, if the facts disclosed by the inquiry warrant a different explanation." –- Chaddock

Above definitions of hypothesis reveals that hypothesis is ……..

1. A possible answer to a question.
2. Establishes imaginary relationship between two or more variables which needs to be tested.
3. A guess may be correct, if not then it will guide further to researcher.

In short hypothesis is affirmatory statement which is an answer to a research question of which the validity needs to be tested using scientific research.

Characteristics of Hypothesis:

In the process of stating the hypothesis students should see that the following aspects of hypothesis are taken care of.

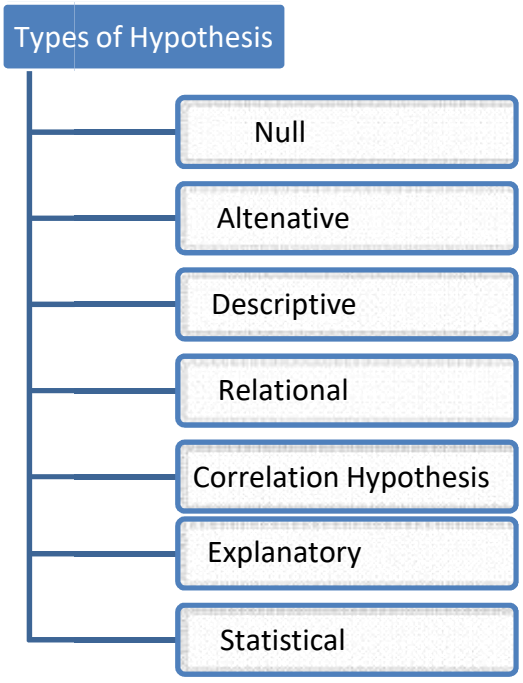
- Conceptual clarity
- Specificity
- Testability
- Availability of techniques
- Theoretical relevance

Consistency –Two or more propositions logically derived from the same theorymust not be mutually contradictory.

eg. There is no significant difference in the skills possesses before perusing MBA and skills possess after MBA course.

See in this example there is conceptual clarity since the example talks about skills preferably managerial skills, the hypothesis is specific since it talks about skills possess before MBA and skills possess after MBA course. The hypothesis can be tested since we have a very good statistical tool i.e. paired sample‘t’ test. The technique of testing is available, we can manually test is or even using a few available statistical software we can test it. The hypothesis has theoretical relevance since now a day’s much has been talked about skills i.e. employability skills and so on. In the same fashion every hypothesis needs to be evaluated on the basis of characteristics of hypothesis.

Types of Hypothesis:



Source: (figure compiled by Authors)

In the parlance of research invariably there are two types of hypotheses discussed one is null hypothesis and another is alternative hypothesis

The beauty of types of hypotheses is, the name suggest the nature of hypothesis. lets study these types of hypotheses.

Null Hypothesis: the null hypothesis is statement which describes the normal and natural position of any variable(s). It is a statement toned opposite to alternative hypothesis. For example if a government report says that the male farm worker in India receives wages of Rs. 300 per day and female farm worker receives wages of Rs. 250 per day then the null hypothesis is

μ= Rs. 300 (for male farm worker)

μ= Rs. 250 (for female farm worker)

Now to check the claim of government regarding the wages received by male and female worker researcher need to collect the data of wages from workers in defined area and compare it with the claim of government using some relevant statistical tool. The results so received from the calculations would decide where the claim of government is correct or otherwise.

Alternative Hypothesis: Alternative hypothesis is statement proposed by researcher. It is a statement which is an answer for a research question. This statement is necessarily affirmative statement. Researcher expect that the testing of hypothesis result in rejection of null hypothesis and acceptance of alternative hypothesis. It means the educated guess as answer for research question is correct. Continuing with example given above of farm worker wages, the alternative hypothesis is

$\mu \neq$ Rs. 300 (For male farm worker)

if, $\mu \neq$ Rs.300 then it could be that

$\mu >$ Rs.300 or

$\mu <$ Rs. 300

and

$\mu \neq$ Rs. 250 (for Female workers)

if, $\mu \neq$ Rs. 250 then it could be that,

$\mu >$ Rs. 250 or

$\mu <$ Rs. 250

Now if the null hypothesis is rejected it means the alternative hypothesis is accepted. This time is to decide which of the alternative hypothesis is accepted. Since, we have three possibilities of alternatives.

Descriptive Hypothesis: The statement which describes the behavior of population under study is termed as descriptive hypothesis. eg. The electronic gadgets along with internet connectivity changed the lifestyle of rural people. Or say the savings and investment pattern of rural people differs compared to their urban counterparts. In the said examples we are only going to find out how the scenario of population is under study. We are not going to find out the reason behind it. It means we are finding the answer for a question what it is? And not why it is?

Relational Hypothesis: the relational hypothesis narrates the possible relationship between two variables and or phenomenon.

eg. More the number of management cases attempted and discussed more the possibility of quality placement.

The relational hypotheses have two sub types one is directional and another is non directional. In directional hypothesis if one variable goes up then another might go up or go down i.e. there might be positive or negative relationship between two variables.

eg. More the income more would be the savings and hence investment. This is directional hypothesis. Where the relationships have been attempted to established or check between income, savings and investment.

Now the statement girls are more intelligent than boys is a non directional statement. Since, we are talking about gender and also the intelligence. It is important in this case to decide on measurement of intelligence. How we are going to measure the intelligence, which also needs to be defined in the research design.

Correlation Hypothesis: Correlation means the relationship between two or more variables. In correlation hypothesis the words positive, negative or no correlation has

been used. The claim is clearly mentioned. eg. There is positive correlation between price of commodity and supply. When price of commodity goes up supply also goes up. There is inverse relationship between price and demand. When price of commodity goes up demand falls down. The directional hypothesis and correlation hypothesis are sounding same. There is difference in the use of hypothesis sentence

construction. Since, in correlation we always use the words positive correlation, negative correlation and no correlation which is explicitly not used in directional relationship. Since this is the way the terms are defined.

Explanatory Hypothesis:

Explanatory hypotheses is one wherein the claims are made that one variable caused other to occur eg. Elderly investors prefer to invest in safer investment avenues as compare to younger investors prefer risky avenues.

Statistical Hypothesis:

One of the simplest forms of hypothesis formulation which uses population parameter to state the hypothesis in the form of numbers only. The population parameters eg. Mean, mode, median, variance, proportion etc.

eg. A company claims that there electric bulb has 3000 hours of life. Then in this case the null hypothesis is

H0: $\mu = 3000$ and alternative hypotheses are
H1: $\mu \neq 3000$
$\mu \geq 3000$

$\mu \leq 3000$

Process of Formulation and testing of Hypothesis:

1. Research issue:
2. Statement of research problem:
3. Hypothesis:
4. Research Protocol:
5. Data collection:
6. Select the relevant test:

7. Decide on level of significant, degrees of freedom and one tail or two tailed test:
8. Calculate the test statistics:
9. Decision on the basis of test statistics

Above depicted the process of hypothesis formulation from step one to step 4 and from step 5 to step 9 are depicting hypothesis testing.

Let's study first four steps of formulating the hypothesis.

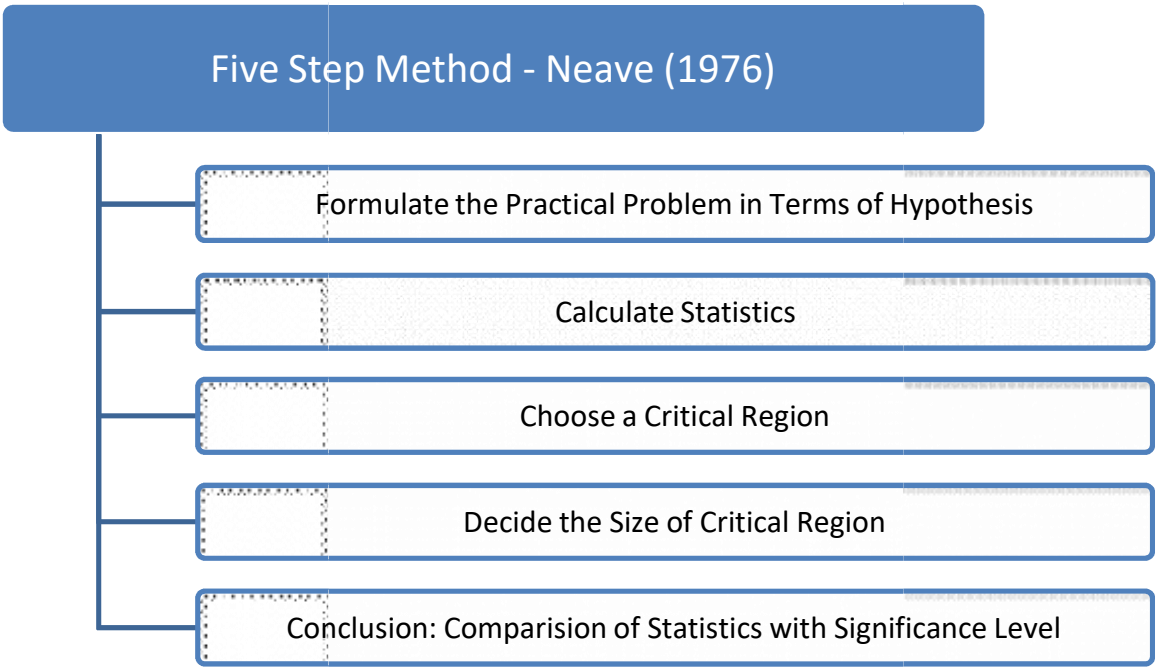
1. **Research issue**: Research issue is a research problem unearthing situation/event/happening which needs a solution and for which possible solutions are exist. Amongst many problems we select one problem for study. The problem leads many questions to answer. We prepare a list of questions then attempt to group the questions carrying similar tone. After grouping of these questions we prioritize these groups on the basis of attention it needed.
2. Statement of Research Problem: Second step of formulation of hypothesis is, select appropriate set of category of research questions or a prioritized research question from earlier step i.e. step one. While selecting question for statement of problem the evidences against questions should be located. The set of questions we select for research should be relevant and interesting. The research problem should be manageable and should have something new to find out. The set of questions we select to find out the answers with the help of systematic research helps us to decide the title of research study. The title encompasses the analytical, geographical, biological, contextual frame of the study. The title is thought short explain the central problem under study.
3. Hypothesis: Third step is stating the hypothesis. As discussed earlier in this chapter hypothesis is an affirmatory answer to the questions raised in step two.
4. Research Protocol: Then to test the hypothesis we need to develop a research protocol. The term research design and research protocol are used synonyms many a times. But research protocol is a document which is written much more in details. The steps involved in the research are narrated much in details which provide answers and guideline to every question a researcher have in his mind

regarding research problem under study. This is discussed earlier. The detailed document needs to prepare which guides research student in the voyage of research.

These are the four important stages of formulation of hypothesis. Then onwards rest stages help to test the hypothesis in which development of data collection schedule appropriately including variables which are going to help the testing of hypotheses needs careful consideration. Data is collected, compiled and processed.

When hypothesis is formulated it needs to be testing using appropriate statistical tools. Steps 5 to 9 details the same. The suitable data needs to be collected and entered into worksheet for further process.

Rests of the stages are elaborative discussed with the help of five step method of hypothesis testing proposed by Neave (1976)



Source: (Figure complied by Authors)

Step 1: Formulate the Practical Problem in Terms of Hypothesis:

The initial stage of hypothesis testing is formulation of hypothesis. The statement needs to be decided to put on test. The null hypothesis is put to test which is basically a standard or control with which the evidence pointing to the alternative hypothesis can be compared.

Step 2: Calculate Statistics:

The statistical calculation is undertaken in this stage. The data for testing a hypothesis has already been collected. Looking towards the scale of measurement used and number of variables to put to test needs to be considered while selecting the

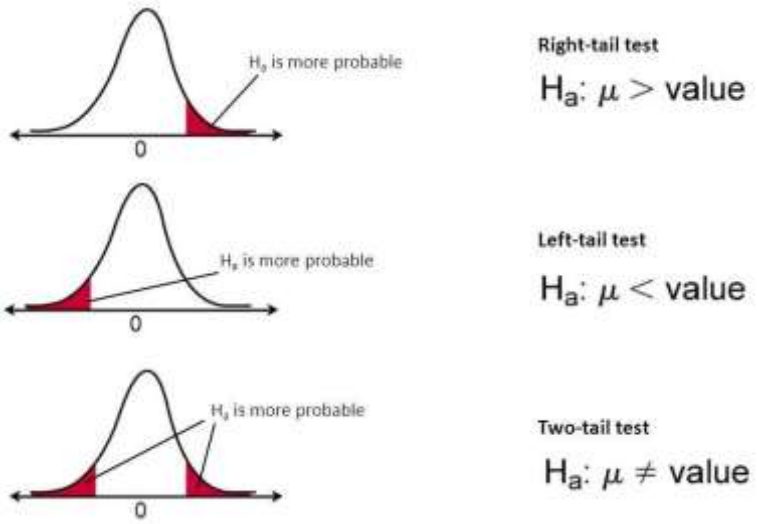
test statistics. The appropriate statistical tool is to be selected for example Chi-square test,‘t’ test and the like. While selecting the test besides scale of measurement and

number of variables processed the conditions to use the respective tests also needs to be considered.

Step 3: Choose a critical region:

Next step after selection of appropriate tool to test the hypothesis is selection of critical region to test the hypothesis. Where it is going to be tested at two tails or right tail or left tailed test. The figure below helps to understand the concept of critical region.

- Right sided, so that we reject H_0 if the test statistics is greater than or equal to some (right) critical value.,
- Left sided, so that we reject H_0 if the test statistics is less than or equal to some (left) critical value
- Both-sided so that we reject H_0 if the test statistics is either greater than or equal to right critical value or less than or equal to left critical value.



Source of figure:

https://www.google.com/search?q=right+tailed+test+left+tailed+test+two+tailed+test&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiJq6rvj7DqAhWOyzgGHdF2C04Q_AUoAXoECAwQAw&biw=1366&bih=635#imgrc=GMz1W1aEWgjgGM, 03.07.2020, 8.52am

The statement of hypothesis itself directs the selection of critical region to test the hypothesis where it is going to be tested at right tail or left tail or two tailed.

The examples given in following table would help to clarity the issue of selection of critical region for testing of hypothesis.

Test	Particulars	Example	H_0 & H_1
Left Tailed Test (One Tailed test)	H_1: parameter < value Notice the inequality points to the left.	The wages of female farm labor is less than Rs. 250/- per day.	H_0: $\mu = 250$ H_1: $\mu < 250$
Right Tailed Test (One Tailed test)	H_1: parameter > value Notice the inequality points to the right.	Female students studying in M.Com score more than first class.	H_0: $\mu = 60$ H_a: $\mu > 60$
Two Tailed Test	H_1: parameter not equal value Another way to write not equal is < or > Notice the inequality points to both sides.	The average of a vehicle claimed by company is 20 kilometers per liter.	H_0: $\mu = 20$ H_1 : $\mu \neq 20$

From above table it is very easy to understand that the words less than, more than directs the tail where hypothesis need to be tested. In the third case just plain statement has been proposed and does not make any use of words more than or less then.

Step 4: Decide the Size of Critical Region:

After deciding the tail where hypothesis is tested the next step is to decide on critical region.

The decision on deciding critical region is based on the amount of risk the research problem carries it means the degree of importance of the research problem under study. Say for example a life saving drug is under test then naturally it needs to

be tested at 1% level of significance i.e. 99% level of confidence. This reveals that after successful testing if the drug is introduced in market that there is probability that out of 100 the 99 patients will have positive impact of the drug.

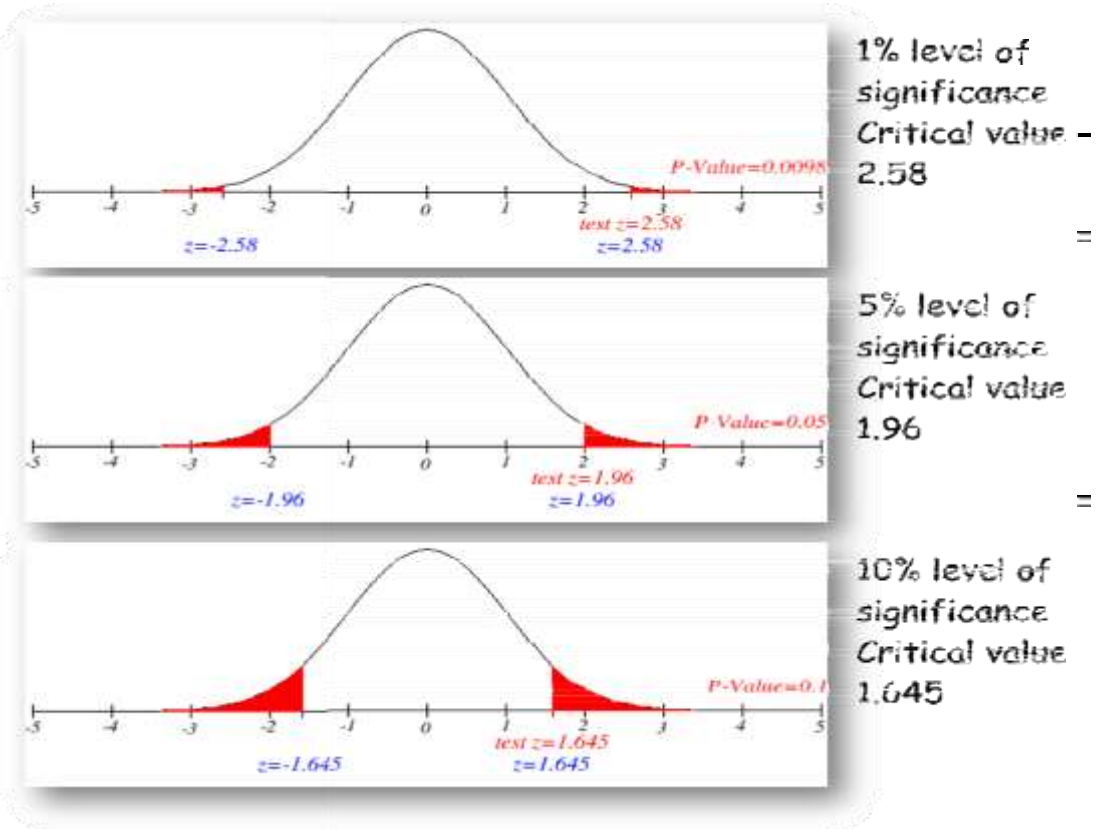
The levels of significance are set generally as 1%, 5% and 10%.

The confidence with which a null hypothesis is accepted or rejected depends upon the significance level u

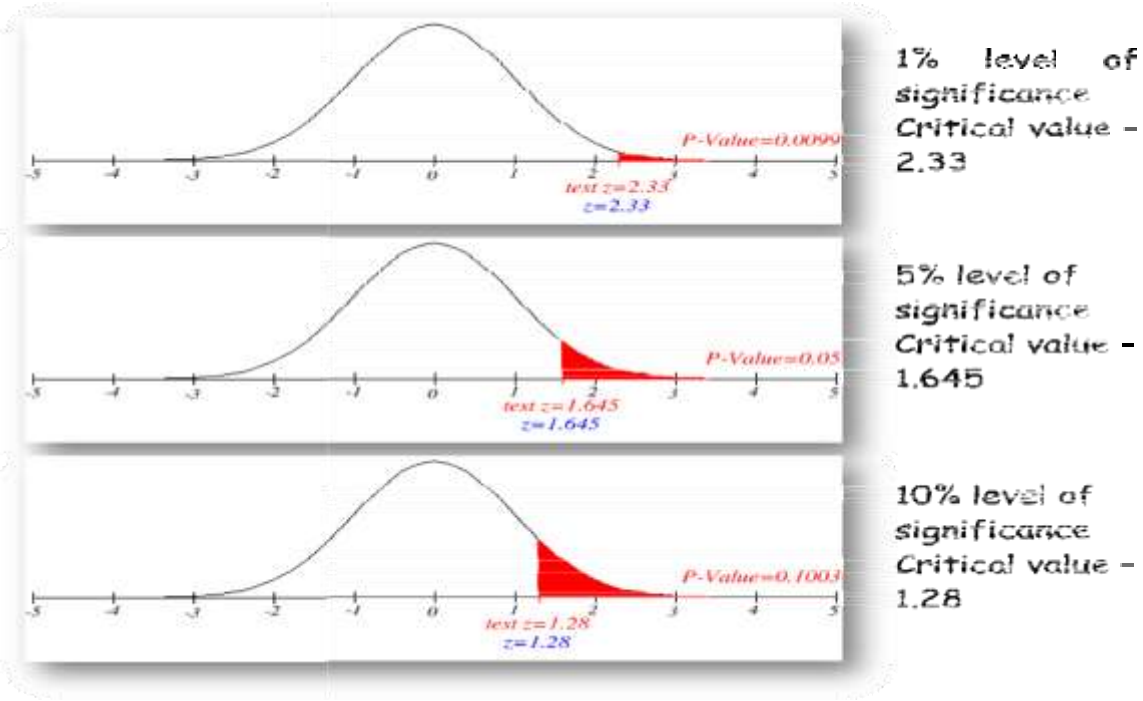
- A significance level of 5% means that the risk of making a wrong decision is 5%.
- The researcher is likely to be wrong in accepting a false hypothesis or rejecting
- A true hypothesis in 5 out of 100 occasions.
- A significance level of 1% provides 99% confidence
- A significance level of 10% provides 90% confidence

Following figures details the two tailed test and one tailed test with its statistical critical value with which we need to compare the calculated test value for decision making to either accept or reject the null hypothesis.

Two tailed test.



One Tailed Test



The critical values of different significance level of one tailed and two tailed tests are summarized in following table.

Critical Value		Level of Significance α	
	1%	5%	10%
Two tailed test	Z = 2.58	Z = 1.96	Z = 1.645
Right tailed test	Z = 2.33	Z = 1.645	Z = 1.28
Left tailed test	Z = - 2.33	Z = - 1.645	Z = -1.28

Step 5: Conclusion: Comparison of Statistics with Significance Level:

After working out aforementioned steps now we have with us two values one is

standardized critical value and another is calculated value. Applying test on the data we have calculated a values it is termed as calculated value and this value need to be computed with standardized critical value which already derived for us and generally at the end of any book on statistics these values are given. We have to make

Comparison of these two values to arrive at decision. The decision whether to reject the null hypothesis or otherwise is to be taken and mention clearly.

Here we need to remember one important thing that while testing the hypothesis we always test null hypothesis and also propose the description of null hypothesis testing first.

Tools used to test the hypothesis.

The quest is to select the appropriate statistical tool to test the hypothesis. Every statistical tool used to test the hypothesis has its own pre conditions regarding the data. The pre conditions are measurement scale used to collect the data, number of variables involved in hypothesis testing, normality of the data and the like. Before selection of tool for testing the pre-requisite needs to be taken care of.

Generally for the beginners it is two important dimensions needs to be taken into consideration while selecting the hypothesis testing tool. One dimension is the scale of measurement of data. The data can be measured using either of the four scales. One is nominal scale, second is ordinal scale, third is interval scale and fourth is ratio scale. Second dimension needs to be taken into consideration is how many variables are involved in testing of hypothesis. Either one variable or two variables or three variables. It is called as univariate analysis, bi-variate analysis and multivariate analysis. Now these two dimensions help to decide the appropriate statistical tool to be selected to test the hypothesis.

Following table is exemplary to explain the tools

Testing of Hypothesis

Number of Variables processed	Measurement Scale Used		
	Univariate	Bi-Variate	Multivariate
Nominal	Chi-Square Test K-S Test	Chi-Square Test	Chi-Square
Ordinal	Count and %	Rank Correlation	Rank Correlation
Interval	One Sample 't' Test	Independent sample 't' Test Paired 't' Test Regression	ANOVA Regression
Ratio	One Sample 't' test	Independent sample 't' Test Paired 't' Test Regression	ANOVA Regression

Source: (compiled by Authors)

The table shows that if one variable is in process of which the data is collected using nominal scale then chi-square test is useful. Likewise if the data is measured using ratio scale and number of variables is more than two then Anova can be used. If in this case researcher wants to establish the relationship then Karl Pearson correlation coefficient followed by regression can be used.

We have very good't' test family extensively used for hypothesis testing. If the data is collected using interval and or ratio scale in any case of univariate or bi-variate data appropriate test from't' test family can bring in use.

The relevant discussion of hypothesis testing is done.

Sampling

Research in social sciences has a biggest quest on sampling. The major characteristic of sampling is of its representativeness of population. In physical science like chemistry,

medical, physics, biology, botany and the like only one pigment, piece of material, drop of blood is enough as a sample since it represents the entire population. The principal of homogeneity plays role. Hence, testing one piece out of whole or testing one drop of blood out of entire body suffice the purpose and the results received then are applicable to the whole lot. The experimentation done on a sample gives same results on experimentation on whole lot. The subject of social science is human beings and by nature human being is heterogeneous in thoughts, attitude, behavior and personality. Hence, one person cannot represent the entire population. Even in our family the thoughts and attitudes towards one issue are different. To be more specific the thoughts and attitudes of twins does not found same at most instances. This poses challenge before research scholar of social sciences to decide on sampling frame on the magnitude of its representativeness. Themajority of the results of research are based on the very reason of representativeness of sampling. In social science research we often take sampling study and the results such found from study are generalize to the population. The way sampling behaves we say the population behaves like the same. Hence, selecting the most appropriate sampling which truly represents the population is a quest. The results are entirely depending on the method adopted for selection of samples.

Various definitions of sampling are put forth by scholars few to mention here are:

Definition of Sampling:

The term sample should be reserved for a set of unit or portion of an aggregate and material which has been selected in the belief that it will be representative of the whole aggregates.

- Frank Yates

"A Sample may be defined as a part of population which selected and examined for estimating the quality of the population." – Sharma A. (2006)

"A Sample is a collection of observations representing only a portion of the population." Lapin L. L. (1973).

"A sample as the name implies is smaller representative of a larger whole." - William J.George and Paul K. Hatt

"A statistical method is a miniature picture or cross section of the entire group or aggregate from which the sample" (Young, 1939)

Understanding sampling requires understanding few related concepts as

Universe: Universe is the maximum possible source of information. Say for example researcher wish to assess opinions on changes in the university examination system from the heads of the higher educational institute i.e. principals of HEI affiliated to Shivaji University, Kolhapur. Now the question is social science is human beings and by nature human being is heterogeneous in thoughts, attitud, behavior and personality. Hence, one person cannot represent the entire population. Even in our family the thoughts and attitudes towards one issue aredifferent. To be more specific the thoughts and attitudes of twins does not found same at most instances. This poses challenge before research scholar of social sciences to decide on sampling frame on the magnitude of its representativeness. Themajority of the results of research are based on the very reason of representativeness of sampling. In social science research we often take sampling study and the results such found from study are generalize to the population. The way sampling behaves we say the population behaves like the same. Hence, selecting the most appropriate sampling which truly represents the population is a quest. The results are entirely depending on the method adopted for selection of samples.

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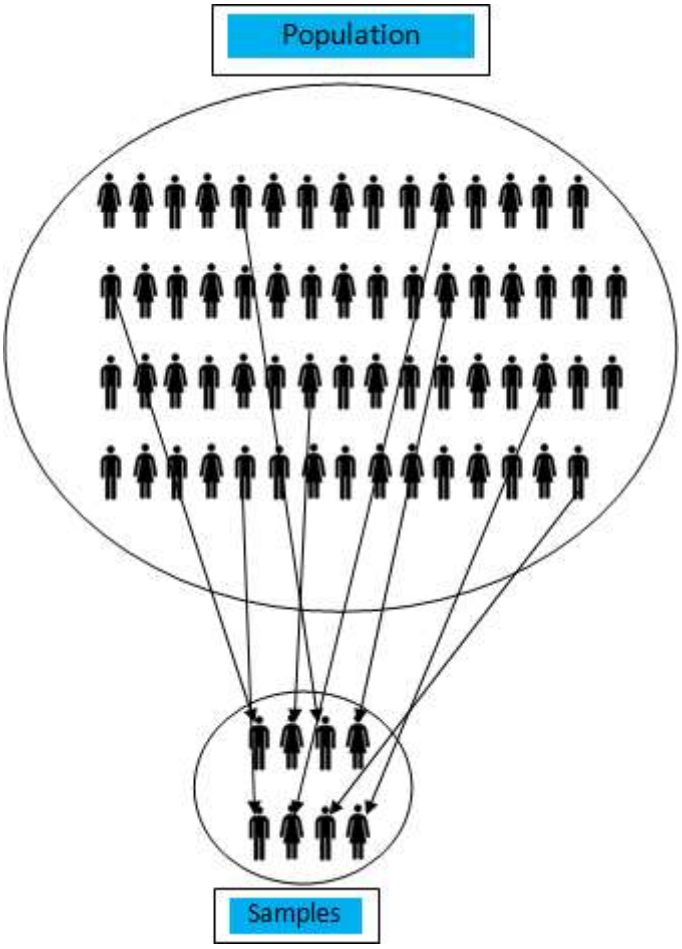
2. Universe: Universe is the maximum possible source of information. Say for example researcher wish to assess opinions on changes in the university examination system from the heads of the higher educational institute i.e. principals of HEI affiliated to Shivaji University, Kolhapur. Now the question is

what is the universe of study? Universe of study is number of colleges affiliated to Shivaji University, Kolhapur i.e. 293. So the universe is 293 principals.

3. Population: Population consists of whole set of data or information from the entire universe which is considered to be the whole source of information. The example we are studying in this case not all the colleges have appointed Principals then in this case the number of available Principals is the population. See that is the difference between universe and population.

   The population is of two types one is finite population and second is infinite population. Finite population where in one can count the size of information source. If the information source is students, workers, housewife's etc. then one can count these information sources and even prepare a list of the sources. Whereas infinite population refer to information sources which cannot be counted. For example how many consumers in Kolhapur, Sangli and Satara like to consume beverages or Pizza. Virtually the entire data sources are finite only but sometimes counting a few data sources is difficult hence they are treated as infinite. We can count how many consumers in these three districts consume beverages then it is not impossible but difficult since we needs to apply different kind of methodology and would also consume much resources. The type of population i.e. finite and infinite determines the type of sampling method to select the samples.

4. Sampling frame: Sampling frame is a defined part of a population. This is a final list of sources of information finalized by researcher from which a few samples are going to pick up for study. For example out of 293 colleges only 193 colleges found to have principal appointed then the population for the study is 193. Then looking towards the issue/problem under study we finalized the list of principles to be considered for study, say principal having a particular experience, principal as per gender, principles working in single faculty college or multi faculty colleges and so on. The final list of principles would be prepared and then from the list applying appropriate statistical technique the number of samples get finalized.



Source: (Figure developed by Authors)

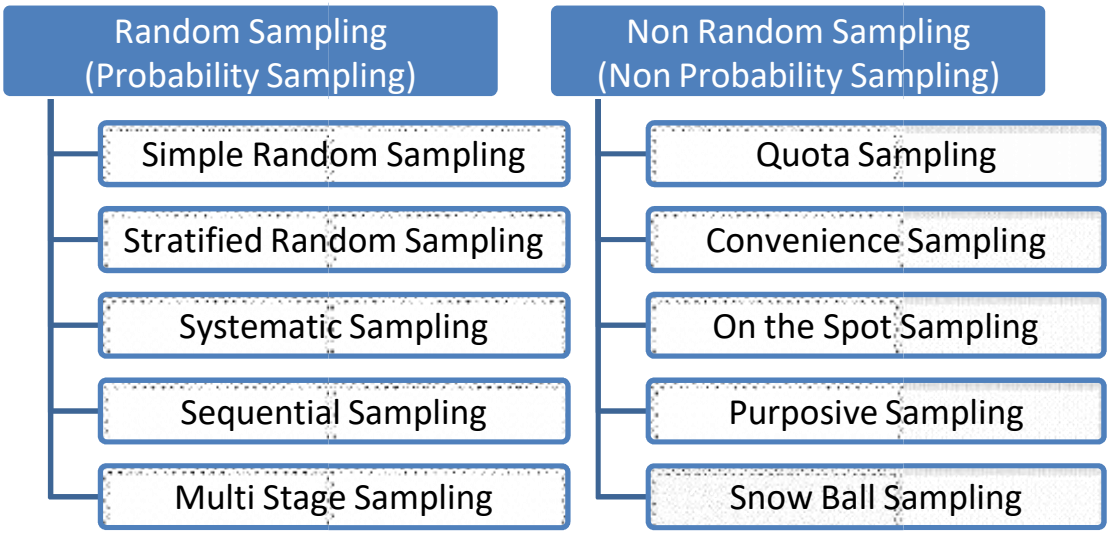
One very important characteristics of sample students have to remember is, samples must be representative of population. This is very difficult in case of social sciences. Hence one person's opinion cannot be considered as the opinion of population. Likewise one student's response towards quality of teaching in a particular college cannot be considered as the opinion of entire class.

Statistically capital letter 'N' is denoted to know the population and small letter 'n' is denoted to know sample.

Types of Sampling:

Following diagram narrates the different types of sampling.

Entire types of sampling are classified into two groups one is random sampling also called as probability sampling and another is non random sampling also called as non probability sampling.



Source: (figure composed by authors)

Random Sampling: (Probability Sampling):

Random sampling is one where every sample in the population has equal opportunity or chance to participate as a sample in the study.

Say in a class of 60 students, teacher wish to take feedback on the understanding of a topic delivered. Applying random sampling every student has equal chance to be selected as sample to provide feedback on. If teacher asks to specific students pointing out or students seating at first bench then it is not termed as random sampling. Since here few specific students only have pointed out and others have not given an opportunity to be a part of feedback. The random sampling generally has less sampling errors as compared to non random sampling.

Simple Random Sampling: This sampling method to select the sample in which out of the total population researcher select the number of samples by providing equal opportunity to every sample. The simple method to select such samples is lottery method. Say you have to select 10 people from a group of 30. Just make 30 chits

naming individual in every chit, put those chits in a box, mix it well and blindly take 10 chits out of the box. Make a list of those 10 names they are your samples. In case of large size of population using Ms-Excel also the random numbers are generated and out of list of population the computer generated sample numbers is to be termed as samples for the study.

Stratified Random Sampling: when the population is large and moreover heterogeneous in that case for getting good and representative results. The population is groups on the basis of some variables to make it homogeneous. The number of homogeneous groups is called as stratum. From every stratum using simple random sampling mentioned above the samples are selected and taken for study are termed as stratified ransom sampling. There are two methods into stratified random sampling. One is proportionate stratified sampling and disproportionate sampling. In proportionate stratified sampling the sampling is selected in the ratio of population of group. And in disproportionate sampling the samples are taken without considering the size of stratum.

For example few studies need to understand the opinions on the basis of gender differences. In such case when we classify the samples in two groups of gender i.e. male samples and female samples and then we take appropriate size of samples using random sampling method then this is stratified random sampling since the samples are classified into two stratums i.e. male and female. Likewise few studies demand stratification of companies on the basis of their constitution i.e. public limited companies, private limited companies, partnership firms, proprietary firms, cooperative firms and the like.

Systematic Sampling: the first unit is drawn at random from the selected class interval and the remaining units are systematically and purposively drawn. eg. The size of the population (N) is 500, and the size of the sample (n) is 50; then the proportion of the sample would be (N/n=10) 1:10. The first unit may be chosen at random from the first interval i.e. 1-10. Suppose the first unit drawn is 5, then the second would then be 5+10=15(5+K), where K stands for N/n; the third sample

would be 5+K+K i.e. 5+2K=25.

For example to study the satisfaction of workers towards welfare facilities provided by large scale company. A list of all workers arranged in a alphabetic order

is to be taken. Following the above formula the samples are to be selected for study. In drawing systematic sampling the updated data of population is needed.

Sequential Sampling: the process of selecting a small number of samples from a large population. Sequential sampling is generally used in industrial tests. Statistical quality control of finished products. In a pharmaceutical company, small samples are drawn from each batch in a sequential manner to test the quality in which case sequential sampling is useful.

For example a pharmaceutical company or a company producing milk products like paneer, ice crème or a company manufacturing hair oil, edible oil will have a policy to pick up every 100^{th} product or every 1000^{th} product from a production line for testing to decide whether the product is in line with defined parameters of quality. The 100^{th} or 1000^{th} product will be tested in laboratory for its defined quality parameters.

Multi Stage sampling: the selection of sample is made in different stages. The selection is made in different stages so called multi stage sampling. This method is used when the universe is very large area.

eg. Study the migrated labour in sugar industry of Maharashtra.

i. Prepare list of district where sugar factories are in existing. And select randomly few districts for study.
ii. Prepare list of sugar factories from the selected district. And select randomly few sugar factories for study.
iii. Prepare list of all migrated labour from selected sugar factors. Suppose the list of labour is 1000.
iv. Select randomly number of labour to be studies. eg. 10% or 20% etc.

Another example is when one wish to take a election poll multistage sampling is used. To know the opinion of citizens of nation towards an economic policy, educational policy and the like then multistage sampling is used.

Non Random Sampling: (Non Probability Sampling)

It is exactly opposite to random sampling, where every sample in the population does not get equal opportunity to be selected as a sample.

This is deliberate effort to select the sample for study.

Quota Sampling: This sampling is parallel to stratified sampling. In quota sampling for better representation of population the entire population is divided into various groups i.e. stratum and from every stratum the number of samples to be taken are decided. The stratums are done on the basis of some kind of similarities like gender, income group, age group, occupation and the like. The samples from such sub groups are selected to find a general opinion of the entire group. For example there is quite a possibility the different gender and people from different socio economic class may have different preferences towards investment and also have different objectives behind investment. In such case quota sampling is preferred.

Convenience Sampling: The name itself suggests that the sampling is drawn at the convenience of researcher is termed as convenience sampling. This method of sampling preferably used during pilot testing. For example researcher takes samples from their nearby vicinity so to avoid travelling. Or researcher would include those people as samples that are easily get ready to cooperate to give feedback to data collection instrument. Your own friend circle or for a teacher their own students are better example of convenience sampling.

On the Spot Sampling: sometimes some persons opt for their own inclusion or non-inclusion in the sample units. In this case, researcher may select such samples on the spot. Reporters usually use this method of sampling. At the place of event happened reporter interview the people who are available at the place and seen the event happened. Many a times the sample already listed for inclusion but due to non availability the sample needs replacement. At this stage also on the spot sampling technique is used. Many a times we see the journalist while taking the opinions of people about a particular happening they use on the spot sampling. The people who are available to comment on and also ready to participate in the discussion are taken

and interviewed.

Purposive Sampling: the name itself suggests the nature of purposive sampling. The samples are purposefully selected and taken for study. Say for example researcher wish to study the effect of a particular cosmetic on the fairness of skin. In such case samples using the specific cosmetic need to be identified and taken for study. This act of identifying a specific sample using a defined cosmetic is purposeful act.

Snow Ball Sampling: Snow ball is used when the population is scattered and niche in nature. It is difficult for a research student to exactly identify the samples from the population. In such cases one sample is identified and from the same sample the references for next samples are taken. Say for example researcher with to study the quality deployment function of racing bikes then finding racing bikes users is difficult hence, in this case anyhow from the population one racing bike user is identified and from him information of such racking bike owner/users will be taken. From the next sample racing bike user the additional information on racking bike users will be taken. This method is termed as snow ball sampling.

Features of Good Sampling:

1. Representative Character: Sample must be representative of population. Since in social sciences most of the time people are the samples and the very characteristics of population is, it is heterogeneous. From this heterogeneous population selecting samples that would represent the population is difficult task.
2. Small sampling error: Sample design must be such which results in a small sampling error.
3. Adequate number of samples: entire study is governed by the representative units. Since the opinions are very subjective in social sciences it is necessary that their number should be adequate. We often use the statistical formulae to calculate the sample size.
4. Economic Viability: Sample design must be viable in the context of funds available for the research study.

Sample Size Calculation:

There is range of formulas to calculate the sample size. But for our discussion

we are going to limit only two formulas.

As we have discussed above that the population is of two types one is finite and another is infinite population.

We have simple two formulas below one is used when the population is finite and another is used for infinite population.

$$n = \frac{N}{1 + N * (e)^2}$$

Where,

n= sample size

N = Size of population

e= sampling error

for example,

Principal of college wish to take feedback from students regarding different facilities provided in the college. Facilities like sports, library, computer laboratory, language laboratory and the like college students strength is 3200 students. The question is how many students to be taken as a sample?

By using above formula and assuming 5% sampling error the sample size is calculated as below.

$n = 3200/1+3200\ (0.05)^2$

n= 355.5 the calculated sampling size needs to be rounded off since we cannot have half student to interview hence the final sample size is 356.

Following formula is used to calculate sample size where population is infinite means the exact information resources are difficult to calculate.

For example

You want to know the additional likely flavors preferred by consumers of potato chips. In this case the consumers to be considered who consumes potato chips often. We cannot estimate the size of number of consumers in a defined geography. In such

cases following formula is to be used.

Sample Size Formula

$$n = \left(\frac{zs}{E} \right)^2$$

Where,

n= sample size

Z= the desired level of significance (confidence level)

S= standard deviation

e= tolerable sampling error

The assumed tolerable sampling error is 5% and the standard deviation is 0.66.
at 5% level of error the value of ‘Z’ should be taken at 95% confidence level i.e. 1.96.
So plugging the above figures in given formula yields,
n=((1.96*0.66)/0.05))2
n=669.36

rounded off to 670

So the adequate sample size calculated using stated formula is 670.

Table 1: Table for Determining Minimum Returned Sample Size for a Given Population Size for Continuous and Categorical Data

Population size	Sample size					
	Continuous data (margin of error = .03)			Categorical data (margin of error = .05)		
	alpha = .10 t = 1.65	alpha = .05 t = 1.96	alpha = .01 t = 2.58	p = .50 t = 1.65	p = .50 t = 1.96	p = .50 t = 2.58
100	46	55	68	74	80	87
200	59	75	102	116	132	154
300	65	85	123	143	169	207
400	69	92	137	162	196	250
500	72	96	147	176	218	286
600	73	100	155	187	235	316
700	75	102	161	196	249	341
800	76	104	166	203	260	363
900	76	105	170	209	270	382
1,000	77	106	173	213	278	399
1,500	79	110	183	230	306	461
2,000	83	112	189	239	323	499
4,000	83	119	198	254	351	570
6,000	83	119	209	259	362	598
8,000	83	119	209	262	367	613
10,000	83	119	209	264	370	623

NOTE: The margins of error used in the table were .03 for continuous data and .05 for categorical data. Researchers may use this table if the margin of error shown is appropriate for their study; however, the appropriate sample size must be calculated if these error rates are not appropriate. Table developed by Bartlett, Kotrlik, & Higgins.

Source: (https://www.slideshare.net/sumitmonk/samle-size, 1.9.2020, 6.00pm)

SELF ASSESMENT QUESTIONS

Answers for Check Your Progress

Objective Type Questions. Choose the appropriate alternative

1. The major Characteristics of Hypothesis are
    a. Conceptual clarity
    b. Specificity
    c. Testability
    d. All the above
2. The hypothesis narrates the possible relationship between two variables is termed as …
    a. Descriptive hypothesis
    b. Explanatory hypothesis
    c. Relational hypothesis
    d. None of the above
3. The hypothesis stated using population parameters viz. mean, median etc. is termed as ….
    a. Descriptive hypothesis
    b. Statistical Hypothesis.
    c. Explanatory hypothesis
    d. Relational hypothesis
4. The statement of hypothesis can be tested at ….
    a. Right tail
    b. Left tail
    c. Two tails
    d. All the above
5. The critical value at 1% level of significance two tailed test is
    a. 1.96
    b. 2.58
    c. -1.64
    d. None of the above

6.The critical value at 5% level of significance one tailed test is

a. 2.33

b. 1.64

c. 1.28

d. None of the above

7. The document research design is also termed as …….

a) Research Protocol b) Hypothesis

c) Sampling d) None of the above

8 . A Research design is ……..

a.It is a systematic plan

b) It specifies methods and procedures to conduct research

c) It laid down condition of collection and analysis of data.

d) All the above

9.The question when in research design sought the answer for.

e) Statistical design b) Period of conduct of study

c) Sampling design d) None of the above

10.Statistical design decides on the ….

f) Implementation of research design

g) Processing and Analysis of data

h) Conditions of observe

i) All the above

11.The logical sequence of research designs are

j) Experimental – Diagnostic – Descriptive – Exploratory

k) Exploratory – Descriptive – Diagnostic – Experimental

l) Descriptive – Diagnostic – Experimental – Exploratory

m) Diagnostic – Descriptive – Exploratory – Experimental.

12.One of the important principles of experimental research design is.

a. Principal of observation

b.Principal of sampling

c.Principal of randomization

d. None of the above

13.The type of random sampling includes

a. Simple random sampling

b. Stratified random sampling

c. Systematic sampling

d. All the above

14.The type of non random sampling includes

a. Quota sampling

b. Convenience sampling

c. On the spot sampling

d. All the above

15.Random sampling is also called as

a.Non probability sampling

b.Probability sampling

c.Both probability and non probability sampling

d.None of the above

16.In the formula of sample size calculation the term ‘e’ refers to

a.Exact figure b.Extract from population c.Sampling error d.Estimated figure

17.The feature of good sampling includes

a.Economic viability b.Adequate number of samples c. Representative of population d.All the above

State whether the following statements are True or False.

1. Hypothesis is a central and focal point of any research.
2. Hypothesis is a skeptical assumption about desire results.
3. Hypothesis is a possible answer to a question.
4. Two or more propositions logically derived from the same theory must be mutually contradictory.
5. Null and alternative hypothesis are the same statements.
6. Research design specifies methods and procedures to conduct research
7. Research only talks about sampling and hypothesis
8. Research design is a blue print, a comprehensive and detailed document which facilitates research in systematic and scientific manner.
9. The question whom ? in research design sort out sampling design issues.
10. Descriptive research design is very flexible.
11. Experimental research design necessarily follows a hypothesis
12. Sample is a miniature picture of the entire group
13. Universe is the maximum possible source of information
14. Universe and population and same concepts.
15. The population is denoted by small letter n and sample is denoted by capital letter
16. Random sampling is one where every sample in the population has equal opportunity or chance to participate as a sample in the study.

Fill in the Blanks.

1 ..... as a possible explanation of the phenomenon under observation.

2. The statement of alternative hypothesis is .....to the null hypothesis.

3. Alternative hypothesis is statement proposed by …….
4. If the null hypothesis is rejected it means the ……. hypothesis is accepted
5. In descriptive hypothesis the statement of hypothesis describes the behavior of ……
6. Outcomes of exploratory research design are the inputs to the ---------- research design.
7. Principal of randomization refers to selection of samples strictly on ..... basis to avoid possible biases.
8. --is a master plan specifying the methods and procedures for collecting and analysis the needed information.
9. 3talks about the population, sampling unit, and overall sampling frame.
10. Fundamental research also known as----------research

11. Sampling frame is a defined part of a…….

12. Samples must be ..... of population.

13. Statistically small letter '…. ' is denoted to know sample.

14. Non random sampling also called as ..... sampling.

15. In the formula of sample size calculation *'s'* explains …….

Solve the following Case Studies

1. A pharmaceutical distributor having supplying medicines to 326 retail counters in a city wish to know the satisfaction of retailers towards the services provided by a distributor. Calculate the sample size for 1% level of significance, 5% and 10% level of significance.
2. Researcher wanted to know the satisfaction towards government functioning during a calendar year/financial year or in the pandemic situation like Covid-19 and the like. Calculate the sample size to be approached.

Summary :

Finding the answers to the research questions are pivotal. Research design is a systematic way to find the answers to the research problem. The research design has four major sub designs within it, sampling design, statistical design, operational design and observational design. Research design is a systematic plan and comprehensive document which answers the basic questions what is the research problem under study, why the study has to be undertaken, which data needs to be considered (the variables and categories), from whom the data is to be collected (sampling), when the data is to be collected and how to analyze the data and interpretit. There are four major designs of research i.e. exploratory research design, descriptive research design, diagnostic research design and experimental research design. Every research design has its own features. The important concept in researchdesign is hypothesis. Since the entire research is revolves around this concept. We undertake research to test the hypothesis. Hypothesis is a end point of research. Hypothesis is skeptical assumption about the results of research. When researcher has a question or questions in mind then the question or questions are answered by researcher with almost care using the experience and knowledge acquired. The answer is tentative not confirm whether it is right or wrong and hence put to test. So the statement of answer which put to test is hypothesis. There are major two types of hypotheses one is null hypothesis and another is alternative hypothesis. Researcher tests the null hypothesis. The science has evolved towards every stage of research. Hypothesis

testing as well a scientific process which involves five steps, first is formulate the practical problem in terms of hypothesis then calculate statistics, choose a critical region, decide the size of critical region and last is draw the conclusion. One of the important aspects of research design is sampling. Since in social science we get the data from people and hence sampling carries importance. Sampling is cross section of population. It is a smaller representation of larger population. Since always it is not possible to attain the entire population under study. We take a small portion of population and study and then the results we get out of it we generalize it to the population. We say that population behaves like this since we got it known from the samples. Since the generalization of results are based on the results of population the right selection of sample carries utmost importance. Sample must be representative one of population and that is the quest. Selection of samplecan be done by two methods one is probability sampling method and another is non probability sampling method. Probability sampling means every sample has equal opportunity to be selected as sample and non probability method is quite reverse to it. The science has developed and formulae are available to calculate the sample size

Answers to check your progress –

Section: 1

Answers to the questions:						
MCQ type questions	1	a	2	d	3	b
	4	b	5	b	6	c
True of False	1	True	2	False	3	True
	4	True	5	False	6	True
Fill in the blanks	1	Descriptive	2	Random	3	Research Design
	4	Sampling Design	5	Statistical Design	6	Ideal /Basic

Section: 2

Answers to the questions:						
MCQ type questions	1	D	2	C	3	B
	4	D	5	B	6	B
True of False	1	True	2	True	3	True
	4	False	5	False	6	
Fill in the blanks	1	Hypothesis	2	Opposite	3	Researcher
	4	Alternative	5	Population	6	

Section: 3

Answers to the questions:						
MCQ type questions	1	d	2	d	3	b
	4	c	5	d		
True of False	1	True	2	True	3	False
	4	False	5	True		
Fill in the blanks	1	population	2	representative	3	n
	4	non probability	5	Standard Deviation		
Solve the examples	1	1% = 316 5% = 180 10% = 77	2	670		

Exercise:

a. Define research design and narrate various components of research design.
b. Elaborate different types of research designs.
c. Details the contents of research design.
d. Narrate the basic principals need to be observed in experimental research design.
e. Which research design according to you is more reliable to get the accurate results – Justify your answer.
f. Define a term hypothesis and briefly narrate the different types of hypothesis.
g. Hypothesis is backbone of any research project – discuss.
h. Elaborate the process of formulating and testing of hypothesis.
i. Discuss the five step method of hypothesis testing.
j. Define sampling and explain the concepts related to sampling
k. Brief the different types of sampling
l. Explain the sample size calculation.

GLOSSARY

a. Research Design: is a document that detailed plan which answers every question arouses regarding research problem under study.

b. Components of research design: what (problem under study, hypothesis and objectives of study), Why (importance of study), which (data, findings and suggestions), whom (sampling design, variables detailing) , when (period of study) and how (statistical design, operational design, observational design).

c. Types of research designs: Four types of research design, exploratory research design, descriptive research design, diagnostic research design and experimental research design.

d. Three basic principles of experimental research design: Three principles, one is principle of randomization, principle of replication and principle of local control.

e. Features of good research design: reliability of data, experimental error, information yields, flexibility and economical.

f. Hypothesis: Hypothesis is a central and focal point of any research; it is a supposition about desired results of research issues or research phenomenon under study. Hypothesis is a possible explanation of the phenomenon under observation.

g. Types of hypothesis: Null hypothesis, alternative hypothesis, descriptive hypothesis, relational hypothesis, correlation hypothesis, explanatory hypothesis and statistical hypothesis.

h. Five steps for testing hypothesis: First is formulate the practical problem in terms of hypothesis, calculate statistics, choose a critical region, decide the size of critical region and the last is comparison of statistics with significance level.

i. Sampling: sampling as a part of population which selected and examine for estimating the quality of the population.

j. Random sampling: Random sampling is one where every sample in the population has equal opportunity or chance to participate as a sample in the study.

a. Non random sampling: It is exactly opposite to random sampling, where every sample in the population does not get equal opportunity to be selected as a sample.

b. Types of random sampling: Simple random sampling, stratified random sampling, systematic sampling, sequential sampling and multi stage sampling.

c. Types of non random sampling: Quota sampling, convenience sampling, on the spot sampling, purposive sampling and snow ball sampling.

Reference for further study:

G., Z. W. (2013). *Business research methods.* UK: South-Western Cengage Learning.

Kothari, C. R., & Garg, G. (2015). *Research Methodology - Methods and Techniques* (3rd Reprint ed.). New Delhi: New Age Internaional Publishers.

Michael, V. P. *Research Methodology.* Mumbai : Himalaya Publishing House .

Nargundkar, R. (2008). *Marketing Research.* Bangalore: Tata McGraw-Hill Education.

Sachdeva, J. K. (2011). *Business Research Methodology* (Vol. 2nd Revised). Mumbai: Himalaya Publishing House.

Selitiz, C. (1965). *Research methods in social relations.* New York: Methuen & Co. LTD.

Young, P. V. (1939). *Scientific Social Surveys and Research.* New York: Prentice-Hall, Inc.

Zikmund, W. G. (2008). *Business Research Methods.* Mason (Ohio): South-Western Cengage Learning,.

UNIT III

DATA COLLECTION

Unit Objectives

- Understand the meaning of variables and identify different types (e.g., independent, dependent, continuous, categorical).
- Identify and describe various techniques for collecting data and their appropriate contexts.

Define primary data and explain its significance in research.

Evaluate Advantages and Limitations of Primary Data:

- Analyze the benefits (e.g., relevance, accuracy) and drawbacks (e.g., cost, time) associated with primary data collection.

Examine Techniques for Primary Data Collection:

Interview:

- Understand different types of interviews (structured, unstructured) and their appropriate applications.

- **Schedule:**
  - Learn how to structure schedules for data collection and their importance in research.
- **Questionnaire:**
  - Analyze the design, types of questions, and effectiveness of questionnaires in gathering data.
- **Observation:**
  - Assess various observational techniques and their suitability for different research scenarios.

Secondary Data

Define Secondary Data:

- Clarify the meaning of secondary data and its role in research.

Identify Sources of Secondary Data:

- Explore various sources of secondary data, including academic journals, government publications, and online databases.

Comparative Analysis

Compare Primary and Secondary Data:

- Differentiate between primary and secondary data in terms of characteristics, advantages, and appropriate usage contexts.

Practical Skills Development

Develop Data Collection Skills:

- Equip learners with practical skills to select suitable data collection techniques based on specific research objectives.

Evaluate Data Quality:

- Analyze and assess the quality, reliability, and validity of data obtained from various methods and sources.

Application of Knowledge

Apply Knowledge to Real-World Scenarios:

- Encourage students to apply data collection techniques in practical situations, enhancing their research competencies.

By achieving these objectives, learners will gain a thorough understanding of data collection methodologies, enabling them to conduct effective and reliable research.

Developing hypothesis:

Hypothesis is tentative assumption which may probable answer to the research question. It is a working assumption for a specific research. It should be a logical statement. 'By formulating a series of reasonable guesses of cause and effect, we are able to understand and explore the events in our surrounding environment (Leedy and ormrod, 2001). For proper evaluation, the researcher needs to define specifics in operational terms. A hypothesis is a 'supposition made as a starting point for further investigation from known facts' (Pearsall & Trumble, 1996). It has aim of generating new knowledge. It should be novel and contain a testable prediction. Hypothesis may be formulated on the basis of earlier theories or review of literature or pilot studies

Hypothesis Meaning:

A hypothesis is a proposed explanation for a phenomenon or a tentative answer to a scientific question. It's a statement that suggests a relationship between two or more variables and is formulated based on prior knowledge, observations, and reasoning. Hypotheses are central to the scientific method as they guide experiments and investigations aimed at testing their validity.

Formulation of hypothesis:

Formulating a hypothesis typically involves several key steps:

1. Identifying the Problem: Clearly define the topic or issue you want to study or explore.

2. Conducting Background Research: Gather information and conduct a literature review to understand existing knowledge and theories related to your topic.

3. Developing a Research Question: Based on your understanding, formulate a specific research question that addresses the problem or gap in knowledge.

4. Formulating Hypotheses: Hypotheses are specific statements that propose a relationship between variables in your study. They are usually framed as predictions about what you expect to find.

- Null Hypothesis (H_0): States that there is no significant relationship between the variables or no effect of the treatment.

- Alternative Hypothesis (H_1 or Ha): States the opposite of the null hypothesis, suggesting that there is a relationship between the variables or an effect of the treatment.

5. Testing the Hypothesis: Determine the appropriate research design and methods to test your hypotheses. This could involve experiments, surveys, observational studies, etc.

6. Analyzing Data: Collect data according to your research design and analyze it using statistical methods to determine whether your findings support or reject the hypotheses.

7. Drawing Conclusions: Based on your analysis, draw conclusions about whether your hypotheses were supported or not. Discuss the implications of your findings and how they contribute to the field of study.

Remember, hypotheses should be specific, testable, and based on existing knowledge or theory. They guide your research and provide a framework for interpreting results.

Testing of hypothesis :

Sure, hypothesis testing is a fundamental concept in statistics used to make decisions or inferences about a population based on sample data. Here's a brief overview:

1. Formulate Hypotheses: Start with a null hypothesis (H_0) that represents a default position and an alternative hypothesis (H_1) that contradicts H_0 and is what you're trying to prove.
2. Choose a Significance Level: Typically denoted as α (alpha), it determines how confident you want to be in your decision. Common levels are 0.05 or 0.01.

3. Select a Test Statistic: This depends on the type of data (e.g., t-test, z-test, chi-square test) and the nature of the hypotheses being tested.
4. Compute the Test Statistic: Use the sample data to calculate the test statistic.
5. Determine the Critical Region: This is based on the chosen significance level and the distribution of the test statistic.
6. Make a Decision: Compare the test statistic to the critical value(s). If the test statistic falls into the critical region, you reject the null hypothesis; otherwise, you fail to reject it.
7. Draw Conclusions: Based on your decision, interpret the results in the context of the problem.

Hypothesis testing helps us make data-driven decisions and draw conclusions in a wide range of fields, from medicine and business to social sciences and engineering.

Type I and Type II error:

Type I and Type II errors are concepts used in hypothesis testing and statistical inference:

Type I Error (False Positive):

Definition: Type I error occurs when the null hypothesis H 0 Is true, but we reject it.

Probability: Denoted as α, it represents the level of significance of the test.

Example: Concluding a new drug is effective when it actually has no effect.

Type II Error (False Negative):

Definition: Type II error occurs when the null hypothesis H0 Is false, but we fail to reject it.

Probability: Denoted as β, it relates to the power of the test ($1 - \beta$ gives the power of the test).

Example: Failing to conclude a new drug is effective when it actually is.

In summary, Type I error is rejecting a true null hypothesis, while Type II error is failing to reject a false null hypothesis. These errors are inversely related: reducing the probability of one type of error typically increases the probability of the other. Formulating the research design:

Research design is formulated while the research problem and objectives are defined. It is nothing but blueprint of the research proposed. It will clear all future things about research project i.e. when, how, why, where and who will do things about research. It will clear the methods, tools and techniques to be adopted, the methods of data collection, methods of data presentation and methods of data analysis and interpretation. Research design also explain the structure of the research project and the material to be used for it. On the basis of orientation of the research, the researcher has number of techniques for testing the stated objectives. Such orientation may be exploratory, descriptive or causal and so on. After definingresearch problem, review of literature and developing hypothesis, the research design is formulated for the proper planning and execution of the research.

Determining sample design:

Sample design of the research project clears population and sample of the study. It also explains the adequacy of sample size, sampling method adopted and its justification, basis of selecting sample. The researcher has to make sample most representative of population. To avoid a probability of error in prediction, the selected sample should be free from bias. The degree of precision/error should be measurable and small enough to be deducted from the results. The selection of probability or non-probability sampling depends on the nature of research, degree of accuracy required and the time and financial resources available for the research.

Data collection:

Data collection is a crucial stage of research process. It is based on research design. Before going into the field, scales of measurement is important issue addressed. Before execution of data collection instrument we have check measurement options. There is

wide variety of data collection instruments available to any researcher. They may be broadly classified as secondary sources and primary sources of data. The data collection instruments include interviews, focus group discussions, telephonic interview, mail survey, questionnaire or schedule etc. To achieve objectives of a particular research, the researcher collect the data either quantitative or qualitative. This stage requires systematic collection of data with considering careful and rigorous quality checks to ensure the reliability and validity of the data collected.

Data analysis:

Firstly the data collected should be refined and processed for evaluating the information in order to answer the research question(s) and test the hypothesis. The data editing is also required to minimize errors and improve accuracy. Data analysis depends upon the type of data i.e. quantitative or qualitative. Quantitative analysis or statistical analysis is divided into two parts i.e. descriptive statistics and inferential statistics. Qualitative data collected should be classified into broad categories to be able to arrive at any inference and conclusion. In the present age, software like MS Excel, SPSS or R etc. are used for data analysis.

Testing of hypothesis:

Testing of hypothesis is also a part of data analysis. It is one of the important stages of research process. The researcher well understands his research objective, because the type of test that will be used has to go in meeting the research objectives. Test of hypothesis is an inference and a decision-making process in which we use sample information to test whether a population parameter is less than, equal to or greater than a specified value.

Testing of hypothesis is made according to univariate (population) analysis, bivariate (population) analysis and multivariate (population) analysis. Test of hypothesis may be test of association or test of differences. Parametric or non- parametric test are alternatively applied for normal distribution and non-normal distribution respectively.

Interpretation:

In simple words, an interpretation is the process of making the things simple and clear. This stage involves interpretation and generalization. Researcher evaluates and enhances data quality and assess potential for bias. Tools and techniques are applied to give shape to the collected data. The expert-opinions can be tools for qualitative research and the statistical methods can be tools for quantitative research. Interpretation is making things simple and clear. It is the skill of researcher to link the results with the research objectives, stating clearly the implications of the findings and it is done with objective and rational approaches.

Preparing research report:

Preparing research report is the final stage of research process. The report is nothing but documenting whole research in a single report or communicating the research in a particular form. It is the report regarding whole research from problem formulation to the interpretation. The report communicates the reader all aspects of research i.e. problem formulation, objectives, conceptual framework, review of literature, scope and limitations of the research, research methodology, data analysis and interpretation, findings, conclusions and suggestions etc. It appends enclosures like specimen questionnaire and documents like financial statements etc. At the end, the bibliography is also appended.

Methods of Research

Research methods refer to the methods of researchers use in performing research operations. There are methods of research such as case study method, survey method, historical method and experimental method etc.

Case Study Method:

The case study method is one of the most popular methods of research. Here, a case is a unit of study and case study is the study of a unit. As far as history of case study method is concerned, **Fredric Le Play (1806-1882)** firstly used this method in studying family budgets. After that, Herbert Spencer used this method in his ethnographic

studies.

The case study method is a tool of social investigation which was intitially developed in U. S. A. Actual introduction of case study as a method of sociological field research was made by Thomas and Zeneniecki and their case studies known as the 'Polish Peasant' by using personal diaries, letters, autobiographies and the files of social agencies n the search for concrete and specific details about personal conduct and group behaviour.

Clifford R. Shaw made an intensive study of a series of such cases and subjected them to a careful analysis and comparison to unique and of common difference. It is extensively used in psychology, education, sociology, economics, political science, commerce and management and so on.

Meaning of Case Study Method:

A case study is an in-depth comprehensive study of a person, a social group, an episode, a process, a situation, a programme, a community, an institution or any other social unit.

1) Burges termed the case study method as "the social microscope".

2) According to P. V. Young, “case study is a method of exposing and analyzing the life of a social unit”. (P. V. Young, Scientific Social Survey and Research, p.229). She also explained that "A comprehensive study of a social unit- be that unit a person, a group, a social institution, a district or a community- is called a case study"

3) Shivpao Young says that “case study method may be defined as a small inclusive and intensive study of an individual in which investigator brings to bear his skills and methods”.

4) According to **H-Odum**, "case study method is a technique by which individual factor whether it be an institution or just an episode in the life of an individual ora group is analyzed in its relationship to any other is the group".

5) **Goode and Hatt** say that "It is a way of organizing social data so as to present the unitary character of the social object being studied".

6) According to **Sart a Queen**, case study is the examination of a single situation, person, group or institution as complex wholes in order to identify types and process".

Case study is the method which aims at studying deeply and thoroughly different aspects of a social unit. Case study method is a careful and complete observation of a social unit. This unit may be a person, a family, an institution, a cultural group or even the entire community. All characteristics of such case are studied under this method with comprehensive approach. In nutshell, we can say that case study is a careful and complete observation of a social unit, be that unit aperson, a family or an institution, a cultural group or even the entire community.

Case study method is a form of qualitative analysis wherein careful and complete observation of an individual or a situation or an institution is done. In this method, efforts are made to study such and every aspect of the concerning unit in minute detail. With its limitation, generalization may not be possible, however, inferences can be drawn.

Characteristics of Case Study Method:

(a) Case study method is a single unit analysis.

(b) It is an intensive study of a social unit.

(c) Case study method is integrated study of all facets of a single unit.

(d) Case study method makes qualitative analysis of characteristics of a unit under study.

(e) The interrelationship can be studied by case study method.

(f) The behavioural pattern of unit can be studied by using case study method.

(g) It helps to generalize social science.

(h) It is flexible to adopt any data collection methods.

(i) With using case study method, the mutual interrelationship can be studied.

Process of Case Study:

The case study has a specific process to accomplish the objective of finding characteristics of a unit under study. Such process of case study is divided into following steps:

(a) Identifying specific problem

(b) Collection of data

(c) Analyzing problem

(d) Applying remedies

(e) Evaluating and Conclusion

(f) Taking follow-up

(a) ***Identifying specific problem:*** In the first step of case study method, specific research problem is identified. The basic issues are defined. It selects and formulate research problem in this step.

(b) ***Collecting data:*** The collection of data is the second step of case study method. It also collects data regarding a particular case. Such data can be collected from documents such as correspondence, diaries and personal and historical documents etc. The researcher can also collect the data by taking in-depth interview.

(c) ***Analyzing problem:*** The research problem is divided into rational easily understood divisions. Such divisions can be examined separately. Analyzing research problem is a process of comparing data collected according to objectives set and identifying deviation, if any, and to influence it.

(d) ***Applying remedies:*** After defining and analyzing the problem, the suitable remedies are suggested to solve the problem. It plays important role in case study method.

(e) ***Evaluating and Conclusion:*** The case study method is used in education, law, human resource management, organizational behaviour, marketing and so on.

Different solutions should be suggested to the problem concerned. After evaluating data collected regarding a particular unit, the researcher should come out with conclusion.

(f) ***Taking follow-up:*** After identifying solution and applying it to a particular problem, the researcher should take follow-up for determining effectiveness of remedial actions.

Merits of Case Study Method

The case study method has some merits or advantages to the researcher and the society.

(1) ***Intensive study:*** With the help of case study method, it is possible to study intensively all aspects of a unit under study. It aims at studying everything about few units. The study is done in comprehensive manner under this method.

(2) ***Flexible data collection:*** The researcher has freedom to approach the problem from any angle he so desire. There is no need of sampling in this method. The researcher can use more than one data collection method such as depth interview, questionnaire, documents, individual letters and study reports etc.

(3) ***Useful for formulating hypothesis:*** The case study method helps to formulate hypothesis. Goode and Hatt say 'the depth of insight afforded by case study will yield fruitful hypothesis for later, full scale study'.

(4) ***Less expensive:*** As compared to laboratory experiment, field experiment and sample surveys, the case study method is less expensive.

(5) ***Comparative study:*** If two sets of cases are picked up, the independent case studies can be done. After such case studies, the comparative study will be possible.

(6) ***Real and enlightened record:*** This method helps us to collect real and enlightened record of personal experiences. It is useful in using sociological material as a real

record of personal experience.

(7) ***In-depth study:*** In case of survey it is not possible to go into detail for each and every unit. However, case study method provides an opportunity to make in- depth study of social unit.

(8) ***Suitable for diagnostic study:*** The case study method is most suitable for diagnostic research and to develop strategy to solve the same problem.

(9) ***Useful for change study:*** The case study method is useful for understanding the social change. The immediate reading of change is possible by this method.

Demerits of Case Study Method:

(1) ***Lack of objectivity:*** The case study method involves the relationship between a researcher and the unit under study, which develops personal feeling and emotions affects. Due to these effects, the objectivity is lost. Hence, there is danger of subjectivity.

(2) ***Comparison not possible:*** In social research, values, attitudes, behaviour, reactions, circumstances etc. of human being are different from each other. So it is very difficult to find out to identical cases. Hence, it is not possible to compare two cases.

(3) ***Time and money consuming:*** The case study method is intensive study which study the all aspects and also its past, present and future. It requires more time, more money and more man-power as it requires to study the natural history of social unit minutely.

Survey Method:

If we look into the history of survey, it is found that in 300 B.C., Herodotus talked of survey of population of Egypt and as such this method in crude form was known to the people. In 11th Century, William, the Conqueror's work 'Dooms Day Book' also has traces of social investigation of problems with the help of surveys. It became scientific

in the writings of John Howard who conducted a survey of prison houses of England and Wales. Le play, a French Social Reformer, undertook research on the conditions of workers, after industrialization. Earnest Engles, a German Economist made research on budget of families. He came to conclusion that the pattern of desire of the people differed on the basis of their income.

Sorokin, the first American scholar, he was inspired by the work of Le Play. Others who follow the same include Zimmerman and Trampton, Llyod Warner, Ralph Linton etc

questioned some of assumptions of Keynesian theory etc. Basic research contributes either by discovery of new theory or development in the existing theory.

Applied Research:

Applied research is the research which is to find out a solution for practical problem which is being faced by society or business etc. The main aim of applied research is to discover a solution for some practical problems. Following are the examples of applied research:

a) The research which find out conclusions for social or business problem

b) The research which identify social, economic or political trends which affects an institution

c) Marketing research

d) Evaluation research

Applied research provides solutions to practical problems, help to identify critical factors in practical problem and develop alternative solutions. It is problem- oriented and action-oriented. As far as business research is concerned, the research in marketing carried out for developing a new market is treated as applied research.

Descriptive Research:

It is nothing but surveys and fact-finding enquiries. It aims at description of the

state of affairs. In this type of research in social science, researcher has no control over the variable. Census of India which is done after every 10 years is famous example of descriptive research which describes characteristics of Indian population. Other examples of descriptive study include Economic Survey of India, World Bank Reports, Pre-election Surveys etc.

Analytical Research:

Analytical research is the research when the researcher uses facts and information already available and makes critical evaluation of the material. It focuses on analyzing data in depth and examining relationships with different perspectives in as many variables as possible. It is useful for measuring variables, comparing groups and examining association between factors. There is wide scope for conducting analytical research by using data collected by World Bank, International Monetary Fund, Government departments, Reserve Bank of India, NABARD, NSE, BSE

Central Statistical Organization and Centre for monitoring Indian Economy (CMIE) etc.

Quantitative Research:

Quantitative research is based on quantitative measurements. The phenomenon which can be expressed in terms of quantities to them quantitative research is applicable.

Qualitative Research:

Qualitative research is concerned with qualitative phenomenon. When we are interesting to investigate

Historical Research:

Historical research is a study of past records and information sources with a view to reconstructing.

Meaning of variable in research Methodology :

In research methodology, a variable refers to a characteristic or attribute that can vary or take on different values. Variables are fundamental to the research process as they are what researchers measure, manipulate, or control to study phenomena, relationships, and effects.

Key points about variables in research methodology include:

1. Independent Variable (IV): This is the variable that is manipulated or controlled by the researcher. It is the presumed cause or predictor in a study and is denoted as XXX. The independent variable is typically tested to see how changes in it affect the dependent variable.
2. Dependent Variable (DV): This is the variable that is observed or measured to assess the effect of the independent variable. It is the outcome or response that the researcher is interested in understanding or explaining, denoted as YYY.
3. Types of Variables:
    - Qualitative Variables: Also known as categorical variables, these describe qualities or characteristics that cannot be measured numerically. Examples include gender, ethnicity, or type of treatment.

- Quantitative Variables: These variables are measurable and can be expressed numerically. They can further be categorized into:
  - Discrete Variables: These take on specific numerical values that are finite or countable, such as number of siblings or number of errors.
  - Continuous Variables: These can take on any numerical value within a range and are often measured with precision, such as height, weight, or temperature.

4. Control Variables: These are variables that are held constant to prevent them from influencing the relationship between the independent and dependent variables. They help ensure that observed effects are due to changes in the independent variable and not other factors.

Understanding variables in research methodology is crucial for designing studies, collecting data, conducting analyses, and drawing valid conclusions. Researchers carefully define and operationalize variables to ensure clarity, reliability, and validity in their findings.

Techniques of data collection:

Data collection techniques vary depending on the type of data and the research objectives. Here are some common techniques:

Surveys and Questionnaires: Surveys and questionnaires are widely used data collection methods in research, particularly for gathering quantitative data on opinions, attitudes, behaviors, and characteristics from a sample of participants. Here's a detailed look at surveys and questionnaires as data collection tools:

Definition:

- Surveys: Structured instruments designed to collect standardized information from a sample of respondents. Surveys typically involve a series of questions presented in a fixed order.

- Questionnaires: Written or electronic forms containing a set of questions to gather data from respondents. They can be administered in various formats, such as paper-based, online, or via email.

Process:

- Design: Formulating clear research objectives and constructing questions that are relevant and unbiased. Questions can be closed-ended (e.g., multiple-choice, Likert scales) or open-ended (e.g., free text responses).

- Administration: Surveys can be conducted in person, by mail, telephone, or online. Questionnaires are often self-administered, and respondents complete them independently.

- Data Collection: Responses are collected and recorded systematically, ensuring anonymity and confidentiality as per ethical standards.

Advantages:

- Efficiency: Surveys allow researchers to gather data from a large number of participants efficiently.

- Standardization: Structured questions ensure consistency in data collection and facilitate quantitative analysis.

- Versatility: Can be used across various settings and populations, including large-scale studies and cross-sectional research.

Challenges:

- Response Bias: Participants may provide socially desirable answers or misunderstand questions.

- Question Design: Poorly designed questions can lead to ambiguous or biased responses.

- Sampling Issues: Representativeness of the sample and response rates can impact the generalizability of findings.

- Data Analysis: Requires careful attention to coding, cleaning, and analyzing quantitative data to derive meaningful insights.

Considerations:

- Pilot Testing: Pre-testing surveys/questionnaires helps identify and rectify issues with question wording, format, and response options.
- Response Rate: Strategies to enhance response rates include clear communication, incentives, and reminders.
- Ethical Considerations: Ensure informed consent, confidentiality, and protection of participants' data.

Applications:

- Market Research: Assessing consumer preferences, satisfaction levels, and market trends.
- Social Sciences: Studying attitudes, behaviors, and opinions on social issues or policies.
- Healthcare: Gathering patient feedback, assessing health behaviors, or evaluating healthcare services.

Surveys and questionnaires provide valuable quantitative data that can complement qualitative insights from other methods like interviews or observations. They are versatile tools suitable for various research designs, allowing researchers to systematically collect and analyze data to address research questions and objectives effectively.

Interviews: Interviews are a fundamental qualitative research method used to gather in-depth information and insights from participants about their experiences, perspectives, beliefs, and behaviors. Conducted in a conversational format, interviews allow researchers to explore complex topics and uncover rich, detailed data that may not be easily captured through other methods. Here's an overview of interviews as a data collection tool:

Types of Interviews:

1. Structured Interviews:

- Definition: Also known as formal or standardized interviews, structured interviews use a predetermined set of questions asked in a fixed order.

- Purpose: Provides consistency in data collection, enabling quantitative analysis of responses.

- Advantages: Facilitates comparability across participants, minimizes interviewer bias, and enhances reliability.

- Challenges: Less flexibility in exploring unexpected responses or probing deeper into topics.

2. Semi-Structured Interviews:

- Definition: Semi-structured interviews combine a set of predetermined questions with the flexibility to explore additional topics and probe responses in more depth.

- Purpose: Allows for a balance between structure and flexibility, encouraging richer responses and deeper exploration of participants' perspectives.

- Advantages: Provides detailed insights while maintaining some standardization, suitable for exploring complex phenomena.

- Challenges: Requires skilled interviewers to maintain focus while adapting to participants' responses.

3. Unstructured or Informal Interviews:

- Definition: Unstructured interviews have no predetermined set of questions, allowing for a free-flowing conversation based on participants' responses.

- Purpose: Emphasizes participant's narratives and allows for exploration of unexpected topics or insights.

- Advantages: Captures nuanced, detailed information, and allows for flexibility in following up on emergent themes.

- Challenges: Requires experienced interviewers to manage conversation flow and ensure relevant topics are covered.

Process of Conducting Interviews:

- Preparation: Define research objectives, develop interview protocols (questions and prompts), and consider ethical considerations (informed consent, confidentiality).
- Conducting the Interview: Build rapport with participants, ask questions clearly and neutrally, actively listen to responses, and adapt probing techniques as needed.
- Recording Data: Document responses through detailed notes, audio recordings, or video recordings (with participant consent).
- Transcription and Analysis: Transcribe interviews verbatim and analyze data for themes, patterns, and insights using qualitative analysis techniques.

Advantages of Interviews:

- In-depth Insights: Provide detailed, contextualized information about participants' experiences, perspectives, and behaviors.
- Flexibility: Adapt questioning based on participants' responses, allowing for exploration of complex or sensitive topics.
- Rich Data: Capture nuances, emotions, and personal meanings associated with phenomena.

Considerations and Challenges:

- Time-Intensive: Requires significant time and resources for planning, conducting, and analyzing interviews.

- Interviewer Bias: Interviewers' perspectives and biases can influence data collection and interpretation.

- Participant Comfort: Ensuring participants feel comfortable sharing personal experiences and perspectives.

- Data Analysis: Requires rigorous qualitative analysis to interpret and draw conclusions from interview data.

Applications:

- Qualitative Research: Explore attitudes, beliefs, experiences, and behaviors in-depth.

- Social Sciences: Study complex social phenomena, cultural practices, and societal issues.

- Healthcare: Understand patient experiences, healthcare provider perspectives, and health behaviors.

Interviews play a crucial role in qualitative research by allowing researchers to delve deeply into participants' lived experiences and subjective viewpoints. When conducted effectively, interviews provide valuable insights that contribute to understanding complex phenomena and informing theory and practice.

Observations: Observation is a fundamental data collection method used in qualitative research to systematically record and analyze behaviors, interactions, and phenomena in their natural settings. It allows researchers to gain direct insights into how people behave, interact, and respond within specific contexts. Here's an overview of observations as a data collection tool:

Types of Observation:

1. Participant Observation:
   - Definition: The researcher actively participates in the activities and social interactions of the participants being studied.
   - Role of Researcher: Integrates into the setting as a participant-observer, engaging in activities while observing and taking notes.
   - Purpose: Provides an insider's perspective, capturing contextual nuances, social dynamics, and cultural practices.
   - Advantages: Facilitates deep immersion and understanding of behaviors in natural settings, enhances validity through firsthand experience.
   - Challenges: Requires building trust with participants, managing potential observer bias, and balancing participation with observation.

2. Non-Participant Observation:

- Definition: The researcher observes and records behaviors and interactions without actively participating in the activities.

- Role of Researcher: Maintains an observer role, documenting observations through notes, audio/video recordings, or structured checklists.

- Purpose: Allows for objective documentation of behaviors and interactions, minimizing the influence of the researcher.

- Advantages: Reduces observer bias, enables systematic data collection across various settings, and facilitates comparison.

- Challenges: May miss contextual details and insider perspectives compared to participant observation.

Process of Conducting Observations:

- Planning: Define research objectives, select observation techniques (participant or non-participant), and choose observational settings.

- Data Collection: Engage in systematic observation, recording details such as behaviors, interactions, environmental factors, and non-verbal cues.

- Field Notes: Document observations immediately or shortly after, capturing detailed descriptions, impressions, and interpretations.

- Reflection: Reflect on observations, consider researcher biases, contextual factors, and emerging themes.

- Analysis: Analyze observational data using qualitative methods (e.g., thematic analysis, content analysis) to identify patterns, themes, and insights.

Advantages of Observations:

- Naturalistic Setting: Provides insights into behaviors and interactions as they naturally occur, enhancing ecological validity.

- Rich Data: Captures non-verbal communication, contextual details, and situational factors often missed in interviews or surveys.

- Real-Time Insights: Allows for immediate data collection, adaptation of research focus, and exploration of unexpected phenomena.

- Confirmation of Findings: Triangulates with other data sources (e.g., interviews, documents) to validate and enrich interpretations.

Considerations and Challenges:

- Ethical Considerations: Respecting privacy, confidentiality, and obtaining informed consent from participants.

- Observer Bias: Researchers' perspectives and interpretations may influence data collection and analysis.

- Time-Intensive: Requires extended periods of observation, patience, and commitment to capturing diverse behaviors and interactions.

- Subjectivity: Interpreting observations involves researcher subjectivity and requires reflexivity to minimize bias.

Applications:

- Anthropology and Sociology: Study of cultures, social norms, and behaviors within communities.
- Education: Observing classroom dynamics, teaching practices, and student interactions.
- Healthcare: Assessing patient-provider interactions, healthcare practices, and clinical settings.

Observation is a powerful qualitative research method that provides detailed, contextual insights into human behavior and social phenomena. When used effectively, observations contribute to a deeper understanding of complex dynamics and inform theory, practice, and policy.

Focus Groups: Focus groups are a qualitative research method used to gather insights, opinions, perceptions, and attitudes from a diverse group of participants on a specific topic of interest. This method involves structured group discussions facilitated by a moderator to explore participants' perspectives in-depth. Here's a detailed look at focus groups as a data collection tool:

Characteristics of Focus Groups:

1. Group Dynamics:
    - Participants: Typically consist of 6-12 individuals who share common characteristics relevant to the research topic (e.g., demographics, experiences).
    - Interaction: Encourages interaction, discussion, and debate among participants, generating diverse viewpoints and insights.
    - Moderator: Facilitates the discussion, guiding participants through predetermined topics and ensuring all voices are heard.
2. Discussion Format:
    - Structured: Follows a semi-structured interview format with a predefined set of open-ended questions or topics.
    - Flexible: Allows for spontaneous exploration of emerging themes and issues based on participants' responses.
    - Duration: Sessions typically last 1-2 hours, providing sufficient time for detailed exploration of topics.

Experiments: Experiments are a key research method used primarily in quantitative research to establish cause-and-effect relationships between variables. They involve manipulating one or more variables under controlled conditions to observe the effect on another variable. Here’s an overview of experiments as a data collection method:

Key Components of Experiments:

1. Variables:
    - Independent Variable (IV): The variable manipulated or controlled by the researcher to observe its effect on the dependent variable.

- Dependent Variable (DV): The variable that is measured to determine the effect of the independent variable.

2. Controlled Conditions:
    - Experimental Group: Receives the treatment or manipulation of the independent variable.
    - Control Group: Similar to the experimental group but does not receive the treatment, used as a baseline for comparison.
    - Randomization: Participants are randomly assigned to either the experimental or control group to minimize bias.

Document Analysis: Document analysis is a qualitative research method that involves systematically examining and interpreting written, visual, or audio-visual materials. These materials, often referred to as documents or artifacts, can include a wide range of sources such as texts, reports, newspapers, photographs, videos, social media posts, and historical records. Document analysis allows researchers to extract meaningful insights, understand historical contexts, and explore societal or organizational dynamics. Here's an overview of document analysis as a data collection method.

Process of Document Analysis:

1. Selection of Documents:
    - Purposeful Sampling: Choose documents relevant to the research questions and objectives.
    - Types of Documents: Primary sources (original documents) and secondary sources (interpretations or analyses of primary sources).
2. Coding and Categorization:
    - Thematic Coding: Identify key themes, topics, or patterns within the documents.
    - Open Coding: Allows for flexibility in identifying emerging themes and concepts.
    - Axial Coding: Organize data into categories based on relationships between codes.

Sensor Data Collection: Sensor data collection involves gathering information from sensors that detect and measure physical properties, environmental conditions, or events in real-time. These sensors can be embedded in various devices, equipment, or infrastructure to monitor and capture data continuously or periodically. Here's an overview of sensor data collection:

Types of Sensors:

1. Environmental Sensors:
    - Measure parameters such as temperature, humidity, air quality, light intensity, noise levels, and radiation.
    - Used in weather stations, smart buildings, agriculture, and environmental monitoring.
2. Biomedical Sensors:
    - Monitor physiological parameters like heart rate, blood pressure, glucose levels, and oxygen saturation.
    - Used in healthcare for patient monitoring, fitness tracking, and medical research.

Ethnography: Ethnography is a qualitative research method originating from anthropology that involves deep immersion into a particular culture or social group to understand their behaviors, beliefs, values, and practices. It is a systematic study of people and cultures through direct observation, participation, and interaction within their natural environment. Here's an in-depth look at ethnography as a research approach:

Key Elements of Ethnography:

1. Participant Observation:
    - Definition: Researchers actively engage with and observe participants in their everyday activities and social interactions.
    - Role of Researcher: Takes on the role of a participant-observer, integrating into the community to gain insider perspectives.

- Purpose: Provides rich, detailed descriptions of cultural practices, norms, rituals, and social dynamics.

2. Fieldwork:
   - Duration: Involves long-term immersion in the field, often spanning months or even years.
   - Data Collection: In addition to observation, methods include informal conversations, interviews, and document analysis.
   - Triangulation: Combines multiple sources of data to validate findings and ensure comprehensive understanding.

Case Studies: Case studies are a research method that involves an in-depth and detailed examination of a single instance or a small number of individuals or groups. It is a qualitative research approach that focuses on understanding complex phenomena within their real-life context. Here's a comprehensive overview of case studies as a research design:

Characteristics of Case Studies:

1. Single or Multiple Cases:
   - Single Case Study: Focuses on investigating a single individual, event, organization, or phenomenon in depth.
   - Multiple Case Study: Compares and contrasts multiple cases to identify common patterns, variations, or unique aspects.
2. Holistic Approach:
   - Comprehensive Exploration: Seeks to understand the case in its entirety, considering multiple dimensions and contextual factors.

   - Contextualization: Emphasizes understanding the unique context and circumstances surrounding the case.

3. Rich Data Collection:

   - Methods: Involves multiple data collection methods such as interviews, observations, documents, and archival records.

- Longitudinal Perspective: May involve data collection over an extended period to capture changes and developments.

4. Qualitative Analysis:
- Inductive Reasoning: Analyzes data to identify themes, patterns, and relationships without imposing preconceived theories.
- Thick Description: Provides detailed and nuanced descriptions of the case, often using qualitative data analysis techniques.

Process of Conducting Case Studies:
- Selection of Case: Choose a case that is relevant to the research question and offers rich opportunities for exploration.
- Data Collection: Gather data through various methods, ensuring triangulation to validate findings and enhance reliability.
- Analysis: Analyze data using thematic analysis, narrative analysis, or other qualitative approaches to uncover underlying themes and meanings.
- Interpretation and Reporting: Interpret findings within the context of existing literature and theories, and present results through detailed case descriptions and theoretical insights.

Advantages of Case Studies:
- In-depth Understanding: Provides rich, detailed insights into complex phenomena that may not be easily captured by other research methods.
- Contextualization: Offers a holistic view of the case within its real-life context, enhancing understanding of causal relationships.
- Theory Development: Can contribute to theory development by generating new hypotheses or validating existing theories.

Considerations and Challenges:
- Generalizability: Findings may not be easily generalized to broader populations due to the focus on specific cases.

- Subjectivity: Interpretations may be influenced by researcher biases and perspectives.

- Time and Resources: Requires significant time and resources for data collection, analysis, and interpretation.

Applications of Case Studies:

- Psychology: Study of individual behavior, mental health issues, and therapeutic interventions.

- Business and Management: Analysis of organizational behavior, leadership styles, and strategic decision-making.

- Education: Examination of teaching methods, student performance, and educational outcomes.

Case studies are valuable for exploring complex issues in-depth, providing detailed insights that can inform practice, policy, and further research in various fields. They emphasize the importance of context, richness of data, and rigorous analysis to ensure robust and credible findings.

Secondary Data Analysis: Secondary data analysis involves the use of existing data that has been collected by someone else for a different purpose. This data can include a wide range of sources such as government surveys, organizational records, academic studies, and datasets from research repositories. Here's an overview of secondary data analysis as a research method:

Characteristics of Secondary Data Analysis:

1. Existing Data Sources:
    - Types of Data: Includes quantitative data (e.g., survey responses, census data) and qualitative data (e.g., transcripts, field notes).
    - Accessibility: Data may be publicly available, accessible through archives or repositories, or obtained through collaborations.
2. Purpose and Utilization:
    - Reuse of Data: Researchers analyze existing datasets to address new research questions or test alternative hypotheses.

- Cost-Effectiveness: Can be more cost-effective and efficient compared to collecting new data, especially for large-scale studies.

The choice of data collection technique depends on factors such as the research question, the type of data needed, resources available, and ethical considerations.

Meaning of primary data :

In research methodology, primary data refers to data that is collected firsthand by the researcher specifically for the purpose of the investigation at hand. This type of data is original and directly obtained from the source of interest, rather than being gathered from secondary sources or existing data sets. Primary data can be collected through various methods such as surveys, interviews, experiments, observations, or direct measurements, depending on the nature of the research and the research questions being addressed. It is valued for its freshness and relevance to the specific research objectives.

Advantages and limitations of primary data :

Primary data in research methodology offers several advantages and limitations:

Advantages:

Relevance: Primary data is collected specifically for the research question at hand, ensuring it is directly relevant to the study objectives.

Accuracy: Researchers have control over the data collection process, which helps in ensuring accuracy and reliability of the data.

Specificity: Researchers can tailor the data collection methods to suit their research needs, allowing them to gather specific information that may not be available in existing datasets.

Freshness: Since primary data is collected firsthand, it is up-to-date and reflects the current situation or conditions under study.

Control: Researchers have greater control over the research process, including the design of data collection instruments, sampling methods, and timing of data collection.

Limitations:

Cost and Time: Collecting primary data can be time-consuming and expensive, especially if extensive fieldwork, surveys, or experiments are involved.

Resource Intensive: It requires significant resources such as personnel, equipment, and logistical support to collect primary data effectively.

Bias Potential: There is a risk of bias in data collection, especially if the researcher's presence or methods influence respondents' answers (e.g., interviewer bias in surveys).

Ethical Concerns: Researchers must ensure ethical standards are upheld when collecting primary data, particularly regarding consent, confidentiality, and participant safety.

Limited Scope: Depending on the research scope and resources available, primary data may not always cover a broad geographic area or a large population, limiting generalizability.

Overall, while primary data offers unique advantages such as relevance and control, researchers must carefully weigh these against the limitations to determine the most appropriate data collection strategy for their research objectives.

Techniques:

Interview:

Interview techniques are crucial in collecting primary data, especially in research or data gathering scenarios. Here are some effective techniques:

1. Structured Interviews: These follow a predetermined set of questions, ensuring consistency across all interviews. Useful when aiming for standardized data collection.
2. Unstructured Interviews: These are more conversational and flexible, allowing interviewers to explore topics in-depth based on the interviewee's responses. Useful for exploring complex issues or new areas of research.

3. Semi-Structured Interviews: Combining aspects of both structured and unstructured approaches, these have a set of core questions but allow for follow-up questions and exploration of responses.
4. Open-Ended Questions: Questions that encourage detailed responses, allowing interviewees to express themselves freely. Useful for gaining insights into personal experiences, opinions, or feelings.
5. Closed-Ended Questions: Questions with predefined response options (e.g., yes/no, multiple choice). Useful for gathering specific data quickly or when needing quantitative responses.
6. Probing: Follow-up questions to explore responses further, clarify ambiguities, or delve deeper into specific points. Helps in obtaining detailed and comprehensive information.
7. Active Listening: Essential in all types of interviews, active listening involves paying full attention to the interviewee, demonstrating interest, and responding appropriately to their cues.
8. Building Rapport: Creating a comfortable and trusting environment for the interviewee enhances data quality. Techniques include introductions, small talk, and showing empathy.
9. Adaptability: Being prepared to adapt interview techniques based on the interviewee's personality, communication style, and cultural background enhances rapport and data collection.
10. Ethical Considerations: Respecting confidentiality, informed consent, and ensuring the well-being of interviewees are critical throughout the interview process.

Each technique serves different purposes and can be combined depending on the research objectives and context. Effective interviewing requires practice, sensitivity to context, and a willingness to adjust approaches based on feedback and experience.
Schedule techniques:

In the context of primary data collection, scheduling techniques refer to methods used to plan and organize data collection activities. Here are some common scheduling techniques:

Time Blocking: Allocate specific time slots or blocks for data collection activities. This ensures that tasks are systematically performed within designated time frames.

Gantt Charts: Create Gantt charts to visually represent the timeline of tasks and their dependencies. This helps in scheduling and tracking progress of data collection activities over time.

Critical Path Method (CPM): Identify the sequence of tasks that must be completed on time to ensure the overall project stays on schedule. CPM helps in scheduling activities based on their dependencies and durations.

Task Lists: Prepare detailed task lists outlining each step of the data collection process. Assign deadlines to each task to ensure timely completion.

Resource Scheduling: Allocate necessary resources (such as personnel, equipment, and facilities) required for data collection activities. Ensure resources are available when needed to avoid delays.

Scheduling Software: Utilize project management software or tools that specialize in scheduling to automate and streamline the process. These tools often provide features like task assignment, deadline tracking, and collaboration.

Buffer Time: Include buffer time between tasks or stages to account for unexpected delays or issues that may arise during data collection.

Regular Monitoring and Adjustment: Continuously monitor the progress of data collection activities against the schedule. Make adjustments as necessary to address any deviations or delays.

These scheduling techniques help ensure that primary data collection is conducted efficiently, on time, and within budget, thereby enhancing the quality and reliability of the data obtained.

Questionnaires techniques :

Questionnaire techniques are crucial in collecting primary data, which is data gathered firsthand for specific research purposes. Here are some key techniques involved in designing and using questionnaires effectively:

1. Clear Objectives: Define the research objectives clearly to ensure the questionnaire addresses the necessary information.
2. Structured Questions: Use clear and concise language. Questions should be structured logically to avoid ambiguity and ensure respondents understand what is being asked.
3. Types of Questions: Include a mix of question types such as closed-ended (multiple-choice, yes/no) and open-ended (allowing for free-text responses) to gather both quantitative and qualitative data.
4. Order of Questions: Arrange questions in a logical order, starting with simple and less sensitive topics before moving to more complex or personal questions.
5. Pilot Testing: Conduct a pilot test of the questionnaire with a small sample to identify any ambiguities, confusions, or problems with question wording or order.
6. Question Wording: Use neutral and unbiased language to prevent leading questions that could influence respondents' answers.
7. Response Options: Provide appropriate response options for closed-ended questions, ensuring they cover all possible answers without overlapping or leaving gaps.
8. Length and Layout: Keep the questionnaire concise and organized, with a clear layout that is easy to follow.
9. Instructions: Include clear instructions for respondents on how to complete the questionnaire to minimize errors or misunderstandings.
10. Data Analysis Considerations: Plan ahead for how the data will be analyzed based on the types of questions and responses collected.

By following these techniques, researchers can design effective questionnaires that yield reliable and relevant primary data for their studies.

Observation techniques :

Observation techniques in primary data collection involve directly watching and recording phenomena without directly interacting with the subjects. Some common techniques include:

1. Participant Observation: The researcher participates in the activities of the subjects being studied while observing them.

2. Non-participant Observation: The researcher observes subjects without actively participating in their activities.
3. Structured Observation: Observations are made according to a predetermined set of categories or behaviors.
4. Unstructured Observation: Observations are more open-ended, allowing for the discovery of unexpected behaviors or patterns.
5. Naturalistic Observation: Observations are conducted in the subjects' natural environment without any manipulation or interference.
6. Controlled Observation: Observations are conducted in a controlled environment, often in a laboratory setting, to control variables and conditions.
7. Systematic Observation: Observations are conducted systematically according to a predetermined plan or schedule.

Each technique has its advantages and is chosen based on the research objectives, the nature of the phenomenon being studied, and practical considerations such as time, resources, and access to subjects.

Meaning and source of secondary data:

Secondary data refers to information that has been collected by someone else previously for their own purposes, but which can be utilized for new research or analysis. It is data that has not been gathered firsthand by the researcher conducting the current study.

Sources of secondary data include:

1. Published sources: Books, journals, newspapers, and magazines.
2. Government sources: Data collected by government agencies or departments, such as census data, economic indicators, and administrative records.
3. Academic institutions: Research reports, theses, and dissertations.
4. Commercial sources: Market research reports, industry studies, and data from business organizations.
5. Non-governmental organizations (NGOs): Reports and data published by NGOs and international organizations.
6. Online databases: Accessible repositories of data and statistics, such as data.gov, World Bank databases, or specialized databases in various fields.

Researchers often use secondary data because it is readily available, cost-effective, and can provide valuable insights. However, they need to critically evaluate its quality, relevance,

and reliability for their specific research purposes.

SELF ASSESMENT QUESTIONS

Answers for Check Your Progress

Check your progress-

(A) Fill in the blanks:

(a) Fredric Le Play (1806-1882) firstly used this method in studying…….

(b) Burges termed the case study method as ……..

(c) According to P. V. Young, ...is a method of exposing and analyzing the life of a social unit.

(d) Each and every unit of population is investigated in …….

(e) The information required on regular nature, the ..... survey is suitable

(B) State whether the following statement is true or false

(a) When survey is conducted after regular interval, it is called regular survey.

(b) Government does not conduct official surveys for policy prescription and intervention or welfare purposes.

(c) Case study method makes qualitative analysis of characteristics of a unit under study.

Check your progress

(A) Fill in the blanks:

(a) is systematic process of reviewing scholarly written sources like books and research papers/articles published in journals etc. in the contextof a particular research problem.

(b) We can understand there are two-folds of ..... i.e. review concepts and theories and review of previous research findings.

(c) The ..... consists of series of various actions, which are necessary to effective research work.

(B) Choose the most appropriate alternative:

(1) Following is not the step of the research process……

(a) defining the research problem,

(b) selling books

(c) review of literature

(d) developing the hypothesis

(e) preparing research report.

Check your progress-

(A) State whether the following statement is true or false

(a) Pure research is also called as basic research or fundamental research.

(b) Evaluation research is categorized under applied research.

(c) Descriptive research aims at description of the state of affairs.

(B) Choose most appropriate alternative:

(1) Following are the examples of applied research:

(a) The research which find out conclusions for social or business problem

(b) The research which identify social, economic or political trends which affects an institution

(c) Marketing research

(d) Theory developing research

(2) The contribution of pure research may be seen in major four areas (i) contributing new facts, (ii) putting theory to test, (iii) applied research, (iv) conceptual clarification and (v) interesting previously existing theories.

(a) (i), (ii), (iii) & (iv)

(b) (i), (ii), (iv) & (v)

(c) (i), (ii), (iii) & (v)

GLOSSARY

Variable

Meaning: A variable is a characteristic or attribute that can take on different values or categories. It is used in research to quantify and analyze data.

Types:

- **Quantitative Variables**: Numeric values (e.g., height, age).
  - **Discrete**: Whole numbers (e.g., number of children).
  - **Continuous**: Any value within a range (e.g., temperature).
- **Qualitative Variables**: Categorical values (e.g., gender, color).
  - **Nominal**: Categories without a specific order (e.g., types of fruit).
  - **Ordinal**: Categories with a meaningful order (e.g., satisfaction levels).

Techniques of Data Collection

Primary Data

Meaning: Primary data refers to information gathered directly from original sources for a specific research purpose.

Advantages:

- **Specificity**: Tailored to research objectives.
- **Current**: Up-to-date information reflecting the latest trends.
- **Control**: Researchers have direct control over data collection processes.

Limitations:

- **Costly**: Often more expensive due to resource requirements.
- **Time-Consuming**: Data collection can take significant time.
- **Complexity**: May require specialized skills or training to gather effectively.

Techniques:

1. **Interview**: Direct, face-to-face or virtual discussions to gather detailed information.
    - **Advantages**: In-depth insights, flexibility in questioning.
    - **Limitations**: Time-intensive, potential interviewer bias.
2. **Schedule**: A structured format for collecting data, often used in formal interviews.
    - **Advantages**: Standardization, easier to analyze.
    - **Limitations**: Less flexibility, may not capture all nuances.
3. **Questionnaire**: A set of written questions distributed to gather information.
    - **Advantages**: Cost-effective, can reach a large audience.
    - **Limitations**: Limited depth of responses, reliance on self-reporting.
4. **Observation**: Collecting data through watching behaviors or events in their natural setting.
    - **Advantages**: Real-time data collection, no reliance on self-reporting.
    - **Limitations**: Observer bias, time-intensive.

Secondary Data

Meaning: Secondary data refers to information that has already been collected and published by others, used for analysis in a different context.

Sources:

- **Published Sources**: Academic journals, books, government reports, and statistical databases.
- **Unpublished Sources**: Theses, dissertations, and internal company reports.
- **Online Databases**: Websites, archives, and repositories that compile data from various studies.

Summary Table

Type	Meaning	Advantages	Limitations
Primary	Original data for specific	Specific, current,	Costly, time-consuming,

Type	Meaning	Advantages	Limitations
Data	research	controlled	complex
Secondary Data	Pre-existing data used for new analysis	Cost-effective, accessible	Potentially outdated, less specific

Reference for further study:

- Kothari, C. R. and Garg, Guarav (2016). Research Methodology Methods and Techniques (Third Edition), New Age International Publishers, London.
- Krishnaswami, O. R. and Ranganathan, M. (2011). Methodology of Research inSocial Sciences, Himalaya Publishing House, Mumbai, Second edition, Sixth print.
- Redman LV &Mory AVH (1923) The Romance of Research, pp. 6-10.
- Young, P. V. (1953). *Scientific Social Surveys and Research.* New York: Pzentice-Hall Inc., 1949. 621 pages. Nursing Research, 2(2), 95.
- Slesinger, D. and Stephenson, M. (1930) The Encyclopaedia of Social Sciences. Vol.IX, MacMillan Publications

UNIT IV

DATA ANALYSIS

Unit Objectives

- Understand the concept, tools and techniques of analysis and interpretation of data.
- Analyze and interpret data with computing measures of central tendency, measures of dispersion, correlation and regression.
- Explain the methods of hypothesis testing and their application.
- Explain the layout of research project and prepare such layout.
- Find relationship between the nature of data and analytical tool to use.
- Explain concept and types of research report and characteristics of good report.

Write a research report.

Meaning of data analysis: Data analysis refers to the process of examining, cleaning, transforming, and interpreting data with the goal of extracting useful information, drawing conclusions, and making informed decisions. It involves various methods and techniques to uncover patterns, trends, relationships, and insights from datasets, whether they are quantitative (numbers, measurements) or qualitative (textual, visual).

Key Aspects of Data Analysis:

1. Examination and Cleaning:

- Data Cleaning: Removing or correcting errors, inconsistencies, and missing values in the dataset to ensure accuracy and reliability.
- Exploratory Data Analysis (EDA): Initial examination of data to summarize main characteristics and identify patterns or outliers.

2. Transformation and Preparation:

- Data Transformation: Converting data into a format suitable for analysis, such as normalization or standardization.
- Feature Engineering: Creating new features or variables based on existing data to enhance predictive power or simplify analysis.

3. Analysis Techniques:

- Quantitative Analysis: Statistical methods (e.g., regression, hypothesis testing, clustering) used to analyze numerical data and quantify relationships.
- Qualitative Analysis: Interpretative methods (e.g., thematic analysis, content analysis) used to analyze textual or visual data to identify themes or patterns.

4. Interpretation and Visualization:

- Visualization: Presenting data visually through charts, graphs, and dashboards to facilitate understanding and communicate findings effectively.
- Pattern Recognition: Identifying trends, correlations, or anomalies in the data to derive insights and support decision-making.

5. Reporting and Decision-Making:

- Findings: Summarizing analysis results and interpreting their implications in relation to research questions or business objectives.
- Decision Support: Using data-driven insights to inform strategic decisions, policy-making, or further research directions.

Importance of Data Analysis:

- Insight Generation: Provides valuable insights into patterns, trends, and relationships within the data.
- Evidence-Based Decision Making: Supports informed decision-making processes in various domains, from business to healthcare to public policy.
- Validation and Verification: Validates hypotheses or theories through empirical analysis, enhancing credibility and reliability of findings.
- Continuous Improvement: Identifies areas for improvement or optimization based on data-driven feedback and analysis.

In essence, data analysis transforms raw data into meaningful information that informs understanding, prediction, and action in both research and practical applications. It plays a crucial role in extracting actionable insights from data to drive innovation, efficiency, and progress in diverse fields.

Data analysis refers to the process of inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, informing conclusions, and supporting decision-making. It involves various methods and techniques to interpret and derive insights from datasets, often with the aid of specialized software tools and algorithms.

Uni variate analysis:Univariate analysis refers to the statistical analysis of a single variable. It focuses on describing and summarizing the distribution, central tendency, and variability of that variable.

Methods of uni variate analysis:

Univariate analysis is the analysis of a single variable. Here are some common methods used in univariate analysis:

1. Descriptive Statistics:
    - Measures of central tendency: mean, median, mode
    - Measures of dispersion: range, variance, standard deviation
    - Measures of shape: skewness, kurtosis
2. Frequency Distribution:
    - Organizes data into classes or intervals and shows how many observations fall into each class.
    - Can be presented using histograms, frequency polygons, or bar charts.
3. Measures of Central Tendency:
    - Mean: Average value of the data.
    - Median: Middle value of the data when arranged in ascending or descending order.
    - Mode: Most frequently occurring value in the data.
4. Measures of Dispersion:
    - Range: Difference between the maximum and minimum values.
    - Variance: Average of the squared differences from the mean.
    - Standard Deviation: Square root of the variance, measures the spread of data around the mean.
5. Skewness and Kurtosis:
    - Skewness: Measures the asymmetry of the data distribution.

- Kurtosis: Measures the heaviness of the tails of the distribution.

6. Graphical Methods:
   - Histogram: Shows the frequency distribution of a continuous variable.
   - Box plot: Displays the median, quartiles, and potential outliers of a dataset.
   - Probability plots: Evaluate how well a data set fits a particular distribution.
7. Summary Tables:
   - Present key statistics (mean, median, mode, range, etc.) in a concise format.
8. Percentiles and Quartiles:
   - Percentiles: Divides the data into 100 equal parts.
   - Quartiles: Divide the data into four equal parts.
9. Normality Tests:
   - Check whether a variable follows a normal distribution using tests like the Shapiro-Wilk test or Kolmogorov-Smirnov test.
10. Transformations:
    - If the data is not normally distributed, transformations (like logarithmic or square root) may be applied to achieve normality.

11. Independent sample test:

An independent samples test typically refers to a statistical test used to compare the means of two independent groups. The most common tests for this purpose are:

1. Independent t-test: Used when comparing the means of a continuous variable between two groups. Assumptions include normality of data within each group and homogeneity of variances.
2. Mann-Whitney U test: Used when assumptions of the t-test are not met (e.g., non-normal distributions). It assesses whether the distributions of two groups differ significantly in terms of their medians.

These methods help in understanding the characteristics and distribution of a single variable, providing insights that can guide further analysis and decision-making in various fields including statistics, business, and research.

Meaning of bi variate analysis :

Bivariate analysis refers to the statistical analysis that involves the examination of the relationship between two variables simultaneously. In essence, it focuses on understanding how one variable behaves in relation to another variable. Here's a detailed explanation of bivariate analysis:

Key Aspects of Bivariate Analysis:

1. Two Variables:

- Independent Variable (X): The variable that is manipulated or controlled by the researcher.

- Dependent Variable (Y): The variable that is measured to observe the effect of the independent variable.

2. Types of Relationships:

- Categorical vs. Categorical: Analyzing the association or contingency between two categorical variables using techniques like Chi-square test, Fisher's exact test, or cross-tabulation.

- Categorical vs. Continuous: Assessing the differences in means or proportions of a continuous variable across different categories of a categorical variable, often using t-tests or ANOVA.

- Continuous vs. Continuous: Examining the correlation or relationship between two continuous variables using correlation coefficients (e.g., Pearson correlation, Spearman rank correlation).

3. Purpose and Techniques:

- Descriptive Analysis: Provides a summary of the relationship between variables, such as frequencies, percentages, means, or medians.

- Inferential Analysis: Tests hypotheses or makes predictions about the relationship based on statistical tests and measures.

Examples of Bivariate Analysis:

- Example 1 (Categorical vs. Categorical): Analyzing the association between gender (male/female) and voting preference (candidate A/B) using a Chi-square test.

- Example 2 (Categorical vs. Continuous): Comparing the average income (continuous variable) across different levels of education (categorical variable) using ANOVA.

- Example 3 (Continuous vs. Continuous): Examining the correlation between temperature (independent variable) and ice cream sales (dependent variable) using Pearson correlation coefficient.

Importance of Bivariate Analysis:

- Understanding Relationships: Identifies and quantifies relationships between variables, helping to understand how changes in one variable affect another.

- Foundation for Further Analysis: Provides insights that can guide more complex analyses, such as multivariate analysis.

- Decision Making: Supports evidence-based decision-making processes in research, business, healthcare, and policy-making.

Bivariate analysis is foundational in statistical analysis, providing essential insights into the interdependence and associations between variables in various fields of study and applications. It forms the basis for more sophisticated analyses aimed at deeper understanding and prediction based on empirical data.

METHODS:

Bivariate analysis refers to the statistical analysis that involves the simultaneous examination of two variables (often denoted as X and Y) to determine if there is a relationship between them. Here are some common methods used in bivariate analysis:

1. Scatter Plot: A scatter plot is a graphical representation that shows the relationship between two variables. Each point on the plot represents a pair of values for the

two variables, making it easy to visualize patterns such as correlation or lack thereof.

2. Correlation Coefficient: This numerical measure indicates the strength and direction of the linear relationship between two variables. The most common correlation coefficient is Pearson's correlation coefficient (r), which ranges from -1 (perfect negative correlation) to +1 (perfect positive correlation), with 0 indicating no linear correlation.

3. Regression Analysis: Regression analysis helps to understand how the value of one variable changes in relation to another variable. Simple linear regression is used when there is a linear relationship between the two variables, while multiple regression can handle situations where more than one independent variable affects the dependent variable.

4. Cross tabulation (Contingency Tables): This method is used when both variables are categorical. It displays the frequency distribution of one variable with respect to another, showing how the two variables might be related.

5. Chi-Square Test: When dealing with categorical variables, the chi-square test of independence can determine whether there is a significant association between the variables. It compares observed frequencies with expected frequencies assuming no association between the variables.

6. ANOVA (Analysis of Variance): ANOVA tests whether there are significant differences between the means of two or more groups. When comparing two groups, it's a bivariate analysis method.

7. Logistic Regression: This method is used when the dependent variable is categorical and the independent variable(s) can be either continuous or categorical. It predicts the probability of the dependent variable falling into a particular category.

These methods collectively provide insights into the relationship between two variables, whether they are both categorical, both continuous, or one of each type. Choosing the appropriate method depends on the nature of the variables and the research question being addressed.

Man Whitney test:

The Mann-Whitney U test, also known as the Mann-Whitney-Wilcoxon test, is a non-parametric statistical test used to determine whether there is a statistically significant difference between two independent groups in terms of their distributions of a continuous variable. It's particularly useful when the assumptions of parametric tests like the t-test are not met (e.g., when data are not normally distributed).

Key points about the Mann-Whitney U test:

Assumptions: It does not assume that the data are normally distributed. However, it does assume that the observations are independent and that the measurements are at least ordinal.

Null Hypothesis: The null hypothesis of the Mann-Whitney U test is that the distributions of both groups (from which the samples are drawn) are equal.

Interpretation: If the calculated p-value is less than the chosen significance level (usually 0.05), then the null hypothesis is rejected, suggesting that there is a statistically significant difference between the two groups.

Effect Size: Common effect size measures for the Mann-Whitney U test include the probability of superiority (P_s) and the common language effect size (CL).

Advantages: It is robust against outliers and does not require the assumption of normality, making it suitable for a wide range of data types.

Limitations: It is less powerful than the t-test when data are normally distributed and variances are equal. It also does not provide information about how the groups differ in terms of location or spread.

Overall, the Mann-Whitney U test is a valuable tool for comparing two independent groups when assumptions of parametric tests are not met, providing a reliable alternative for analyzing non-normally distributed data.

Wilcoxon signed rank test:

The Wilcoxon signed-rank test is a non-parametric statistical test used to determine whether two related paired samples come from the same distribution. It's typically used when the data do not meet the assumptions required for a parametric test like the paired t-test (e.g., normality of data or when the data are ordinal).

Here's a brief overview of how the Wilcoxon signed-rank test works:

Data Requirement: You need paired data, where each pair consists of two measurements or observations on the same subject or unit.

Procedure:

I) Calculate the differences between paired observations.

II) Disregard pairs where the difference is zero.

III) Rank the absolute values of the differences.

IV) Calculate the signed ranks (taking into account the direction of the differences).

V) Sum the ranks of the positive and negative differences separately.

VI) Compare the smaller of these two sums to critical values from the Wilcoxon signed-rank distribution to determine statistical significance.

Interpretation: If the calculated test statistic (the smaller sum of ranks) is less than or equal to the critical value, you reject the null hypothesis, suggesting a significant difference between the paired samples. If it is greater, you fail to reject the null hypothesis.

Assumptions: The Wilcoxon signed-rank test does not assume normality of the data but does assume symmetry around the median. It is sensitive to outliers, but less so than the parametric paired t-test.

Advantages: It’s robust against non-normality and outliers, making it suitable for a wide range of data types, including ordinal data.

In summary, the Wilcoxon signed-rank test is a valuable tool when you need to compare two related samples but cannot assume normal distribution or when dealing with ordinal data.

Kruskal wallis test:

The Kruskal-Wallis test is a non-parametric statistical test used to determine whether there are statistically significant differences between two or more independent groups. It’s often used as an alternative to the one-way analysis of variance (ANOVA) when the data do not meet the assumptions of normality required by ANOVA.

Key points about the Kruskal-Wallis test:

Assumptions: It does not assume normality of data, but it does assume that the groups have similar shapes of distributions.

Null Hypothesis: The null hypothesis is that all groups come from the same population (i.e., they have the same median).

Procedure:

I) Rank all data values together across all groups.

II) Calculate the sum of ranks for each group.

III) Compute the test statistic *H* from the ranked data.

IV) Compare *H* to a critical value from the Kruskal-Wallis distribution to determine statistical significance.

Interpretation: If the calculated *H* statistic is greater than the critical value from the table (based on significance level and degrees of freedom), then there is evidence to reject the null hypothesis and conclude that there are significant differences between at least two of the groups.

Post-hoc Tests: If the Kruskal-Wallis test indicates significant differences, further pairwise comparisons (like Dunn's test) can be performed to identify which specific groups differ significantly.

Software: Most statistical software packages (like R, Python's scipy library, or SPSS) can compute the Kruskal-Wallis test for you.

The Kruskal-Wallis test is particularly useful when dealing with ordinal or non-normally distributed interval data and when the assumptions of parametric tests like ANOVA are not met.

Meaning of Multi variate analysis :

Multivariate analysis refers to statistical techniques that analyze data sets containing observations on multiple variables simultaneously. Unlike univariate analysis, which examines a single variable at a time, multivariate analysis considers the relationships between multiple variables to understand patterns, dependencies, and interactions among them.

Here are key aspects and meanings of multivariate analysis:

1. Multiple Variables: It involves analyzing data that includes measurements or observations on more than one variable. These variables could be quantitative (e.g., height, weight) or categorical (e.g., gender, occupation).

2. Simultaneous Analysis: Instead of looking at variables individually, multivariate analysis examines how variables behave in relation to each other. This helps uncover complex relationships and patterns that might not be apparent in univariate or bivariate analyses.

3. Types of Techniques: There are various multivariate analysis techniques, each suited to different types of data and research questions:

4. Applications: Multivariate analysis is widely used in various fields such as psychology, sociology, biology, economics, marketing research, and environmental science. It helps researchers and analysts understand complex data structures, identify hidden patterns, make predictions, and test hypotheses involving multiple variables.

5. Advantages: By considering multiple variables simultaneously, multivariate analysis can provide a more comprehensive and nuanced understanding of phenomena. It allows for the exploration of interactions and dependencies that may influence outcomes.

6. Challenges: Multivariate analysis requires careful consideration of assumptions and interpretation. It can be computationally intensive, especially with large datasets or complex models. Proper preprocessing of data (e.g., handling missing values, scaling variables) is crucial for reliable results.

In summary, multivariate analysis is a powerful set of techniques that enhance our ability to analyze and interpret complex data by examining relationships and interactions among multiple variables concurrently. It provides deeper insights into the structure and dynamics of data across various disciplines and research contexts.

Methods of multi variate analysis :Multivariate analysis refers to statistical techniques used to analyze data that involves multiple variables simultaneously. Unlike bivariate analysis, which examines relationships between two variables, multivariate analysis considers the interactions and dependencies among three or more variables. Here are some common methods of multivariate analysis:

1. Multivariate Regression Analysis:
   - Definition: Extends linear regression to multiple independent variables to predict the value of a dependent variable.
   - Types: Includes multiple linear regression (continuous dependent variable), logistic regression (binary dependent variable), and multinomial regression (categorical dependent variable).

2. Principal Component Analysis (PCA):
   - Definition: Reduces the dimensionality of data by transforming variables into a smaller set of uncorrelated components (principal components).
   - Purpose: Identifies patterns and underlying structures in data while retaining as much variation as possible.

3. Factor Analysis:
   - Definition: Examines the interrelationships among a large number of variables by identifying underlying factors that explain the correlations observed among observed variables.
   - Types: Includes exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) for model validation.

4. Cluster Analysis:
   - Definition: Groups observations (e.g., individuals, cases) into clusters based on similarities in variables, aiming to find natural groupings within the data.
   - Types: Hierarchical clustering (agglomerative and divisive) and k-means clustering are common techniques.

5. Discriminant Analysis:

- Definition: Determines which variables discriminate between two or more naturally occurring groups (categories).
- Purpose: Classifies observations into predefined groups based on predictor variables.

6. Canonical Correlation Analysis (CCA):

- Definition: Examines the relationship between two sets of variables by identifying linear combinations (canonical variates) that have the highest correlation with each other across sets.
- Application: Often used to explore relationships between sets of variables in different domains (e.g., marketing research, psychology).

7. Multivariate Analysis of Variance (MANOVA):

- Definition: Extends analysis of variance (ANOVA) to multiple dependent variables simultaneously, testing for differences across groups while controlling for covariates.
- Purpose: Determines whether there are significant differences in mean values of multiple variables between groups.

8. Structural Equation Modeling (SEM):

- Definition: Models complex relationships between observed and latent variables (factors) using simultaneous equations.
- Application: Tests theoretical models and hypotheses, incorporating measurement models (factor analysis) and structural models (path analysis).

Importance of Multivariate Analysis:

- Complex Relationships: Accounts for interactions and dependencies among multiple variables, providing a more comprehensive understanding of data.
- Dimension Reduction: Reduces the complexity of large datasets while retaining meaningful information.
- Predictive Power: Generates models that can predict outcomes or classify observations based on multiple factors.

- Insight Generation: Reveals underlying patterns, structures, and relationships that may not be apparent in univariate or bivariate analyses.

Multivariate analysis is essential in various fields including psychology, sociology, economics, biology, marketing, and healthcare, where understanding complex relationships and making informed decisions based on data are critical. Each method of multivariate analysis offers unique strengths and is selected based on the research objectives, data characteristics, and assumptions underlying the analysis.

Factor Analysis: Factor Analysis (FA) is a statistical method used to identify underlying relationships between variables. It seeks to explain the correlations among observed variables in terms of a smaller number of unobserved latent variables called factors. These factors represent common dimensions or constructs that explain the patterns of correlations among the observed variables.

Here are the key concepts and steps involved in Factor Analysis:

1. Correlation Matrix: Factor Analysis begins with a correlation matrix of the observed variables. This matrix shows how each variable relates to every other variable in the dataset.
2. Factor Extraction: The main goal of Factor Analysis is to identify a smaller number of factors that can explain the correlations in the original data. These factors are constructed so that each one accounts for as much variance in the original variables as possible.

Cluster Analysis: Cluster Analysis is a statistical technique used to classify objects (or observations) into groups, or clusters, based on similarities among them. The goal is to group objects such that objects in the same cluster are more similar to each other than to those in other clusters. It's an unsupervised learning method because it doesn't require predefined labels or categories for the objects.

Here are the main concepts and steps involved in Cluster Analysis:

1. Similarity Measure: Before clustering, a similarity (or dissimilarity) measure is defined to quantify how similar or dissimilar pairs of objects are. Common

measures include Euclidean distance, Manhattan distance, cosine similarity, and correlation coefficients, depending on the nature of the data.

2. Clustering Algorithms: There are various clustering algorithms that can be used to partition the data into clusters. Some popular algorithms include:
    - K-means: A centroid-based algorithm that partitions the data into K clusters, where each object belongs to the cluster with the nearest mean (centroid).
    - Hierarchical Clustering: Builds a tree-like hierarchy of clusters by either agglomerative (bottom-up) or divisive (top-down) approaches.
    - DBSCAN (Density-Based Spatial Clustering of Applications with Noise): Identifies clusters of varying shapes and densities based on the density of points in the neighborhood.
    - Gaussian Mixture Models (GMM): Models clusters as a mixture of multivariate normal distributions.

Multivariate Analysis of Variance (MANOVA): Multivariate Analysis of Variance (MANOVA) is a statistical technique used to analyze the differences among multiple dependent variables (also known as outcome variables or response variables) across two or more groups defined by one or more categorical independent variables (also known as factors or predictors).

Here are the key components and steps involved in MANOVA:

1. Dependent Variables: MANOVA deals with two or more dependent variables that are measured on a continuous scale. These variables are typically correlated with each other, and MANOVA considers their relationships simultaneously.
2. Independent Variables: MANOVA involves one or more categorical independent variables (factors) that define the groups being compared. For example, these groups could represent different treatment conditions, levels of a factor, or different groups of participants.
3. Assumptions: MANOVA assumes that the dependent variables are normally distributed within each group and that the variances of the dependent variables are

equal across groups (homogeneity of variances). It also assumes that there is no multicollinearity among the dependent variables.

Canonical Correlation Analysis: Canonical Correlation Analysis (CCA) is a multivariate statistical technique used to explore the relationships between two sets of variables. It identifies linear combinations (canonical variates) of variables from each set that maximize the correlation between the two sets. CCA is particularly useful when you have two sets of variables and you want to understand how these sets are related to each other.

Here's a breakdown of the key concepts and steps involved in Canonical Correlation Analysis:

1. Two Sets of Variables: CCA requires two sets of variables, typically denoted as X and Y:
    - Set X: Contains p variables X1,X2,…,XpX_1, X_2, \ldots, X_pX1,X2,…,Xp.
    - Set Y: Contains q variables Y1,Y2,…,YqY_1, Y_2, \ldots, Y_qY1,Y2,…,Yq.
2. Correlation Structure: CCA seeks linear combinations of variables from each set (canonical variates) such that the correlation between the canonical variates is maximized. It finds pairs of canonical variates that have the highest possible correlation between them.

Discriminant Analysis: Discriminant Analysis (DA) is a statistical technique used to classify observations into predefined groups based on their characteristics or predictors. It is a supervised learning method because it requires a set of labeled data where the group membership of each observation is known beforehand. The goal of Discriminant Analysis is to find a linear combination of variables that best separates or discriminates between the groups.

Here are the key aspects and steps involved in Discriminant Analysis:

1. Groups or Categories: Discriminant Analysis starts with a categorical dependent variable that defines the groups or categories into which observations are

classified. For example, these groups could represent different species of plants, customer segments, or treatment outcomes.

2. Predictor Variables: Discriminant Analysis uses one or more continuous predictor variables (also called independent variables or features) to classify the observations into groups. These variables should be related to the groups being classified.
3. Linear Discriminant Functions: Discriminant Analysis calculates linear combinations of the predictor variables that best separate the groups. These linear combinations are called discriminant functions and are designed to maximize the differences between group means while minimizing the variation within each group.

Multidimensional Scaling (MDS): Multidimensional Scaling (MDS) is a statistical technique used to visualize the similarity/dissimilarity of data points in a lower-dimensional space. It is primarily used for exploratory data analysis and visualization, especially when dealing with proximity or dissimilarity data.

Here are the key aspects and steps involved in Multidimensional Scaling (MDS):

1. Proximity/Dissimilarity Data: MDS starts with a matrix of pairwise distances or dissimilarities between a set of objects or observations. These distances can be based on any metric or similarity measure, such as Euclidean distance, correlation coefficient, or rank-order differences.
2. Dimensionality Reduction: MDS aims to project the objects from a high-dimensional space (based on the number of objects) into a lower-dimensional space (typically 2D or 3D) while preserving the original pairwise distances as much as possible. This allows for visualization of the relationships between objects in a more interpretable format.

Structural Equation Modeling (SEM): Structural Equation Modeling (SEM) is a powerful statistical technique used to test and estimate complex relationships among variables. It combines elements of factor analysis, regression analysis, and path analysis into a unified framework. SEM is particularly useful for modeling complex theoretical relationships and for testing hypotheses about causal relationships among variables.

Here are the key components and steps involved in Structural Equation Modeling (SEM):

1. Path Diagram: SEM starts with a theoretical model that specifies the relationships among latent variables (unobserved constructs) and observed variables (measured variables). These relationships are depicted graphically in a path diagram, where arrows represent hypothesized causal paths between variables.
2. Measurement Model: In SEM, latent variables are often represented by multiple observed variables (indicators) that measure the underlying constructs. The measurement model specifies how these observed variables relate to their respective latent variables through factor loadings (regression coefficients).

Multivariate Regression Analysis:

Multivariate Regression Analysis is a statistical technique used to analyze the relationship between multiple independent variables (predictors) and multiple dependent variables (responses) simultaneously. It extends the concept of simple linear regression, which models the relationship between one dependent variable and one or more independent variables, to cases where there are multiple dependent variables.

- Here's an overview of Multivariate Regression Analysis:
- Multiple Dependent Variables:When dealing with multiple dependent variables in statistical analysis, researchers are often interested in examining how these variables are related to one or more independent variables. This scenario requires specific methods that can handle multiple outcomes simultaneously. Here's an overview of approaches and considerations for analyzing multiple dependent variables:
- Methods for Analyzing Multiple Dependent Variables:
- Multivariate Analysis of Variance (MANOVA):
- - Definition: Extends the analysis of variance (ANOVA) to multiple dependent variables simultaneously.
- - Purpose: Tests whether there are significant differences in means of multiple dependent variables across groups while controlling for covariates.

- - Assumptions: Assumes normality, homogeneity of variance-covariance matrices, and linearity.

- Multivariate Regression Analysis:
- - Definition: Extends linear regression to predict multiple dependent variables using multiple independent variables.
- - Types: Includes multiple linear regression (continuous dependent variables), multinomial logistic regression (categorical dependent variables), and multivariate probit models.
- - Interpretation: Examines how changes in independent variables affect multiple outcomes simultaneously.
- Structural Equation Modeling (SEM):
- - Definition: Models complex relationships between observed and latent variables using simultaneous equations.
- - Components: Includes measurement models (factor analysis) and structural models (path analysis) to analyze relationships among multiple variables.
- - Applications: Tests theoretical models and hypotheses, examining direct and indirect effects among variables.
-
- Canonical Correlation Analysis (CCA):
- - Definition: Examines the relationship between two sets of variables by identifying linear combinations (canonical variates) that have the highest correlation with each other across sets.
- - Purpose: Analyzes associations between multiple independent and dependent variables simultaneously.
- - Interpretation: Identifies patterns of relationships and underlying dimensions that explain correlations across sets of variables.
- Multilevel Modeling (MLM):
- - Definition: Accounts for nested data structures where observations are grouped within clusters (e.g., individuals within schools).

- - Components: Includes random effects for different levels of nesting, allowing for analysis of multiple outcomes at different levels simultaneously.
- - Advantages: Models contextual effects and accounts for dependencies within clusters.
- Considerations for Analyzing Multiple Dependent Variables:
- - Data Structure: Ensure data are structured appropriately for multivariate analysis, with each row representing a unique observation and columns representing multiple dependent variables.
- - Assumptions: Understand and validate assumptions of chosen methods, such as normality, homoscedasticity, and independence of errors.
- - Interpretation: Interpret results considering the interrelationships among dependent variables and their collective impact on the research question.

- - Model Complexity: Select methods that align with the research objectives, complexity of the data, and assumptions underlying the analysis.
-
- Applications:
-
- - Psychology and Sociology: Analyzing outcomes on multiple psychological scales or social constructs.
- - Healthcare: Evaluating the impact of interventions on multiple health-related outcomes.
-
- - Business and Economics: Studying effects of marketing strategies on multiple performance metrics.
-
- Analyzing multiple dependent variables requires careful consideration of statistical techniques that can handle complex relationships and dependencies. Each method offers unique strengths and should be selected based on the research design, objectives, and nature of the data being analyzed.

- Multiple Independent Variables: There are also two or more independent variables (X variables) that are hypothesized to influence the dependent variables. The relationship between the X variables and the Y variables is modeled through a set of regression coefficients.

Confirmatory factor analysis :

Confirmatory Factor Analysis (CFA) is a statistical technique used to test and confirm the hypothesized relationships between observed variables (indicators) and latent variables (factors) based on a priori theoretical assumptions. It is a type of structural equation modeling (SEM) that specifically focuses on the measurement model, assessing how well the observed data fit the hypothesized factor structure.

Here are the key aspects and steps involved in Confirmatory Factor Analysis (CFA):

1. Theory and Hypotheses: CFA begins with a theoretical framework that specifies the relationships among latent variables (factors) and their corresponding observed variables (indicators). These relationships are typically based on existing theory or prior empirical research.
2. Measurement Model: The measurement model in CFA specifies how each latent variable is measured by its indicators. Indicators are observed variables that are believed to reflect the underlying latent construct. The model assumes that each indicator is related to one or more latent variables (factors) through factor loadings (regression coefficients).
3. Friedman test: The Friedman test is a non-parametric statistical test used to determine whether there are statistically significant differences between multiple related groups. It is used as an alternative to the repeated measures analysis of variance (ANOVA) when the assumptions of normality and sphericity (equal variances of differences between groups) are not met or when the data are ranked or ordinal.

Here's a breakdown of the key aspects and steps involved in the Friedman test:

1. Data Structure: The Friedman test is appropriate when you have one dependent variable measured on the same subjects or entities under multiple conditions or treatments. Each subject or entity is measured under all conditions, resulting in paired or repeated measures.
2. Ranking Data: For each subject or entity, the data are ranked across the different conditions or treatments. The ranks are assigned separately for each subject across conditions, and ties are handled by assigning them the average rank.

Multi discriminant analysis :Multi Discriminant Analysis (MDA), also known as Multiple Discriminant Analysis, is a statistical technique used for classification and dimensionality reduction. It is an extension of Discriminant Analysis (DA) to situations where there are more than two groups to classify. MDA allows for the simultaneous classification of observations into multiple groups based on multiple predictor variables.

Here are the key aspects and steps involved in Multi Discriminant Analysis (MDA):

1. Multiple Groups: MDA is used when there are three or more groups (classes) that observations can be classified into based on their characteristics or predictors.
2. Predictor Variables: Like in Discriminant Analysis (DA), MDA uses several independent variables (predictors) to predict the group membership of observations. These predictors are usually continuous variables, and the model assumes multivariate normality within each group.

These methods are applied based on the nature of the data, the research questions, and the goals of the analysis. Each technique offers insights into different aspects of the relationships between variables in complex data sets.

Measure of central tendency, measures of dispersion.

Measures of central tendency are a value attempt to describe the central position of the set of data. The most common measures of central tendency are mean, median and mode.

Definitions of Average:

1. "Averages are statistical constant which enable us to comprehend in a single effort the significance of the whole." A.L.Bowley
2. "An average is a single value selected from a group of values to represent them in some way, a value which is supposed to stand for whole group of which it is a part, as typical of all the values in the group." A.E.Waugh
3. "An average is a sometimes called a measure of central tendency because individual values of the variable usually cluster around it. Average are useful, however for certain types of data in which there is little or no central tendency." Crum and smith
4. "An average is a single value within the range of the data that is use to represent all of the values in the Series. Since an average is somewhere within the range of

the data, it is sometimes called a measure of central value." Croxton and Cowden

Definition of Arithmetic Mean: “Arithmetic mean is a set of observations is their sum divided by the number of observations.”

Suppose i f $x_1, x_2, x_3, \ldots\ldots\ldots\ldots x_n$ the given n observations are, then their arithmetic mean, usually denoted by $\bar{x}$ is given by:

$$\bar{x} = \frac{x_1 + x_2 + \ldots\ldots\ldots\ldots + x_n}{n} = \frac{\sum x}{N}$$

where,

∑x= Sum of the values N = Number of values.

Definition of Median:

“The median is that value of the variable, which divides the group in two equal parts, one part comprising all the values greater and the other, all values less than the median.”

Formula:

Median =size of $\left(\frac{N+1}{2}\right)$ th item

Definition of Mode: “Mode is the value which has the greatest frequency density in its immediate neighborhood.” –

Formula:

Mode= the value having maximum frequency.

Above given three measures of central tendencies are most widely analysis.

Measures of Dispersion

Dispersion refers to the spread of the data how one data point is spread from another data point. In the analysis the term dispersion is very important. It might possible that the mean of two series would be same that does not reveals that the two series performs the same. It is the dispersion tell researcher about the performance. If the value of measures of dispersion especially standard deviation is s all then it can be stated that the series has less variability and it has more consistency.

Definition of Measures of Dispersion:

“Dispersion is the measure of the variation of the items.” - A.L.Bowley Dispersion is a measure of the extent to which the individual items vary.” -

L.R.Connor ”Dispersion or spread of the degree of scatter or variation of the variables about central value.” -B.C.Brooks.and W.F.L.Dick.

"The degree to which numerical data tend to spread about and average value is called the variation or dispersion of the data.” - Spiegel.

We have few commonly used measures of dispersion. Even in our routine life also we use some of the measures of dispersion especially range is widely used in common transactions.

Let’s get into little depth to understand these measures of dispersions.

Range

It is the difference between the minimum and maximum items of the series. It is

$$\textbf{Absolute Range or Range} = x_{max} - x_{min},$$

or $$\textbf{Range} = L - S,$$

where **L** is the largest value and **S** is the smallest value of the term.

$$\textbf{Coefficient of Range or Relative Range} = \frac{\textbf{Absolute Range}}{\textbf{Sum of the two extremes}} = \frac{L-S}{L+S}.$$

generally used in quality control.

Standard Deviation

Standard deviation is the most important and commonly used measure of dispersion. It measures the absolute dispersion or variability of a distribution. A small standard deviation means a high degree of uniformity in the observations as

well as homogeneity of the series.

Definition

Standard deviation is the positive square root of the average of squared deviations taken from arithmetic mean.

Standard Deviation: $\sigma = \sqrt{\Sigma \frac{(x-\bar{x})^2}{n}}$

Alternatively,

$$\sigma = \sqrt{\frac{\Sigma d^2}{n} - \left(\frac{\Sigma d}{n}\right)^2},$$

Coefficient of standard deviation is a relative measure of standard deviation.

$$\text{Coefficient of Standard Deviation} = \frac{\sigma}{\bar{x}},$$

Variance

The variance is the square of standard deviation and is denoted by σ^2.

We have to understand that calculating every statistics there are formulae available we need to understand the formulae. There different formulae also available to calculate same statistics one has to understand the alternate use of such formulae.

Beyond the use of formulae and mechanical calculations what more important is the very interpretation of figure derived out of statistical calculations.

Now let's understand the aforementioned concepts of measures of central tendency and measures of dispersion with the help of examples based on the data we have collected.

We are taking a data of MBA-I year students age only to calculate measures of central tendency and dispersion.

Case 1:

Calculate the measures of central tendency and measure of dispersion for the age of

MBA-I year students.

22	23	20	22	20	25	22	21	21	22	25	21	23	20	22	23	24	21	21	21

Solution:

First we arrange the data in ascending order as follows

20	20	20	21	21	21	21	21	21	22	22	22	22	22	23	23	23	24	25	25

Formula:

We are going to use following formulae to calculate desired measures of central tendency and measures of dispersion.

1) $\bar{X} = \sum xi / n$= (Sum of all values / Total Number of values)

2) Median = {(n /2)th term + [(n/2) +1]th term} /2

3) Mode = Most of the value

4) Range= Maximum Value – Minimum Value = (L-S)

5) Coefficient of range =(L- S) / (L + S)

7) Standard Deviation (σ) =[$\sqrt{}$ ($\sum$ xi^2 /n) – ($\sum$ xi/n)^2]

8) Coefficient of s.d= ($\sigma / \bar{X}$)

9) Variance =σ^2

Calculations:

1) $\bar{X} = \sum xi / n$= (Sum of all values / Total Number of values)
   $\bar{X}$ =439 /20
   $\bar{X}$ =21.95

2) Median = {(n /2)th term + [(n/2) +1]th term} /2
   Median = {(20 /2)th term + [(20 /2) +1]th term} /2
   Median =[(10)th term + (11)th term]/2
   Median = (22+ 22) /2

   Median =22

3) Mode = Most common value = 21

4) Range= Maximum Value – Minimum Value = (L-S)

   Range= (25-20)

   Range = 5

5) Coefficient of range =(L- S) / (L + S)

   Coefficient of range =(25-20) / (25+20)

Coefficient of range =0.1111

Standard Deviation (σ)

Here n=20

Sr.No	X	X^2
1	22	484
2	23	529
3	20	400
4	22	484
5	20	400
6	25	625
7	22	484
8	21	441
9	21	441
10	22	484
11	25	625
12	21	441
13	23	529
14	20	400
15	22	484
16	23	529
17	24	576
18	21	441
19	21	441
20	21	441
Total	439	9679

Standard Deviation (σ) =[√ (∑ xi^2 /n) – (∑ xi/n)^2]

Standard Deviation (σ) =[√ (9679 / 20) – (439/20)^2]

Standard Deviation (σ) =[√ (483.95) – (481.8025)]

Standard Deviation (σ) =(√ 2.1475)

Standard Deviation (σ) =1.4654

6) Coefficient of S.d= (σ/ $\bar{X}$)

Coefficient of S.d= (1.4654 / 21.95)

Coefficient of S.d= 0.0668

7) Variance =σ^2

Variance =(0.0668)^2

Variance =0.0046

Correlation and Regression:

Correlation is a statistical tool which studies the relationship between two variables.

Correlation analysis is a statistical procedure by which we can determine the degree of association or relationship between two or more variables.

Coefficient of correlation is a measure of such a tendency, i.e. the degree to which the two variables are interrelated is measured by a coefficient which is called the coefficient of correlation.

Definition – The relationship between two variables such that a change in one variable results in a positive or negative change in the other variable and also a greater change in one variable results in corresponding greater or smaller change in the other variable is known as correlation.

'When the relationship is of a quantitative nature, the appropriate statistical tool for discovering and measuring the relationship and expressing it in a brief formula is known as correlation'. – Craxton and Cowden.

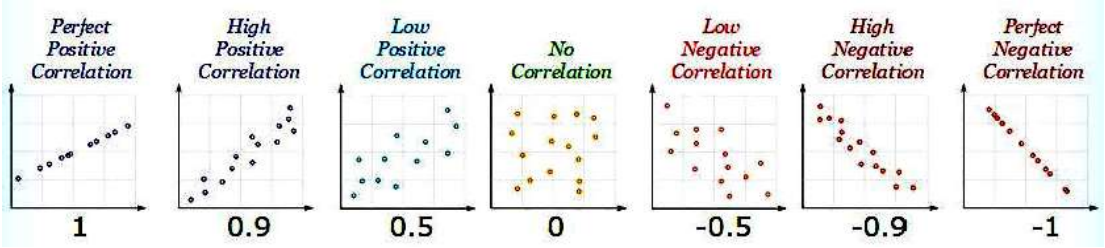
The coefficient of correlation between the two variables x, y is generally denoted by r or $r_{XY.}$

Covariance is an, 'absolute measure' and coefficient of correlation is relative measure of association.

The coefficient of correlation between the two variables x and y is generally denoted by r or r_{xy} or p (x,y) or p.

Properties of coefficient of correlation:

1. It is a measure of the closeness of a fit in a relative sense.
2. Correlation coefficient lies between - - and +1 i.e. $-1 \leq r \leq 1$.
3. The correlation is perfect and positive if r=1 and it is perfect and negative if r= -1.
4. If r=0 then there is no correlation between the two variables and thus the variables are said to be independent.
5. The correlation coefficient is a pure number and is not affected by a change of origin and scale.
6. It is a relative measure of association between two or more variables.



Ref:

https://www.google.com/search?q=diagrams+of+correlation+positive+and+negative

+correlation&tbm=isch&ved=2ahUKEwiU6cj3-uzqAhXe3XMBHcoOAmMQ2-cCegQIABAA&oq=diagrams+of+correlation+positive+and+negative+correlation&gs_lcp=CgNpbWcQAzoICAAQsQMQgwE6AggAOgUIABCxAzoECAAQQzoHCAAQsQMQQzoECAAQCjoGCAAQBRAeOgYIBAIEB46BggAEAoQGDoECAAQGFD9fFiSyQFgoswBaAFwAHgAgAGfAogBllKSAQYwLjUwLjiYAQCgAQGqAQtnd3Mtd2l6LWltZ8ABAQ&sclient=img&ei=EIkeX5ShJ967z7sPyp2ImAY&bih=635&biw=1366#imgrc=ikLqb7i9v05m3M, 27.07.2020, 1.29pm.

Karl Pearson's coefficient of correlation

Karl Pearson (1857-1936) gave following formula for measuring the magnitude

$$\rho(X, Y) = \frac{\Sigma x_i y_i - \frac{(\Sigma x_i)(\Sigma y_i)}{n}}{\sqrt{\left\{\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}\right\}\left\{\Sigma y_i^2 - \frac{(\Sigma y_i)^2}{n}\right\}}}$$

of linear correlation coefficient between two variables.

Let's study the correlation with an example from our case.

We will attempt two examples of correlation one is

Calculate the Correlation between HSC marks and Graduation marks and second is Calculate the Correlation between graduation marks and CET score.

HSC	Graduation	CET
64.9	69.6	36
53.9	53.77	35
69.5	53	29.8
66.6	55.55	67
64.2	69.24	20.5
59	65	94.45
53	52	40
65.7	61.52	43
64.7	45.67	38.11

82	77	36
61.7	68.94	49
70.3	75.08	51
58.8	67.38	39

69	64	39
60	70	78
54	48	39
50	62	38
70	63	50
63.2	72.28	52.11
68.7	66	51

First we will calculate the Correlation between HSC marks and Graduation marks

For the same using the formula we need to calculate few figures viz. Xi square, Yi square and multiplication of xi and yi. So preparing such table below we will calculate the figures.

HSC Marks (xi)	Graduation Marks (yi)	(xi)2 This column is the square of figures given in column number one i.e. xi	(yi)2 This column is the square of figures given I column number two i.e. yi	(xiyi) This column is the multiplication of figures in column 1 and column 2 i.e. multiplication of xi x yi
(1)	(2)	(3)	(4)	(5)
64.9	69.6	4212.01	4844.16	4517.04
53.9	53.77	2905.21	2891.21	2898.203
69.5	53	4830.25	2809	3683.5
66.6	55.55	4435.56	3085.8	3699.63
64.2	69.24	4121.64	4794.18	4445.208
59	65	3481	4225	3835
53	52	2809	2704	2756
65.7	61.52	4316.49	3784.71	4041.864
64.7	45.67	4186.09	2085.75	2954.849
82	77	6724	5929	6314
61.7	68.94	3806.89	4752.72	4253.598
70.3	75.08	4942.09	5637.01	5278.124
58.8	67.38	3457.44	4540.06	3961.944

69	64	4761	4096	4416
60	70	3600	4900	4200
54	48	2916	2304	2592
50	62	2500	3844	3100
70	63	4900	3969	4410
63.2	72.28	3994.24	5224.4	568.096
68.7	66	4719.69	4356	4534.2
Total the respective columns				
(x_i)=1269.2	**(y_i)= 1259.03**	**(x_i)^2= 81618.6**	**(y_i)^2= 80776**	**(x_i)^2 (y_i)^2= 80459.26**

Now we got all the figures we want for n=20, here 20 is the sample size or we can say the cases we have processed. Now plug in the figures in the formula to calculate

$$\rho(X, Y) = \frac{\Sigma x_i y_i - \frac{(\Sigma x_i)(\Sigma y_i)}{n}}{\sqrt{\left\{\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}\right\}\left\{\Sigma y_i^2 - \frac{(\Sigma y_i)^2}{n}\right\}}}$$

correlation as follows.

$$= \frac{80459.26 - \frac{(1269.2)(1259.03)}{20}}{\sqrt{\{81618.6 - \frac{(1269.2)^2}{20}\}\{807760.1 - \frac{(1259.03)^2}{20}\}}}$$

$$= \frac{80459.26 - \frac{1597960.88}{20}}{\{\sqrt{81618.26} - 80453.432\}\{80776.01 - 79257.82704\}} = \frac{561.216}{\sqrt{1632301.736}}$$

$$= \frac{80459.26 - 79898.0438}{\sqrt{\{1075.168\}\{1518.18296\}}}$$

$$= \frac{561.216}{1277.6156}$$

$$=0.4392$$

Correlation between HSC marks and Graduation marks is 0.4392

Now using the diagrammatic scale of correlation given above thi

0.4392 is interpreted as low positive correlation.

correlation of

So there is low positive correlation between HSC marks and Graduation marks.

Let’s solve another example, to calculate the correlation between graduation marks and CET score.

Correlation between graduation marks and CET score.

Graduation marks (x_i)	CET marks (y_i)	(x_i)2	(y_i)^2	(x_i)(y_i)
69.6	36	4844.16	1296	2505.6
53.77	35	2891.21	1225	1881.95
53	29.8	2809	888.04	1579.4
55.55	67	3085.8	4489	3721.85
69.24	20.5	4794.18	420.25	1419.42
65	94.45	4225	8920.803	6139.25
52	40	2704	1600	2080
61.52	43	3784.71	1849	2645.36
45.67	38.11	2085.75	1452.372	1740.484
77	36	5929	1296	2772
68.94	49	4752.72	2401	3378.06
75.08	51	5637.01	2601	3829.08
67.38	39	4540.06	1521	2627.82
64	39	4096	1521	2496
70	78	4900	6084	5460
48	39	2304	1521	1872
62	38	3844	1444	2356
63	50	3969	2500	3150
72.28	52.11	5224.4	2715.452	3766.511
66	51	4356	2601	3366
(x_i)=1259.03	(y_i)=925.97	(x_i)2=80776.01	(y_i)^2= 48345.92	(x_i)(y_i)=58786.78

$$\rho(X, Y) = \frac{\Sigma x_i y_i - \frac{(\Sigma x_i)(\Sigma y_i)}{n}}{\sqrt{\left\{\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}\right\}\left\{\Sigma y_i^2 - \frac{(\Sigma y_i)^2}{n}\right\}}}$$

$$= \frac{58786.76 - \frac{(1269.03)(925.97)}{20}}{\sqrt{\{80776.01 - \frac{(1259.03)^2}{20}\}\{48345.92 - \frac{(925.97)^2}{20}\}}}$$

$$= \frac{58786.76 - 58291.20043}{\sqrt{(80776.01 - 79257.82704)(48345.92 - 42871.02204}}$$

$$= \frac{495.57955}{\sqrt{(1518.18296)(5474.89796)}}$$

$$= \frac{495.57955}{\sqrt{8311896.790}}$$

$$= \frac{495.57955}{2883.036036}$$

$$= 0.1718$$

Correlation between Graduation marks and CET marks is 0.1718

Again this correlation is also very low positive correlation. Looking towards this figure the figure nearer to zero but the figure is not exactly zero hence, this figure is termed as very low positive correlation and good as no correlation.

Having studied the correlation now let's study the concept of regression. Generally regression is followed by correlation.

Regression

Regression is a statistical measure that attempts to determine the strength of the relationship between one dependent variable (Y) and a series of other changing variables (independent variables) (X).

Linear regression: $Y = a+bx+e$

Where,

Y = Dependent variable

a = constant (population Y intercept)

b = Population slope coefficient

x = independent variable

e = random error

Definition:

Regression analysis is a mathematical measure of the average relationship between two or more variables in terms of the original units of the data – M.M. Blair.

One of the most frequently used techniques in Economics and Business research, to find a relation between two or more variables that are related usually is Regression Analysis. – Taro Yamane.

Regression Analysis attempts to establish the Nature of Relationship between the variables, that is, to study the functional relationship between the variables x and y, and thereby provides a mechanism for predication or forecasting – Ya-Lun – Chou.

Regression Helps……

1. Analyze the relationship between y and x since y = f(x1, x2,x3,....., xk)
2. How much y changes with changes in each of the x's (x1, x2, x3 ……xn).
3. Forecast or predict the value of y based on the values of the X's.

Now let's take a practical example to understand the linear regression analysis.

Case: CET scores are dependent on the HSC and graduation marks.

Here we have used regression analysis where CET score is dependent variable and marks scored at HSC and Graduation are independent variables. Our effort is to check whether the CET score of a candidate is dependent on the HSC and graduation marks or otherwise.

So the formula to calculate regression is,

$Y=b_0 + b_1x_1 + b_2x_2$

to get the values of above formula we, first need to calculate,

1) $\bar{X}_1 = \frac{\Sigma X_1}{n}$

2) $\bar{X}_2 = \frac{\Sigma X_2}{n}$

3) $\bar{Y} = \frac{\Sigma Y}{n}$

4) $b_0 = \bar{Y} - b_1 \bar{X}_1 - b_2 \bar{X}_2$

5) $b_1 = \frac{[(\sum X2)2\ (\sum X1Y) - (\sum X1\ X2).(\sum X2Y)\ ]}{[\ (\sum X1)2\ (\sum X2)2 - (\sum X1X2)2\ ]}$

6) $b_2 = \frac{[(\sum X1)2\ (\sum X\ 2Y) - (\sum X1X2).(\sum X1Y)\ ]}{[\ (\sum X1)2\ (\sum X2)2 - (\sum X1X2)2\ ]}$

Observation Table:

From raw data we go following figures of CET score of n=40 candidates

CET	HSC	Graduation
$\bar{Y}$	$\bar{X}$ 1	$\bar{X}$ 2
38	50	62
46	63	71
35	53.85	53.77
36	64.92	69.6
20.5	64.15	69.24
48	63.54	59
45	57	58
40	53	52
38	60	60.13
79	80.5	59
94.45	59	65
55	55	69
40	72	65
41	83	65
36	60.31	73.36
78	60	70

51	68.66	66
43	65.69	61.52
29.8	69.53	53
60	58	71
23	80	69
91	64.45	58
39	58.8	67.38
49	61.67	68.94
52.11	63.23	72.28
50	70	63
52	64.46	65.12
54	54.92	51
51	70.31	75.08
48	60	61.74
25	61	64
35	70.31	59.14
67	66.6	55.55
51	55	62
31	51.38	57.56
52	75.69	61.61
38.11	64.65	45.67
39	54	48
39	69	64
36	82	77

Calculations:

To facilitate the figures for our formula lets prepare a table as below.

Sr.No	**Y**	**X_1**	**X_2**	**$X_1 X_2$**	**X_1Y**	**X_2Y**	**X_1^2**	**X_2^2**
1	38	50	62	3100	1900	2356	2500	3844
2	46	63	71	4473	2898	3266	3969	5041
3	35	53.85	53.77	2895.515	1884.75	1881.95	2899.823	2891.213
4	36	64.92	69.6	4518.432	2337.12	2505.6	4214.606	4844.16
5	20.5	64.15	69.24	4441.746	1315.075	1419.42	4115.223	4794.178
6	48	63.54	59	3748.86	3049.92	2832	4037.332	3481
7	45	57	58	3306	2565	2610	3249	3364
8	40	53	52	2756	2120	2080	2809	2704
9	38	60	60.13	3607.8	2280	2284.94	3600	3615.617
10	79	80.5	59	4749.5	6359.5	4661	6480.25	3481
11	94.45	59	65	3835	5572.55	6139.25	3481	4225
12	55	55	69	3795	3025	3795	3025	4761
13	40	72	65	4680	2880	2600	5184	4225
14	41	83	65	5395	3403	2665	6889	4225
15	36	60.31	73.36	4424.342	2171.16	2640.96	3637.296	5381.69
16	78	60	70	4200	4680	5460	3600	4900
17	51	68.66	66	4531.56	3501.66	3366	4714.196	4356
18	43	65.69	61.52	4041.249	2824.67	2645.36	4315.176	3784.71

19	29.8	69.53	53	3685.09	2071.994	1579.4	4834.421	2809
20	60	58	71	4118	3480	4260	3364	5041
21	23	80	69	5520	1840	1587	6400	4761
22	91	64.45	58	3738.1	5864.95	5278	4153.803	3364
23	39	58.8	67.38	3961.944	2293.2	2627.82	3457.44	4540.064
24	49	61.67	68.94	4251.53	3021.83	3378.06	3803.189	4752.724
25	52.11	63.23	72.28	4570.264	3294.915	3766.511	3998.033	5224.398
26	50	70	63	4410	3500	3150	4900	3969
27	52	64.46	65.12	4197.635	3351.92	3386.24	4155.092	4240.614
28	54	54.92	51	2800.92	2965.68	2754	3016.206	2601
29	51	70.31	75.08	5278.875	3585.81	3829.08	4943.496	5637.006
30	48	60	61.74	3704.4	2880	2963.52	3600	3811.828
31	25	61	64	3904	1525	1600	3721	4096
32	35	70.31	59.14	4158.133	2460.85	2069.9	4943.496	3497.54
33	67	66.6	55.55	3699.63	4462.2	3721.85	4435.56	3085.803
34	51	55	62	3410	2805	3162	3025	3844
35	31	51.38	57.56	2957.433	1592.78	1784.36	2639.904	3313.154
36	52	75.69	61.61	4663.261	3935.88	3203.72	5728.976	3795.792
37	38.11	64.65	45.67	2952.566	2463.812	1740.484	4179.623	2085.749
38	39	54	48	2592	2106	1872	2916	2304
39	39	69	64	4416	2691	2496	4761	4096
40	36	82	77	6314	2952	2772	6724	5929
Total	1875.97	2558.62	2518.69	161802.8	119912.2	118190.4	166420.1	160717.2

Calculations:

1) $\bar{X}_1 = \frac{\sum X}{1_n}$

$\bar{X}_1 = 2558.62/40$

$\bar{X}_1 = 63.9655$

2) $\bar{X}_2 = \frac{\Sigma X_2}{n}$

$\bar{X}_2 = 2518.69/40$

$\bar{X}_2 = 62.96725$

3) $\bar{Y} = \frac{\Sigma Y}{n}$

$\bar{Y} = \frac{1875.97}{40}$

$\bar{Y} = 46.899$

4) $b_1 = \frac{[(\sum X2)2\ (\sum X1Y) - (\sum X1\ X2).(\sum X2Y)\ ]}{[\ (\sum X1)2\ (\sum X2)2 - (\sum X1X2)2\ ]}$

$b_1 = \frac{[(160717.2)\ (119912.2) - (161802.8).(118190.4)]}{[(166420.1)\ (160717.2) - (161802.8)2]}$

$b_1 = \frac{[19271953030 - 19123537653]}{[26746572496 - 26180146088]}$

$b_1 = \frac{148415380}{566426408}$

$b_1 = 0.262020587$

5) $b_2 = \frac{[(\sum X1)2\ (\sum X\ 2Y) - (\sum X1X2).(\sum X1Y)\ ]}{[\ (\sum X1)2\ (\sum X2)2 - (\sum X1X2)2\ ]}$

$b_2 = [(166420.1)\ (118190.4) - (161802.8)\ (119912.2)] / [(166420.1)\ (160717.2) - (161802.8)^2]$

$b_2 = [19669258187 - 19402129714] / [26746572496 - 26180146088]$

$b_2 = (267128473 / 566426408)$

$b_2 = 0.471603$

6) $b_0 = \bar{Y} - (b_1 \bar{X}_1 - b_2 \bar{X}_2)$

$b_0 = 46.89925 - [(0.262020587)(63.9655)] - [(0.471603)(62.96725)]$

$b_0 = 46.89925 - 16.76027786 - 29.695544$

$b_0 = 0.443428141$

7) $Y = b_0 + b_1X_1 + b_2X_2$

After calculation of above now we can establish the regression as,

$Y = 0.4434 + (0.2620)X_1 + (0.471603)X_2$

It means dependent variable i.e. CET score = 0.4434 times x1(HSC marks) plus

0.4716 times x2 (Graduation marks).

Now with this we can estimate the figure of dependent variables as well with having known HSC and Graduation marks of candidate

51, 55, 62

Y = 0.4434(55)+ 0.4716 (62)

Y = 24.39 + 29.2

Y = 53.62Actual figure of y is 51 and from our regression statement we got the figure 53.62 we got little deviation, but the estimated figure is close to 51.

UNIT IV

SELF ASSESMENT QUESTIONS

Answers for Check Your Progress

Multiple Choice Questions:

1. Correlation is a statistical tool which studies the ……..between two variables
    a. Relationship
    b. Dependability
    c. Independence
    d. None of the above
2. Correlation coefficient lies between plus 1 and …….
    a. Plus 1
    b. Minus 1
    c. Zero
    d. None of the above
3. If r=0 then there is ..... between the two variables
    a. Perfect positive correlation
    b. Perfect negative correlation
    c. No correlation
    d. Low positive correlation
4. The dependent variable in regression analysis is generally denoted by English letter …….
    a. X
    b. e
5. In linear regression Y = a+bx+e the letter e stands for……..
    a. Dependent variable
    b. Constant
    c. Independent variable
    d. Random error

6.Chi-square test is used to find the.....between variables.

a. Association

b. Relation

c. Dependency

d. None of the above

7.In the formula of chi-square test the letter E_i denotes .....

a.Observed frequencies

b. Expected frequencies

c. Column data

d.Row data

8.In hypothesis testing the term alpha (α) refers to ……

a.Degrees of freedom

b.Level of confidence

c.Level of significance

d.None of the above

9.When the value of calculated test statistics is less than table value then null hypothesis is ……

a.Accepted

b.Rejected

c.No action is taken

d.None of the above

10.The measurement scale preferred to test the hypothesis using‘t’ test is ……

a.Nominal scale

b.Ordinal scale

c.Interval and ratio scale

d.None of the above

Test following two hypotheses.

Case problem 1: Test the hypothesis. $H0_3$: There is no association between the

income of parents and stay of vicinity i.e. residential location. 5% level of Significance.

Case Problem 2: Test the hypothesis. There is no significant difference between the agreement on output of MBA syllabus among MBA-I and MBA-II Year students. 5% level of significance.

Case 3: Calculate the correlation between HSC marks and graduation marks using our collected data from MBA-II year students.

Case2: Calculate the correlation between Graduation marks and CET score using our collected data from MBA-II year students.

Case 3: Calculate the correlation between CET score and HSC marks from MBA-II year students.

HSC	61	70	65	60	55	51	64	58	80	76	81	60	63	57	65	72	55	55	60	83
Graduation	64	59	58	60	62	58	59	71	69	62	59	73	71	58	65	65	69	51	62	65
CET	25	35	91	38	51	31	48	60	23	52	79	36	46	45	52	40	55	54	48	41

Case 4: Work out the regression analysis and find out the dependability of graduation score on HSC score.

Graduation	69.6	53.8	53	55.6	69.2	65	52	61.5	45.7	77	68.9	75.1	67.4	64	70	48	62	63	72.3	66
HSC	64.9	53.9	69.5	66.6	64.2	59	53	65.7	64.7	82	61.7	70.3	58.8	69	60	54	50	70	63.2	68.7

Summary:

This chapter is fusion of important concepts in research and report writing.

We have learned from previous three chapters the different dimensions of research designs. Now it is time to analyze and interpret the data when data is collected. The data analysis is done objectively hence the statistical tools to be selected to analyze the data need due consideration. Measures of central tendency viz. mean, mode and median helps to find out the central figure in data series whereas the measured of dispersion viz. range, standard deviation and variance helps to identify variation in the data set. Every measure of central tendency and measure of dispersion has formula to calculate.

Correlation and regression are another interesting statistical tools helps to establish the relationship between variables. Correlation narrates the relationship in figures ranging from -1 to +1 perfect negative correlation to perfect positive correlation. Correlation is followed by regression. Regression analysis determines the relationship between two variables on the basis of dependability or impact of one variable on another. Hence we have a linear regression model i.e. Y = a+bx+e where Y is dependent variable.

Hypothesis is skeptical assumption about desired results of research undertaken. Hypothesis is central cord of any research and the entire research design in revolve around the hypothesis set for study. The major types of hypothesis we have studied in earlier chapters. The set hypothesis needs to be tested. The testing follows five steps one is formulate the hypothesis i.e. practical problem second is calculate the

statistics using relevant statistical tool third is choose the critical region then fourth step is decide the size of critical region i.e. 1%, 5% and 10% level of significance and the last compare the test statistics with standard table value to arrive at conclusion towards null hypothesis. Whether the statistics support to accept null hypothesis or reject the null hypothesis. There are various statistical tools available to test the hypothesis. Every tool has its own conditions of applications which needs to be carefully studied and select the appropriate tool for testing the hypothesis.

GLOSSARY

Uni-variate Analysis

- **Percentile**: A value below which a given percentage of observations in a dataset fall.
- **Mean**: The average of a dataset, calculated by summing all values and dividing by the count of values.
- **Median**: The middle value in a dataset when arranged in ascending or descending order.
- **Mode**: The most frequently occurring value in a dataset.

- **Standard Deviation**: A measure of the dispersion of a set of values, indicating how much individual data points deviate from the mean.
- **Range**: The difference between the maximum and minimum values in a dataset.
- **Minimum**: The smallest value in a dataset.
- **Maximum**: The largest value in a dataset.
- **Independent Sample t-test**: A statistical test to compare the means of two independent groups to determine if they are significantly different.

Bi-variate Analysis

- **Simple Correlation**: A statistical technique to measure the strength and direction of the relationship between two variables.
- **Simple Regression**: A method to model the relationship between two variables by fitting a linear equation to observed data.
- **Chi-square Test**: A statistical test used to determine if there is a significant association between categorical variables.
- **Paired Samples t-test**: A test used to compare means from the same group at different times or under different conditions.
- **ANOVA (Analysis of Variance)**: A statistical method used to compare means among three or more groups to see if at least one differs significantly.
- **Mann-Whitney Test**: A non-parametric test to compare differences between two independent groups when the data does not meet normality assumptions.
- **Wilcoxon Signed Rank Test**: A non-parametric test for comparing two paired groups to assess whether their population mean ranks differ.
- **Kruskal-Wallis Test**: A non-parametric alternative to ANOVA, used to compare three or more independent groups.

Multi-variate Analysis

- **Multiple Correlation**: A measure of the relationship between one dependent variable and multiple independent variables.

- **Multiple Regression**: An extension of simple regression that models the relationship between one dependent variable and two or more independent variables.
- **Factor Analysis**: A technique used to reduce data dimensions by identifying underlying factors that explain observed correlations among variables.
- **Friedman's Test**: A non-parametric test used to detect differences in treatments across multiple test attempts.
- **Cluster Analysis**: A method of grouping a set of objects in such a way that objects in the same group (cluster) are more similar than those in other groups.
- **Confirmatory Factor Analysis (CFA)**: A statistical technique used to verify the factor structure of a dataset based on a predefined model.
- **Structural Equation Modelling (SEM)**: A comprehensive statistical approach that combines factor analysis and multiple regression to analyze complex relationships.
- **Multiple Discriminant Analysis**: A technique used to distinguish between two or more groups based on their characteristics by finding a linear combination of features.

Reference for further study:

G., Z. W. (2013). *Business research methods.* UK: South-Western Cengage Learning.

Kothari, C. R., & Garg, G. (2015). *Research Methodology - Methods and Techniques* (3rd Reprint ed.). New Delhi: New Age Internaional Publishers.

Michael, V. P. *Research Methodology.* Mumbai : Himalaya Publishing House .

Nargundkar, R. (2008). *Marketing Research.* Bangalore: Tata McGraw-Hill Education.

Sachdeva, J. K. (2011). *Business Research Methodology* (Vol. 2nd Revised). Mumbai: Himalaya Publishing House.

Selitiz, C. (1965). *Research methods in social relations.* New York: Methuen & Co. LTD.

Young, P. V. (1939). *Scientific Social Surveys and Research.* New York: Prentice-Hall, Inc.

Zikmund, W. G. (2008). *Business Research Methods.* Mason (Ohio): South-Western Cengage Learning,.

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UNIT V

Preparation of Research Report

Unit Objectives

1. **Guidelines for Interpretation**:
    - Ensure clarity and accuracy in interpreting statistical results.
    - Use appropriate statistical techniques based on data characteristics.
    - Clearly define terms and assumptions to avoid misinterpretation.
2. **Steps in Report Writing**:
    - **Planning**: Outline the purpose, scope, and structure of the report.
    - **Research**: Gather and analyze data using appropriate methods.
    - **Organization**: Arrange findings logically with clear headings and subheadings.
    - **Writing**: Use clear and concise language, avoiding jargon or ambiguity.
    - **Review**: Edit for clarity, coherence, and adherence to guidelines before finalizing.
3. **Style of Research Reports**:
    - **APA (American Psychological Association)**: Commonly used in social sciences for its specific formatting rules for citations, references, and headings.
    - **MLA (Modern Language Association)**: Typically used in humanities for its focus on author-page citations and bibliography formatting.
    - **Anderson Style**: Specific to business and management fields, often adapted from APA style with emphasis on clarity and directness.
    - **Harvard Style**: A versatile style used in various disciplines, known for its emphasis on author-date citations and bibliography.

Mechanics of Report Writing

- **Structure**: Title page, abstract, introduction, methods, results, discussion, conclusion, references.
- **Language**: Use formal, objective language; avoid bias and ambiguity.
- **Visuals**: Include tables, figures, and charts to enhance understanding.
- **Citations**: Properly cite sources to give credit and support arguments.

Ethics in Research

- **Avoiding Plagiarism**:
    - Attribute ideas, data, and words to their original sources using proper citation.
    - Paraphrase and summarize instead of directly copying text.
    - Use plagiarism checker tools to verify originality (e.g., Turnitin, Copyscape).
- **Funding Agencies for Business Research**:
    - Identify and apply to relevant funding agencies based on research focus and eligibility criteria.
    - Examples include government grants, private foundations, and corporate sponsorships.

These objectives provide a comprehensive framework for conducting and reporting research ethically and effectively. Let me know if you need further clarification on any of these topics.

Report Preparation :

Preparing a report typically involves several key steps:

Define the Purpose: Understand the objective of the report and who the audience is.

Gather Information: Collect relevant data, facts, and figures that support your report's purpose.

Organize and Structure: Create an outline or framework for your report. This could include sections like Introduction, Methodology, Findings, Recommendations, and Conclusion.

Analysis and Interpretation: Analyze the data collected and interpret the findings. This is where you derive insights and conclusions from the information gathered.

Write the Report: Start with drafting the sections based on your outline. Ensure clarity, coherence, and logical flow throughout.

Review and Edit: Proofread your report for grammar, spelling, and clarity. Ensure that it meets the intended objectives and addresses the audience's needs.

Finalize and Present: Make any final adjustments and prepare the report for distribution or presentation to stakeholders.

Each of these steps requires attention to detail and clarity of communication to ensure the report effectively conveys its message and achieves its goals.

Guidelines and precautions for interpretation:

Interpretation, whether in the context of language, data, or any other field, involves deriving meaning or making sense of something. Here are some general guidelines and precautions to keep in mind:

Guidelines for Interpretation:

Understand the Context: Understanding the context is crucial in any research or analysis endeavor as it provides the backdrop against which data, findings, and interpretations are situated. Context refers to the broader circumstances, conditions, environment, or setting in which something exists or occurs. Here's why understanding the context is essential:

Importance of Understanding Context:

1. **Interpretation of Findings:**
    - Contextual factors shape how data and findings are interpreted. Understanding the context helps researchers avoid misinterpretation and ensures accurate conclusions.
2. **Meaning and Relevance:**

- Context provides meaning to data by explaining why certain patterns or behaviors occur. It helps researchers understand the relevance of their findings to real-world situations.

3. **Influence on Variables:**
    - Variables and outcomes can be influenced by contextual factors such as culture, history, geography, socioeconomic status, and political climate. Acknowledging these influences improves the validity and reliability of research outcomes.
4. **Ethical Considerations:**
    - Contextual understanding is essential for ethical research practices. It ensures that researchers respect cultural norms, values, and sensitivities when conducting studies involving human subjects or sensitive topics

Consider Multiple Perspectives: Considering multiple perspectives is a critical aspect of thorough analysis and decision-making across various disciplines and contexts. It involves actively seeking, acknowledging, and integrating diverse viewpoints, opinions, and interpretations related to a particular issue or topic. Here's why considering multiple perspectives is important and how it can be effectively implemented:

Importance of Considering Multiple Perspectives:

1. **Enhanced Understanding:**
    - Different perspectives offer unique insights and interpretations, leading to a more comprehensive understanding of complex issues or phenomena.
    - They provide a holistic view that considers various angles, contributing to a deeper grasp of the subject matter.
2. **Critical Thinking and Problem-Solving:**
    - Engaging with diverse perspectives encourages critical thinking by challenging assumptions and biases.
    - It fosters creative problem-solving approaches by exploring alternative solutions and strategies.

3. **Conflict Resolution and Collaboration:**
    - Integrating multiple perspectives facilitates effective communication and collaboration among stakeholders with differing viewpoints.
    - It promotes consensus-building and constructive dialogue, aiding in conflict resolution and decision-making processes.
4. **Ethical Considerations:**
    - Considering diverse perspectives promotes ethical decision-making by respecting and valuing the voices and experiences of all stakeholders.
    - It helps identify potential ethical implications and ensures fairness in decision outcomes.

Clarify Ambiguities: Clarifying ambiguities is crucial in any communication or decision-making process to ensure clarity, understanding, and effective outcomes. Ambiguity refers to situations where information, instructions, or messages can be interpreted in multiple ways or are unclear. Here are some strategies to clarify ambiguities:

Strategies to Clarify Ambiguities:

1. **Ask Clarifying Questions:**
    - **Probe for Specifics:** Ask questions that seek precise details or examples to clarify vague statements or instructions.
    - **Seek Examples:** Request concrete examples or scenarios to illustrate abstract concepts or unclear points.
2. **Define Terms and Concepts:**
    - **Specify Definitions:** Clearly define terms, jargon, or technical language to ensure a shared understanding among all parties.
    - **Avoid Assumptions:** Don’t assume that everyone has the same understanding of terminology; clarify definitions as needed.
3. **Provide Context:**
    - **Background Information:** Offer background context or relevant background information to help clarify the situation or issue.

- **Explain Relationships:** Describe how different elements or factors relate to each other to provide a clearer picture.

4. **Use Visual Aids:**
    - **Diagrams and Charts:** Use visual aids such as diagrams, flowcharts, or graphs to illustrate complex concepts or processes.
    - **Visual Representation:** Present information visually to complement verbal explanations and enhance comprehension.

Use Reliable Sources: Using reliable sources is crucial for obtaining accurate information and ensuring credibility in research, decision-making, and communication. Reliable sources are those that provide trustworthy, credible, and authoritative information that has been vetted through a rigorous process. Here are some key considerations and strategies for using reliable sources:

Identifying Reliable Sources:

1. **Peer-Reviewed Journals and Academic Publications:**
    - **Definition:** Articles published in peer-reviewed journals undergo rigorous evaluation by experts in the field before publication.
    - **Advantages:** Ensure high-quality research, credibility, and adherence to academic standards.
2. **Government Publications and Reports:**
    - **Definition:** Reports, statistics, and data published by government agencies or departments.
    - **Advantages:** Provide official and authoritative information on policies, laws, and public data.
3. **Books by Established Authors and Publishers:**
    - **Definition:** Books written by recognized experts, scholars, or reputable publishers.
    - **Advantages:** Offer comprehensive coverage, depth of analysis, and credibility in specialized fields.
4. **Educational Institutions and Universities:**

- **Definition:** Websites, publications, and research conducted by universities and educational institutions.
- **Advantages:** Ensure academic rigor, research integrity, and scholarly contributions.

Be Aware of Bias: Being aware of bias is crucial in various aspects of research, decision-making, and everyday information consumption. Bias refers to systematic errors in thinking or judgment that can distort perceptions, influence decisions, and affect the reliability of information. Here are key considerations and strategies to be aware of bias:

Types of Bias to Be Aware Of:

1. Confirmation Bias:
   - Definition: The tendency to search for, interpret, favor, and recall information that confirms one's preexisting beliefs or hypotheses.
   - Impact: Leads to reinforcing existing beliefs and overlooking contradictory evidence, hindering objective analysis.

2. Selection Bias:
   - Definition: Occurs when certain individuals or data points are systematically excluded or underrepresented in a study or sample.
   - Impact: Skews results and conclusions, making them less representative of the entire population or context.

3. Reporting Bias:
   - Definition: Selective reporting of information or outcomes that are more likely to be published or emphasized based on their perceived importance or interest.
   - Impact: Creates an incomplete or biased portrayal of reality, influencing public perception or policy decisions.

4. Cultural Bias:

- Definition: Occurs when research, information, or viewpoints reflect the biases, values, or perspectives of a particular culture or group.
- Impact: Limits the applicability or relevance of information across diverse cultural contexts, potentially perpetuating stereotypes or misconceptions.

5. Experimenter Bias (Researcher Bias):

- Definition: Occurs when researchers' expectations or preferences unconsciously influence the outcomes of experiments or studies.
- Impact: Compromises the objectivity and validity of research findings, affecting the credibility of scientific or academic studies.

Strategies to Address Bias:

1. Awareness and Reflection:

- Self-Reflection: Continuously monitor your own biases and assumptions. Question your interpretations and judgments to ensure objectivity.
- Open-Mindedness: Remain open to different perspectives and be willing to revise your views based on new evidence or information.

2. Diverse Sources and Perspectives:

- Seek Diversity: Consult a variety of sources, including those with different ideological, cultural, or disciplinary perspectives.
- Cross-Check Information: Verify information across multiple reputable sources to mitigate the influence of biased reporting or viewpoints.

3. Critical Thinking and Evaluation:

- Evaluate Information: Scrutinize the credibility and reliability of sources, considering factors such as methodology, evidence, and potential biases.

- Challenge Assumptions: Question assumptions underlying arguments or conclusions presented in information or research.

4. Transparency and Disclosure:

- Disclose Conflicts: Be transparent about any conflicts of interest, affiliations, or funding sources that may influence your interpretation or presentation of information.
- Evaluate Motivations: Consider the motivations or incentives that may shape the presentation or emphasis of information.

5. Peer Review and Validation:

- Peer Review: Rely on peer-reviewed publications and expert reviews that involve rigorous scrutiny and validation of research or information.
- Consult Experts: Seek insights from subject matter experts or individuals with specialized knowledge to gain a deeper understanding of complex issues.

By actively recognizing and addressing bias, individuals can enhance the objectivity, credibility, and fairness of their decision-making processes, research endeavors, and interactions with information. This approach promotes a more informed and balanced perspective in navigating diverse perspectives and complex issues.

Consult Experts: Consulting experts is a valuable strategy when seeking reliable information, insights, or guidance on complex topics or issues. Experts possess specialized knowledge, experience, and expertise in specific fields or disciplines, making them credible sources of information. Here's how consulting experts can be beneficial and how to effectively engage with them:

Benefits of Consulting Experts:

1. **Specialized Knowledge and Expertise:**
    - Experts have in-depth knowledge and expertise in their respective fields, providing authoritative information and insights that may not be readily available from other sources.

2. **Current and Relevant Information:**
    - Experts stay informed about the latest research, trends, and developments within their fields, offering up-to-date information and perspectives.
3. **Problem-Solving and Decision-Making Support:**
    - Consulting experts can provide guidance and recommendations based on their experience and knowledge, aiding in problem-solving and decision-making processes.
4. **Quality Assurance:**
    - Experts can help ensure the credibility, accuracy, and reliability of information by validating findings

Document Assumptions: Documenting assumptions is a critical aspect of any research, project, or decision-making process. Assumptions are beliefs or hypotheses that are taken for granted or accepted as true without proof, and they form the foundation upon which conclusions and actions are based. Here's how to effectively document assumptions:

Why Document Assumptions?

1. **Clarity and Transparency:**
    - Documenting assumptions ensures clarity and transparency about the underlying beliefs or hypotheses guiding your research, project, or decision-making.
2. **Risk Management:**
    - Identifying and documenting assumptions helps in assessing potential risks and uncertainties associated with them.
3. **Communication:**
    - Communicating assumptions clearly helps stakeholders, team members, or reviewers understand the basis for your decisions or conclusions.
4. **Verification and Validation:**
    - Documenting assumptions facilitates the process of verifying and validating them through evidence, data, or further analysis.

5. **Flexibility and Adaptability:**
    - By documenting assumptions, you can easily revisit and update them as new information becomes available or circumstances change.

Update Interpretations: Updating interpretations involves revisiting and refining the understanding or meaning derived from data, information, or research findings based on new insights, evidence, or changes in context. Here's how to effectively update interpretations:

Steps to Update Interpretations:

1. **Review Existing Interpretations:**
    - Start by reviewing your current interpretations of the data, information, or findings. Identify the key conclusions or insights drawn from the original analysis.
2. **Consider New Evidence or Data:**

Evaluate any new evidence, data points, or information that may have emerged since the initial interpretation. This could include additional research findings, updated statistics, or fresh perspectives.

Precautions for Interpretation: Updating interpretations involves revisiting and refining the understanding or meaning derived from data, information, or research findings based on new insights, evidence, or changes in context. Here's how to effectively update interpretations:

Steps to Update Interpretations:

1. **Review Existing Interpretations:**
    - Start by reviewing your current interpretations of the data, information, or findings. Identify the key conclusions or insights drawn from the original analysis.
2. **Consider New Evidence or Data:**

- Evaluate any new evidence, data points, or information that may have emerged since the initial interpretation. This could include additional research findings, updated statistics, or fresh perspectives.

Avoid Over interpretation: Avoiding over interpretation is essential to maintain the accuracy and validity of conclusions drawn from data or information. Over interpretation occurs when conclusions go beyond what the evidence supports, leading to potentially misleading or incorrect assumptions. Here are some strategies to avoid over interpretation:

Strategies to Avoid Over interpretation:

1. **Stick to the Evidence:**
   - Base conclusions strictly on the data, facts, or evidence available. Avoid making assumptions or extrapolating beyond what the data can support.
2. **Be Clear and Precise:**
   - Clearly define the scope and limitations of your interpretations. Use precise language to convey the extent of your conclusions without overstating or embellishing.
3. **Consider Alternative Explanations:**
   - Explore alternative explanations or interpretations of the data. Acknowledge different perspectives and potential biases that could influence your interpretation.

Watch for Misinterpretation: Watching for misinterpretation is crucial to maintain accuracy and clarity in communication, analysis, and decision-making processes. Misinterpretation occurs when information, data, or messages are misunderstood or incorrectly interpreted, leading to potential errors or misunderstandings. Here are some strategies to help watch for misinterpretation:

Strategies to Watch for Misinterpretation:

1. **Clarify Ambiguities:**

- Address unclear or ambiguous statements promptly by seeking clarification from the source or providing additional context if needed.

2. **Verify Understanding:**
   - Confirm comprehension by summarizing key points or asking follow-up questions to ensure alignment between what was communicated and what was understood.
3. **Check for Assumptions:**
   - Identify and challenge assumptions underlying interpretations to avoid jumping to conclusions without sufficient evidence or justification.
4. **Use Clear and Precise Language:**
   - Communicate information using clear, concise, and unambiguous language to minimize the risk of misinterpretation.
5. **Consider Different Perspectives:**
   - Acknowledge diverse viewpoints and interpretations by considering alternative

Check for Consistency: Checking for consistency is crucial in various aspects of analysis, communication, and decision-making to ensure accuracy, reliability, and coherence. Consistency refers to the absence of contradictions or discrepancies within data, information, arguments, or interpretations. Here are some strategies to effectively check for consistency:

Strategies to Check for Consistency:

1. **Cross-Reference Data and Information:**
   - Compare information across different sources, documents, or datasets to identify any inconsistencies or discrepancies.
   - Use reliable sources and ensure data integrity to validate findings.
2. **Review Assumptions and Premises:**
   - Assess underlying assumptions, premises, or foundational principles to ensure they align consistently with the conclusions drawn.

- Verify that assumptions are applied uniformly across analyses or interpretations.

3. **Examine Methodology and Processes:**
   - Evaluate the methodology, procedures, or analytical techniques used to gather and analyze data.
   - Ensure consistency in data collection methods, measurement tools, and statistical procedures.

Verify Facts: Verifying facts is essential to ensure accuracy, credibility, and reliability in any information you use or communicate. In today's information-rich environment, it's crucial to distinguish between factual information and misinformation. Here are effective strategies to verify facts:

Strategies to Verify Facts:

1. Cross-Check Multiple Sources:
   - Consult multiple reputable sources to corroborate the information. Compare details across sources to ensure consistency.

2. Use Reliable and Credible Sources:
   - Rely on established news organizations, peer-reviewed journals, government agencies, and recognized experts in the field.
   - Check the reputation and track record of the sources for accuracy and trustworthiness.

3. Verify Primary Sources:
   - Whenever possible, refer directly to primary sources such as official documents, original research studies, or direct statements from relevant individuals or organizations.
   - Avoid relying solely on secondary or interpretive sources.

4. Evaluate Authorship and Expertise:

- Assess the qualifications, expertise, and credentials of the authors or sources providing the information.
- Consider whether the author or organization has a reputable background in the subject matter.

5. Check Date and Currency:
- Verify the currency of the information. Ensure that the facts are up-to-date and reflect the latest developments or changes.

6. Corroborate with Consensus:
- Look for consensus among experts or multiple independent sources on controversial or complex topics.
- Beware of information that contradicts widely accepted knowledge without strong evidence.

7. Question Biases and Motivations:
- Consider potential biases or motivations that could influence the presentation or interpretation of facts.
- Be cautious of information that appears to promote a specific agenda or viewpoint without transparent disclosure.

8. Seek Verification from Trusted Contacts:
- Engage with trusted colleagues, peers, or subject matter experts to verify facts or discuss interpretations.

By employing these strategies, you can enhance your ability to verify facts accurately and make informed decisions based on reliable information. This approach is critical in combating misinformation and ensuring the integrity of your research, communication, or decision-making processes.

Consider Long-term Effects: Considering long-term effects is crucial in decision-making, planning, and policy formulation to anticipate and mitigate potential consequences over extended periods. Here's why it's important and how to effectively consider long-term effects:

Importance of Considering Long-Term Effects:

1. **Sustainability and Resilience:**
    - Long-term thinking promotes sustainable practices and resilience by ensuring that decisions do not compromise future resources or opportunities.
2. **Risk Management:**
    - Anticipating long-term effects helps in identifying and mitigating potential risks and uncertainties that may arise over time.
3. **Impact on Stakeholders:**
    - Ensures that decisions account for the well-being and interests of stakeholders, both current and future generations.

Respect Complexity: Respecting complexity involves acknowledging and understanding that real-world issues, systems, and situations are multifaceted and interconnected. It emphasizes the recognition that simple solutions or explanations often do not adequately address the intricate nature of problems or phenomena. Here are key aspects of respecting complexity and how to approach it effectively:

Key Aspects of Respecting Complexity:

1. **Holistic Understanding:**
    - Appreciate that complex issues involve multiple dimensions, factors, and stakeholders. Consider how these elements interact and influence each other.
2. **Systemic Approach:**

- Adopt a systemic perspective that examines the interrelationships and interdependencies within systems or processes. Identify feedback loops, nonlinear relationships, and emergent properties.

3. **Embrace Uncertainty:**
   - Acknowledge the inherent uncertainty and unpredictability in complex systems. Recognize that outcomes may be influenced by unforeseen variables or interactions.
4. **Interdisciplinary Insights:**
   - Draw on insights from diverse disciplines, perspectives, and expertise to gain a comprehensive understanding of complex issues. Integrate knowledge across fields to address multifaceted challenges.

Ethical Considerations: Ethical considerations are fundamental principles that guide responsible conduct in research, decision-making, and interactions, ensuring fairness, integrity, and respect for individuals and communities. When addressing ethical considerations, it's important to uphold ethical standards and principles to protect participants, stakeholders, and the broader society. Here are key aspects of ethical considerations and how they can be integrated into various contexts:

Key Aspects of Ethical Considerations:

1. **Informed Consent:**
   - Obtain informed consent from participants before involving them in research, studies, or interventions. Ensure they understand the purpose, procedures, risks, and benefits involved.
2. **Confidentiality and Privacy:**
   - Protect confidentiality by safeguarding personal information and ensuring privacy rights of individuals. Minimize risks of unauthorized access or disclosure of sensitive data.

Communicate Clearly: Communicating clearly is essential in all aspects of professional and personal interactions to ensure understanding, clarity, and effective information exchange. Clear communication helps prevent misunderstandings, fosters collaboration, and facilitates decision-making. Here are key strategies to enhance clarity in communication:

Key Strategies for Clear Communication:

1. **Know Your Audience:**
    - Tailor your message to the knowledge level, interests, and needs of your audience. Consider their background and familiarity with the subject matter.
2. **Use Simple Language:**
    - Avoid jargon, technical terms, or complex language that may confuse or alienate your audience. Use plain language that is easy to understand.
3. **Organize Your Thoughts:**

Structure your message logically with a clear introduction, main points, and a conclusion. Use headings, bullet points, or visual aids to enhance clarity.

By adhering to these guidelines and precautions, interpreters can enhance the accuracy, reliability, and clarity of their interpretations across various domains.
Steps in report writing:

Writing a report on research methodology typically involves several key steps to ensure clarity and completeness. Here are the essential steps:

1. Introduction: Provide background information on the research topic, objectives, and the importance of the methodology used.
2. Research Design: Describe the overall design of the study (e.g., experimental, observational, qualitative, quantitative) and justify why this design was chosen.

3. Sampling: Explain how participants or samples were selected (sampling technique) and justify the sample size.
4. Data Collection: Detail the methods used to gather data (e.g., surveys, interviews, experiments) and explain why these methods were appropriate.
5. Variables: Define and operationalize the variables studied (independent, dependent, and control variables).
6. Data Analysis: Describe the techniques used to analyze the data (e.g., statistical tests, thematic analysis) and justify their use.
7. Ethical Considerations: Discuss ethical issues related to the research (e.g., informed consent, confidentiality, participant welfare).
8. Limitations: Acknowledge any limitations of the methodology (e.g., sample bias, data collection constraints) that may affect the study's validity or generalizability.
9. Conclusion: Summarize how the chosen methodology addressed the research objectives and contributed to the overall findings.
10. Recommendations: Provide recommendations for future research or improvements to the methodology based on the insights gained.
11. References: List all sources cited in the report using a consistent citation style (e.g., APA, MLA).
12. Appendices: Include any additional materials such as questionnaires, raw data, or supplementary analyses.

- Each of these steps ensures that the report on research methodology is comprehensive, transparent, and able to be replicated by other researchers.
- Style of research report :
- A research report typically follows a structured format to communicate findings clearly and effectively. Here are the key components and style considerations for a standard research report:
- Title Page: Includes the title of the report, author’s name, date, and any other relevant information like institutional affiliation.

- Abstract: A concise summary of the research objectives, methodology, findings, and conclusions. It provides a snapshot of the entire report.
- Introduction: Sets the stage by outlining the research problem, its significance, and the objectives of the study. It also includes a brief literature review to provide context.
- Methods: Describes how the research was conducted, including details on participants, materials used, procedures followed, and data analysis methods.
- Results: Presents the findings of the study in a logical sequence using tables, figures, and text. It should be clear and objective, without interpretation or discussion.
- Discussion: Analyzes and interprets the results in relation to the research questions or hypotheses. It should also discuss implications, limitations, and suggest future research directions.

Conclusion: Summarizes the main findings of the study and their implications. It should align with the objectives stated in the introduction.

References: Lists all sources cited in the report, following a specific citation style (e.g., APA, MLA).

Appendices (if applicable): Includes additional material that supports the main text, such as raw data, questionnaires, or detailed methodology.

Style Considerations:

Clarity and Conciseness: Use clear and straightforward language. Avoid jargon unless necessary, and define technical terms.

Objectivity: Present findings objectively without personal bias or interpretation in the results section.

Logical Flow: Arrange sections in a logical sequence: introduction, methods, results, discussion, and conclusion.

Accuracy: Ensure accuracy in reporting data and citing sources.

Formatting: Follow specific formatting guidelines (e.g., font size, margins, spacing) required by the institution or journal.

Citation Style: Consistently apply a specific citation style throughout the report.

Visual Aids: Use tables, figures, and graphs effectively to present data when appropriate, ensuring they are clear and relevant to the text.

By adhering to these components and style considerations, a research report becomes a comprehensive document that effectively communicates the research process, findings, and implications to the intended audience.

Mechanics of report writing :

Report writing involves several key mechanics that ensure clarity, coherence, and professionalism in conveying information. Here are some essential mechanics to consider:

Structure: Reports typically follow a structured format including an introduction, main body with sections or headings, conclusions, and recommendations if applicable. Each section serves a specific purpose in presenting information logically.

Clarity and Conciseness: Use clear and concise language to convey your message effectively. Avoid unnecessary jargon or overly complex sentences that might confuse the reader.

Grammar and Punctuation: Correct grammar and punctuation are crucial for readability and professionalism. Ensure proper use of commas, periods, semicolons, etc., and maintain consistency throughout the report.

Formatting: Pay attention to formatting guidelines such as margins, font size, line spacing, and page numbering. Consistent formatting makes the report visually appealing and easy to navigate.

Citations and Referencing: If your report includes references or citations, follow the appropriate citation style (e.g., APA, MLA) consistently. This applies to both in-text citations and the bibliography or references section.

Visual Aids: Incorporate relevant tables, charts, graphs, or images where necessary to support your findings. Ensure these visuals are labeled correctly and explained in the text.

Logical Flow: Arrange information in a logical sequence that guides the reader from one point to the next. Use headings and subheadings to help organize content and improve readability.

Accuracy and Precision: Double-check all facts, figures, and data included in the report to ensure accuracy. Precision in reporting details is important for credibility.

Proofreading and Editing: Before finalizing the report, thoroughly proofread it to correct any spelling mistakes, typos, or grammatical errors. Editing helps refine the language and structure for clarity.

Audience Consideration: Tailor your writing style and content to suit the intended audience of the report. Consider their knowledge level and expectations when presenting information.

By paying attention to these mechanics, you can create a well-structured, clear, and professional report that effectively communicates your findings or recommendations.

Ethics in research:

Ethics in research refers to the principles of conduct governing research practices, ensuring that studies are conducted in a morally and socially responsible manner. Key aspects include:

Informed Consent: Participants must be fully informed about the study's purpose, procedures, risks, and benefits before agreeing to participate.

Voluntary Participation: Participation in research should be voluntary, and participants should not be coerced or pressured to take part.

Confidentiality: Researchers must protect participants' privacy by keeping their personal information confidential, unless consented otherwise or required by law.

Avoiding Harm: Researchers should minimize potential risks and avoid causing harm to participants, both physically and psychologically.

Fairness and Equity: Research should be conducted with fairness, ensuring that all participants are treated equitably and without discrimination.

Integrity in Reporting: Researchers should report their findings truthfully and accurately, avoiding selective reporting or manipulation of data.

Respect for Participants: Researchers should respect participants' rights, beliefs, cultures, and perspectives throughout the research process.

These principles are typically enforced through ethical review boards or Institutional Review Boards (IRBs) in academic and medical settings, ensuring that research meets ethical standards and guidelines

Avoiding plagiarism :

Avoiding plagiarism is crucial in academic and professional writing. Here are some key tips:

Cite Sources Properly: Whenever you use someone else’s ideas, words, or data, cite the source. Follow the citation style required by your institution or publication.

Paraphrase and Summarize: Instead of copying verbatim, rephrase information in your own words. Be sure to still cite the original source.

Use Quotations Correctly: When directly quoting, use quotation marks and provide a citation. Keep quotes brief and use them sparingly.

Manage Your References: Keep track of all sources you consult and plan to use in your writing. This helps ensure you can properly credit them.

Understand Plagiarism Rules: Familiarize yourself with your institution’s or publisher’s policies on plagiarism. Different places may have varying definitions and consequences.

Develop Your Own Ideas: Balance incorporating others’ work with expressing your own thoughts and analysis. This demonstrates your understanding and engagement with the topic.

Review and Edit: Always review your work before submission to ensure you have appropriately cited all sources and avoided unintentional plagiarism.

By following these guidelines, you can maintain academic integrity and produce original, well-supported work.

Plagiarism checker tools:

Sure, here are some popular plagiarism checker tools:

Turnitin:

Turnitin is a widely used plagiarism detection service that helps educators and institutions identify potential instances of plagiarism in students' work. Here are key aspects and features of Turnitin:

1. Purpose: Turnitin is primarily used to promote academic integrity by checking submitted documents against a vast database of academic content, internet sources, and previously submitted papers to identify similarities.
2. How it Works: When a document is submitted to Turnitin, it compares the text against its database and generates an "Originality Report" highlighting passages that match other sources. It provides a similarity score indicating the percentage of the document that matches existing content.

Grammarly:

Grammarly is a popular digital writing assistant that helps users improve their writing by providing grammar, punctuation, spelling, style, and readability suggestions. Here are the key aspects and features of Grammarly

1. Grammar and Spelling: Grammarly detects and corrects grammatical errors, including punctuation, verb tense, subject-verb agreement, and more. It also identifies spelling mistakes and suggests corrections.

2. Style and Clarity: Beyond basic grammar, Grammarly provides suggestions to enhance the clarity, conciseness, and coherence of your writing. It helps improve sentence structure, word choice, and overall readability.

Copys cape:

Copys cape is an online plagiarism detection service primarily used by website owners, content creators, and publishers to check for unauthorized use of their content on the internet. Here are the key aspects and features of Copys cape:

1. Purpose: Copyscape helps users identify instances of plagiarism by comparing a submitted URL or text against a vast database of web pages and online content.

2. Website Content Protection: Website owners and bloggers use Copyscape to monitor their content across the web. It detects if other websites have copied their articles or blog posts without permission.

Plag scan:

Plag scan is another online plagiarism detection service similar to Copyscape, primarily used by educators, students, writers, and content creators to check for plagiarism in academic papers, articles, and other written content. Here are the key aspects and features of Plag scan:

1. Purpose: Plag scan helps users identify instances of plagiarism by comparing submitted documents against a comprehensive database of academic papers, publications, and internet sources.
2. Types of Content: Users can upload various types of documents for analysis, including essays, research papers, reports, and website content.

Quetext:

Quetext is an online plagiarism detection tool designed to help users check for similarities and potential plagiarism in written content. Here are the key aspects and features of Quetext:

1. Purpose: Quetext is primarily used by students, educators, writers, and professionals to ensure the originality of their work and avoid unintentional plagiarism.
2. Plagiarism Detection: Users can upload documents or paste text directly into Quetext's interface for analysis. The tool compares the submitted content against its database of academic papers, websites, and other online sources to identify similarities.

Dupli Checker:

Dupli Checker is an online plagiarism detection tool and content analysis platform used primarily by educators, students, writers, and website owners to check for plagiarism and ensure content originality. Here are the key aspects and features of Dupli Checker:

1. Plagiarism Detection: DupliChecker allows users to upload documents or paste text directly into its interface for analysis. It compares the submitted content against a large database of academic papers, websites, and other online sources to identify similarities.
2. Document Comparison: Users can also compare two documents or URLs to detect similarities and overlaps between them. This feature is useful for verifying the originality of drafts, revisions, or collaborative work.

Small SEO Tools Plagiarism Checker:

Small SEO Tools offers a plagiarism checker tool that helps users detect duplicate content across the web. It's designed to scan text and compare it against a vast database to identify similarities with existing online content. Users can input text directly into the tool or upload documents for analysis. The tool provides a percentage of originality and highlights specific passages that may be plagiarized, making it useful for students, writers, and businesses to ensure content authenticity and avoid copyright issues.

Plagiarism Checker by Search Engine Reports:

The Plagiarism Checker by Search Engine Reports is another useful tool for detecting plagiarism. It allows users to enter text or upload documents to scan for similarities across the web. This tool also provides a percentage of originality and highlights specific plagiarized content. It's popular among students, educators, and content creators who need to ensure the authenticity of their work and avoid plagiarism issues. The interface is user-friendly, making it easy to understand the results and take necessary actions to rectify any detected plagiarism.

Each tool has its own strengths and limitations, so the best choice depends on your specific needs, such as academic integrity, web content originality, or general text plagiarism detection.

Funding agencies for business research:

There are several funding agencies that support business research across different countries and regions. Here are some notable examples:

National Science Foundation (NSF) (USA): Provides grants for various types of research, including business-related studies.

European Commission – Horizon Europe: Offers funding for research and innovation projects across Europe, including those in the field of business and economics.

UK Research and Innovation (UKRI): Supports research across all disciplines in the UK, including business-related research.

National Research Foundation (NRF) (Singapore): Funds research projects in various sectors, including business and management studies.

Natural Sciences and Engineering Research Council (NSERC) (Canada): Supports research in natural sciences and engineering, including business-related studies.

Australian Research Council (ARC): Provides funding for research projects across Australia, including business, management, and economics.

Japan Society for the Promotion of Science (JSPS): Offers funding opportunities for research in all fields, including business-related studies.

Research Grants Council (RGC) (Hong Kong): Provides funding for research projects in various disciplines, including business and economics.

These agencies typically fund research through competitive grant programs, fellowships, and specific project grants. Researchers and institutions interested in funding for business research should check the specific eligibility criteria and application processes of these agencies.Top of Form

Report writing is science and art. The writing flows through few stages. Different types of reports have specific defined parts which are needed to be understood and follow. Writing is an art as well since report is a written

Case problem 1: Test the hypothesis. $H0_3$: There is no association between the income of parents and stay of vicinity i.e. residential location. 5% level of Significance.

Case Problem 2: Test the hypothesis. There is no significant difference between the agreement on output of MBA syllabus among MBA-I and MBA-II Year students.5% level of significance

Report Writing:

This chapter section helps to understand report writing. Meaning and purpose of report, various types to write a report. Most importantly, project report invariably students need to undertake as a part of partial fulfillment of professional course like MBA.

Introduction:

In the entire process of research, report writing is one of inseparable part. It is considered to be the end task of research which is not true. Report is written at completion of entire research work but its planning is done at beginning. In research design the scheme of report writing and its layout is determined.

The very word report conveys its meaning and purpose. Report means reporting it to somebody. In the research parlance report mean, whatever researcher has studied on the basis of research design is to be reported to expected audience viz. Experts, students dealing in research as a part of their curriculum, researchers dealing

in the subject in which your research indulge in and the like.

Report writing is science and art. The writing flows through few stages. Different types of reports have specific defined parts which are needed to be understood and follow. Writing is an art as well since report is a written

communication of research to others. The communication expected to be very clearand should communicate the same results which researcher mean to be.

Presentation of Subject Matter

Nature:

Research report presents results of formal investigation preferably in a written form. Now-a-days a document carries few pages called report is also presented in electronic form.

Research report carries major three aspects

1. Research problem under investigation
2. Methodology adopted to address research problem
3. Outcomes or results of investigation.

Research report is self explanatory since it is presented to a layperson. Report is written in a manner which is clearly followed by a reader in the absence of researcher.

Various types of reports

Dr. V. P. Michael in his book has classified report on the basis of approach and on the basis of nature of presentation.

On the basis of approach

1. *Journalistic report* – report by journalist for publication in the media termed as journalistic reports
2. *Business report and memorandum* – report for business communication from one department head to another, one functional area to another or ever from top to bottom in the organization.
3. *Project reports* - report on a project undertaken by an individual or a group of individuals relating to any functional area or any segment of a functional area.

4. *Dissertation* – is a detailed report on the subject of study.

5. *Enquiry reports* – detailed report prepared by a committee or a commission appointed for specific purpose of conducting a detailed study of any matter of dispute or of a subject requiring greater insight.

6. *Thesis* – a detailed report on the research problem under investigation. This generally used as documents to be submitted for getting higher research degrees from a university or an academic institution.

On the basis of nature of presentation

1. *Inductive report* – the report, which has a beginning, middle and an end. This report goes from the specifics (facts, figures, and materials of research) to general conclusions, summary, recommendations etc. eg. Academic research reports.
2. *Deductive report* – the pattern of presentation is from general to the specific i.e. from the more important to the less important. eg. Report writing accepted in the business world.
3. *Step by step report* – simply present the material step by step. It is a way of presenting events or steps in an operation frequently following one another in point of time. eg. reports on manufacturing operations. Enquiry reports are generally written step by step.
4. *Time sequence report* – it is like step by step report but gives greater emphasis on the time element.

Layout of project report

A report consists of three broad sections one is introductory section second is body of report and third is supplementary section. Each section envelops different contents.

A. Introductory section – this contents

1. Title Page: title page contents, title of the research, name of researcher or author, publication, date, name of research institute etc.

2. Certificate and declaration: Certificate issued by company where project is undertaken need to be given as a part of procedure. Certificate should be on the company letter head, signed by authorized person, stamped and should have date and outward number. Certificate issued by guide and declaration of researcher also need to be given as a part of procedure.
3. Acknowledgement: researcher, author extends gratitude to people and agencies helped directly or indirectly to complete research work.

4. Executive Summery – Executive summery is crux of research report which is most readable part since, it gives clear idea in brief about research done. Executive summery arouses interest into the mind of reader about reading a complete report.

5. Table of contents i.e Index.

B. Main body –

1. Opening section – includes definition of the problem, problem area, rationale of the study, objective of the study, methodology of the study, sources of data, hypothesis, scope and limitations of the study etc.

2. Section headings – classification and tabulation of data, analysis and interpretation, identifying variables and establishing their relationships, detailed investigation etc.

3. Concluding section – includes mainly findings, conclusions and suggestions.

C. Final section or supplementary section:

1. Appendix – supportive material which is not appropriate to provide in the main body but the mention of such material has made in main body need to be appended to quench of curiosity of readers.

2. Technical aspects –maps and data collection instruments like, schedule, questionnaire etc.

3. Bibliography: list of references used for study undertaken.

Chapterization:

The study revolves around a research or management problem presented in a systematic manner for readers. Presentation of project report with help of chapters is Inductive type of report. Invariably project report housed following five chapters i.e. chapterization also termed as organization of project.

Chapter 1: Introduction to the Study, the chapter also titled as, Research Methodology. The chapter contains research methodology adopted for study.

Chapter 2: Profile of Company (or any organization/ village/ district/ state/ country/ sector/ industry etc.) , this chapter contains briefing of company where project is undertaken.

Chapter 3: Theoretical Background (or review of literature), the chapter carries concepts based for research project.

Chapter 4: Data Presentation and Analysis, this chapter presents collected data and presented preferably in tabular form with analysis and interpretation.

Chapter 5: Findings and Suggestions, this is the last chapter based on earlier chapter for its contents.

Writing a Research Report (Contains of chapters):

Chapter 1 Introduction to the Study

This chapter is expected to give technical information about the framework adopted for the project work. It should be written in specific words i.e. in the words of research and generally runs to six to seven pages. This chapter should be expected to be sub divided into the following sub heads. The matter under each of these sub heads should be technically clear and self explanatory.

a. Research Problem or Management Problem – it is a problem observed in society or market and in case of case study type of research it is a problem unearth in a single unit. Research problem or management problem is vague in nature and touches various perspectives and sub functional area of management. This point of research problem may end up with number of questions raised in the mind of students of which answers can be sought scientifically to tackle existing problem.

b. Statement of research problem – from amongst various questions raised above in research problem one prominent question or the question of students interested functional area of management can be taken for study. This is perspective to approach a problem. Since the research problem is very vague in nature cannot be taken as it is for study. It needs to be converted into researchable statement

termed as statement of research problem.

c. Objectives of the study or project – here objectives behind undertaking project should be stated. Objective of study is/are statement for which the study has been undertaken. The statement should be small, clear and should carry specific meaning. One objective statement should not inter-link another objective, which may mislead reader. Statement of objective should start with word 'To'. Objective should be co-related with title of project study.

d. Importance of the project –the reasons why student considers project to be important or significant are to be stated.

e. Scope of the study –scope or the extent or depth or coverage of study is to be stated here. The information about following aspects is necessary.

   i. Period covered by study – i.e. records used in case of secondary data and period work in case of primary data.

   ii. Units or departments covered in study.

   iii. Number of persons contacted, surveyed etc.

Scope of project study should also include geographical scope, conceptual scope, analytical scope (like fulfillment of objectives set for study) and functional scope (like offering meaningful suggestions for improving research problem).

d. Data details – the information about following aspects of data is to be given.

   i. Type of data – whether data is primary or secondary in nature.

   ii. Sources of data –sources of data i.e. previous records etc. should be stated in specific terms i.e. attendance register, interview of employees etc.

   iii. Method and extent of selection of source of data – whether the census, probability sampling or non probability sampling was adopted or whether any other criteria were applied for selection of source of data is to be given.

   iv. Technique or instrument of data collection – the techniques used i.e. observation, questionnaire, scheduled, interviews, discussions, group discussion etc need to be stated.

   v. System of presentation and analysis of data – the system followed in presentation and analysis of data is to be stated here i.e. tabulation, description etc.

e. Concept and operational definitions – the definitions of the key words of the

criterion, formulas considered to be basic importance for study are to be given.

f. Limitations –difficulties experienced while conducting study are to be stated. Only such difficulties, which are not in form of excuses, are expected to be stated. These difficulties may be of following nature.

   i. The duration of the study i.e. two months may not be sufficient to give

justice to your work.

ii. Problem of communication with some labourers due to language barrier.

iii. Non-availability of certain data. But it must be noted that if the difficulties experienced are of basic nature then they cannot be mentioned as limitation. If student has no data to present, as data was not made available to him, he cannot plead it as a limitation. Student must change project itself in such case.

Chapter 2 Profile of Company

This chapter is expected to give in brief information about the general background operation of the industrial unit in which the project report was undertaken. The expected length of this chapter should be about ten pages. Usually, the information in relation to the following points may be included in this chapter.

a. Name of the industrial unit.

b. Location of the unit (address).

c. Name (s) of the subsidiaries and location details.

d. Brief history of the unit.

e. History of promoters.

f. Present position of the unit. The information about product(s) of the company, services provided, etc. is to be included under this head.

g. Financial position – this should include information in brief about capital structure, assets, sale, turnover, profits etc. preferably of last three years and the researchers comment on the same from financial management point of view. The information regarding the financial position can be gathered from the

organization’s balance sheet.

h. Manpower – this should include the information about number of departments and number of employees working under each department. The tabular presentation of data is expected.

i. Important milestones achieved by the unit, e.g. received ISO 9000 certification, development new version of product, commencement of exports etc.

j. Future plans of company

k. Organizational chart to append at the end of this chapter to give bird eye view of the unit. If the unit doesn't have organizational chart then prepare it.

It is expected that chapter should give overall picture of unit and industry as such.

Chapter 3: Theoretical Background

This chapter is expected to give a theoretical basis of the topic of the project undertaken. Suitable theoretical background should be carefully presented in a precise and specific manner. The matter from any textbook printed work should not be copied out as it is. It should be presented by the students in their own words after careful reading and understanding the contents.

Definitions, quotations and diagrams, figures charts developed by experts may be borrowed from text -books which should be acknowledged through footnotes. The footnotes are given at the bottom of the page. The footnote should be presented in the same fashion, as bibliography and the numbering should be done to the borrowed text and respective footnotes. Care should be taken that the footnote references should appear in bibliography. For maintaining decency and sequence in footnote Microsoft Ms-Word provides insertion function the menu is: references – footnotes –

Insert Footnote. At the end of borrowed text or figure cursor should be placed and given menu command be executed for facilitation of footnote. The chapter should not exceed 20% of the total number of pages of the project report.

Chapter 4: Presentation and Analysis of Data

Collected data is systematically presented in this chapter. The data presented in logical sequence. The data may also include many responses or figures. Collected data is of two types one is quantitative and another is qualitative. Quantitative data is presented with the help of tables and qualitative data can be presented in chapter

itself. Qualitative data is presented in descriptive form and used to support the quantitative data.

Quantitative data presented in table in a systematic way. Table has a specific layout.

Table: 4.1. (Title of the table):

Little description related to title as to what exactly has given in following table.

Sr.No.	Particulars/Description	Frequency	Percentage
1	2	3	4
	Total		

Source: (Filed data) Analysis Interpretation

It is also necessary to note that every table must have reference number and title. Similarly, every row and column of a table must have a reference number and a subheading. Title of table should be followed by little description of what exactly has been given in the table. This would help to give general idea to reader on the table contain. Every table carries source which refers origin of data. In case of data collected from samples the source is, 'field data' and in case of secondary data, source should be document, book, website from where data has taken for study.

The tables should be explained in their logical sequence. They must also be numbered in sequence.

Collected data is discussed below the table. Effort has been made to give meaning to figures in table since figures does not speak on its own. It is duty of researcher to give meaning to figures. Analysis also includes finding relationship between two figures to draw meaningful conclusion. Analyzed data is needed to be interpreted. A conclusion needs to draw at the end of comprehensive data discussion.

Chapter 5 Findings and Suggestions

The purpose of this chapter is to summarize previous chapter 4 in a precise manner or draw conclusions on the basis of data analyzed in chapter 4 in a precise manner and suggest measures to improve the situation. This chapter therefore is to be

divided into two subsections as show below.

a. Findings–

Findings are factual results or decisions arrived at on the basis of data analyzed or explained in chapter 4. It is therefore clear that this chapter cannot have any conclusions which are not borne out by justified on the basis of data given in chapter

4. The findings must be given in the form of definite precise and specific statements. They should be serially numbered. The order of statements of findings should be according to the sequence of interpretation of data followed in chapter 4.

A further subdivision of findings may be thought of if necessary i.e. General findings and specific findings. General findings are findings based on the overall picture of interpretation or explanation of data. Specific findings are based on a specific part of data interpreted, analyzed, or explained. In such a case, all general findings must be stated first and then specific findings should be stated each, subdivision should have a fresh serial number. Order of stating the findings within this subdivision should be as found in chapter 4.

b. Suggestion -

Suggestions are definite steps or measures recommended for improvement of the situation. They must be based on findings. Therefore, it is clear that in this part no suggestions can be stated which are not borne out by, justified by, or based on the findings. The suggestions should be in the form of definite, precise and specific statements. They should be serially numbered. They should be concrete plan of action and should be capable of implementation. If findings are subdivided into general and specific findings, a similar plan should be followed in giving suggestions. General suggestions pertaining to or on the basis of general conclusions and specific suggestions based on specific findings should be given. These must be separately numbered under each head.

Appendices

It means addition to the original part. Appendices are plural of the word Appendix. This is not a separate chapter. The document charts, questionnaires, tables, schedules etc. which are actually referred to in the body of the project report

(this consists of chapters I to VI) are to be included under appendix or appendices. So, appendices may include.

Questionnaires used for collecting information.

Schedules used for collecting information.

Tables formed for presenting the data.

Documents/forms etc., refereed to in body of project report.

Diagram, graphs etc. referred to in body of project report.

Each type of appendix must have a common or classified serial number for facility of quick reference and mention in the body of project report. Every appendix must have a self-explanatory heading. In case of tables etc. all vertical, horizontal columns must also have sub headings and column numbers.

It should be specifically noted that no documents, table, chart etc. which is not refereed to or mentioned specifically should be included in the appendix.

Bibliography:

Bibliography means list of books, journals, published work actually referred to or used in writing of project report. This is not a separate chapter. Bibliography has to be written in a specific manner. It must be in following manner.

The name of author (surname followed by initials), title of the book (is to be underline), year of publication, place of publication, number of the edition, name of the publisher in full (address), pages referred to.

IN SHORT THE FORM OF PROJECT REPORT IS AS GIVENBELOW

Preface

a) Title Page

b) Certificates and declarations

c) Acknowledgements. Synopsis/ executive summery Index

Chapter	Description	Page Number

Chapter 1: Introduction to Study

a. Research Problem

b. Statement of research problem

c. Objectives of the study

d. Importance of the project

e. Scope of the study

f. Data – type, sources, method and/or techniques

g. Limitations

h. Chapterization

Chapter 2 : Profile of Company

a. Name of the unit

b. Location or address of the unit

c. Brief history of the unit and present position

d. Financial position

e. Manpower

Chapter 3: Theoretical Background

Chapter 4: Data Presentation and Analysis Chapter 5: Findings and Suggestions Appendices

Bibliography

The Arrangements of Chapters is the Discretion of Research Guide.

Writing Executive Summary

Executive summery comes first in report but written at the completion of entire research work. It is crux of study undertaken preferably includes non technical data. Some important technical issues pertaining to core research problem may be accommodated.

Executive summery is a page or two in length. Major parts of summery includes research problem under study, methodology adopted for study, major findings related

to objectives and conclusion.

Summery serves as bird eye view of entire research efforts. Academic research reports and preferably business reports carry executive summery. Researcher dealing in academic research does not include summery in report but in case of business report it begins with executive summery.

The general Skelton of executive summery is as below:Title of study

1. Introduction

2. **Research problem**
3. **Statement of research problem**
4. **Methodology – in one paragraph highlighting important aspects of research methodology viz. objectives of study, sampling, instrument used, data analysis tools used etc.**
5. **Major findings and discussion.**

Business reports invariably carries executive summery in report itself but research report does not carry such summery. The summery in form of synopsis is submitted independently be student or researcher in five to ten copies.

Language and Formatting in Research Report

Language of report

Generally the report is written only on one side of the paper. But now owing to environmental consciousness printing of report is done on both sides of paper. The need to written ligile since it is to be read by others. Use small sentences for better understanding and also need to use the words commonly knows. Wisecracks might mislead the very meaning of sentence we want to convey.

While writing a report the combination of past tense and present tense needs to be used. While citing the findings of others and describing the conduct of study the past tense needs to be used. Present perfect tense is to be used in presenting findings of the study. We write the report in third gender it means we do not use the words I, You, We while writing the narration. We use the term ‘researcher’ while writing the detailing and narrations.

Few important cares has to be taken while writing the report as follows.

1. Do not use any short forms. All words must be written in long form and in full.
2. Contents once written in the report should not be repeated in different places in

the report.

3. The chapters, sections in the chapters, titles, sub titles must be planned and executed.
4. Every chapter should have number and the title of the chapter should be written in capital letters.

5. The beginning of sentence should be in capital letter. In between the sentence the unnecessary use of capital letter should be avoided.
6. When the sentence is to begin with a number i.e. figure then the write the figure in words.

These few writing instructions should be followed.

Page Layout of Report

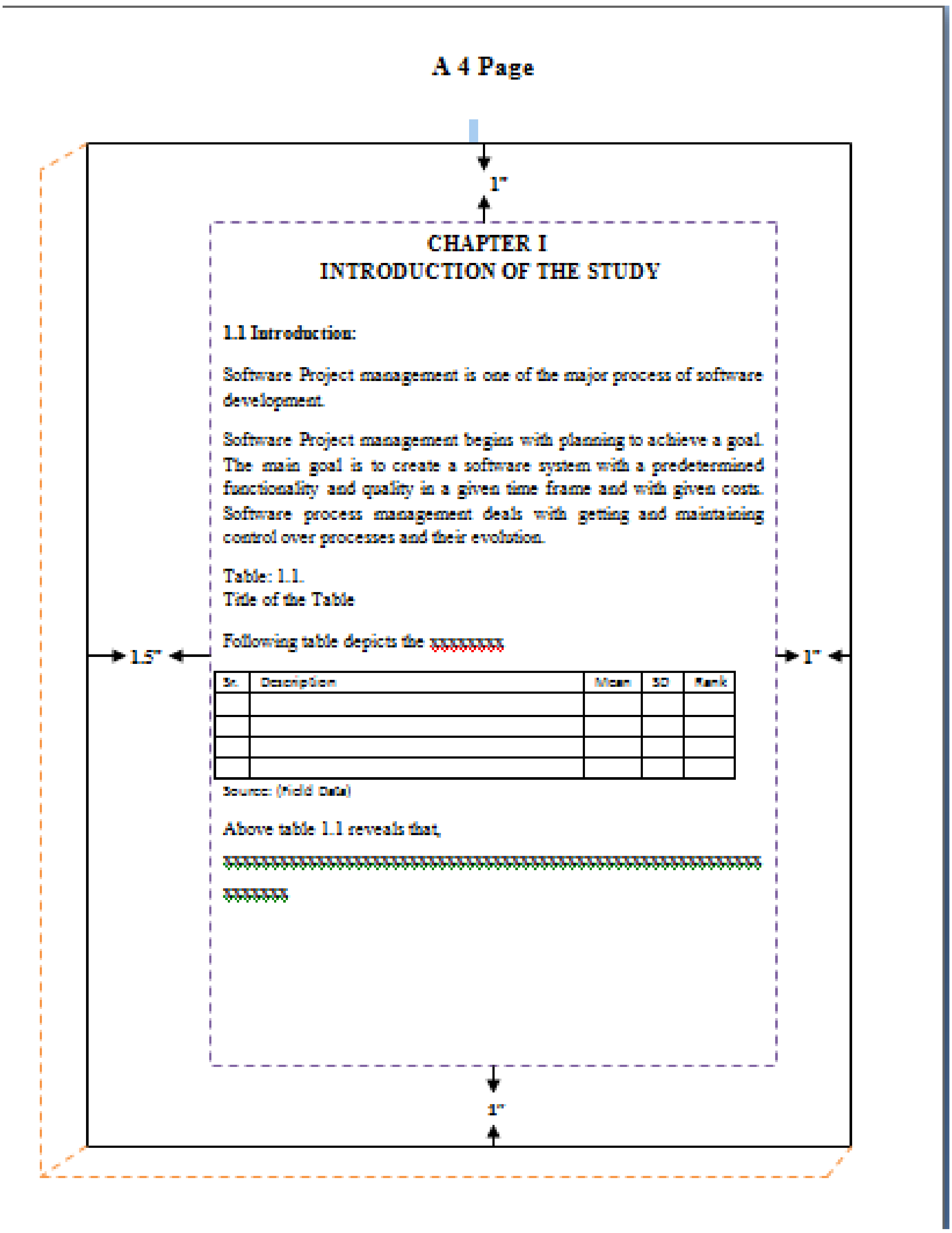
It is said that the page layout of report should be such that every page should look like as a photo frame. Following are few points to consider while doing layout of a research report.

1. Page size: A4 Executive Bond quality of paper is preferred for final project, dissertation and thesis printing. Dumy quality paper is preferred for rest printing than final printing.
2. Margins: on the left 1.5 inches, other sides's 1 inches. If the number of pages in the report exceeds 400 then the left margin should increase.

   If the report is to be printed at both side of the page then mirror margin is to be kept.
3. Font: Times New Roman , Font Size: for chapter headings: 16 ft
   For titles: 14 ft.
   For sub titles: 12ft.
   For regular text: 12 ft.
   Avoid unnecessary marking of bold letters.
4. Insert guided headers and footers. Generally header is chapter title and footer is name of institution.
5. Insert page numbers preferably printed at the bottom right corner of the page

In case of mirror margin insert page numbers at the bottom center is preferred.

6. Spacing: spacing of regular text should be 1.5. Spacing of table should be 1, spacing of mere list of points should also be 1, spacing between table number and table heading should be 1.


A 4 Page
1"
CHAPTER I
INTRODUCTION OF THE STUDY
1.1 Introduction:
Software Project management is one of the major process of software development.
Software Project management begins with planning to achieve a goal. The main goal is to create a software system with a predetermined functionality and quality in a given time frame and with given costs. Software process management deals with getting and maintaining control over processes and their evolution.
Table: 1.1.
Title of the Table
Following table depicts the xxxxxxxx
1.5"
1"
Sr.
Description
Mean
SD
Rank
Source: (Field Data)
Above table 1.1 reveals that,
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxx
1"

Summary:

This chapter is fusion of two important concepts in research one is analysis and interpretation of data and another is report writing.

We have learned from previous three chapters the different dimensions of research designs. Now it is time to analyze and interpret the data when data is collected. The data analysis is done objectively hence the statistical tools to be selected to analyze the data need due consideration. Measures of central tendency viz. mean, mode and median helps to find out the central figure in data series whereas the measured of dispersion viz. range, standard deviation and variance helps to identify variation in the data set. Every measure of central tendency and measure of dispersion has formula to calculate.

Correlation and regression are another interesting statistical tools helps to establish the relationship between variables. Correlation narrates the relationship in figures ranging from -1 to +1 perfect negative correlation to perfect positive correlation. Correlation is followed by regression. Regression analysis determines the relationship between two variables on the basis of dependability or impact of one variable on another. Hence we have a linear regression model i.e. $Y = a+bx+e$ where Y is dependent variable.

Hypothesis is skeptical assumption about desired results of research undertaken. Hypothesis is central cord of any research and the entire research design in revolve around the hypothesis set for study. The major types of hypothesis we have studied in earlier chapters. The set hypothesis needs to be tested. The testing follows five steps one is formulate the hypothesis i.e. practical problem second is calculate the

statistics using relevant statistical tool third is choose the critical region then fourth step is decide the size of critical region i.e. 1%, 5% and 10% level of significance and the last compare the test statistics with standard table value to arrive at conclusion towards null hypothesis. Whether the statistics support to accept null hypothesis or reject the null hypothesis. There are various statistical tools available to test the hypothesis. Every tool has its own conditions of applications which needs to be carefully studied and select the appropriate tool for testing the hypothesis.

Report is written at the end of research but its planning is done at the beginning of which mention is made in the research design. Research report is a systematic process of unfolding entire research using different sections or chapters for lucidity. Report writing is science as well as art. Science mean it has a specific way to write the aspects and art mean the way of presentation and language should be clear to make understand researcher's views or facts in understandable manner. Report is written owing to reporting facts to lay persons, which may be read in absence of researcher hence, while writing a report precaution is to be taken that in absence of researcher the facts, figures, explanation mentioned in report should clearly be followed by readers. Research report often comes along with executive summery. Executive summery is a synoptic presentation of entire research carried by researcher. The quality report also comes with quality of language uses as well as quality of layout of report.

Annexure: 01:

Google form used to collect the data from students.

Sr.	**Question**	**Options Facilitated**
1.	Gender	Male / Female
2.	Class	MBA-I /MBA-II

3.	Graduation	B.Com. /B.Sc. /B.A. /B.E./ BBA-BCA / Any Other
4.	Vicinity	Rural / Urban
5.	Parent Profession	Farmer/ Business /Self Professional /Employment
6.	Family Income	Below 5 lakhs/ 5 to 10 lakhs/10 to 15 lakhs/15 to 20 lakhs
7.	Your Future Plan	Farmer/ Business/ Self Professional/ Employment

Regarding MBA Syllabus

Rate the statement on five point likert scale

Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
1	**2**	**3**	**4**	**5**

	Statement	Rating
8.	The syllabus structure is quite interesting and you like it.	
9.	The syllabus offered is contemporary and meet industry requirements.	
10.	The subjects offered are quite relevant syllabus offered is Contemporary and meet industry requirements.	
11.	Practicals in the syllabus gives exposure to the real life of business and management.	
12.	The open book examination helps in development of decision making skills.	
13.	The syllabus seems to be compatible with other universities and autonomous institutes.	
14.	The electives offered are quite relevant to the industry demand.	

Annexure 02: Coding of Variables:

Following table narrates the coding of variables used in Ms-Excel sheet for feeding the data.

Note: The difference between above format and following format is of coding. Above format is not coded but yes following format have coding. This coding helps data entry into electronic spreadsheet.

Q.No.	**Description**	**Code**	**Variables.**
1	Gender	1	Male
		2	Female
2	Class	1	MBA-I
		2	MBA-II
3	Graduation	1	B.Com.
		2	B.Sc.
		3	B.A.
		4	B.E.
		5	BBA/BCA
		6	Any Other
4	Vicinity	1	Rural
		2	Urban
5	Parent Profession	1	Farmer
		2	Business
		3	Self Professional

		4	Employment
6	Family Income	1	Below 5 lakhs

		2	5 to 10 lakhs
		3	10 to 15 lakhs
		4	15 to 20 lakhs
7	Your Future Plan	1	Farmer
		2	Business
		3	Self Professional
		4	Employment
8	Regarding MBA Syllabus	a1	The syllabus structure is quite interesting and you like it.
		a2	The syllabus offered is contemporary and meet industry requirements.
		a3	The subjects offered are quite relevant syllabus offered is contemporary and meet industry requirements.
		a4	Practicals in the syllabus gives exposure to the real life of business and management.
		a5	The open book examination helps in development of decision making skills.
		a6	The syllabus seems to be compatible with other universities and autonomous institutes.
			The electives offered are quite relevant to the industry demand.

		a7	

Annexure 03: Data Sheet:

MBA-I																			
Sr.	Gender	Class	Graduation	Age	Vicinity	Parents profession	Annual family income	HSC	Graduation	CET	Your future plan	a1	a2	a3	a4	a5	a6	a7	Summated Score
1	1	1	6	22	1	1	1	64.9	69.6	36	4	4	3	3	4	3	3	3	3.29
2	1	1	2	23	1	1	1	53.9	53.77	35	2	4	5	4	4	5	2	5	4.14
3	2	1	1	20	1	1	1	69.5	53	29.8	4	3	5	5	5	3	3	4	4.00
4	1	1	1	22	1	1	1	66.6	55.55	67	4	5	4	5	5	4	5	4	4.57
5	2	1	2	20	1	1	1	64.2	69.24	20.5	4	4	3	3	3	3	3	4	3.29
6	1	1	4	25	2	4	3	59	65	94.45	4	3	3	3	4	5	2	4	3.43
7	1	1	2	22	1	1	1	53	52	40	4	4	4	5	5	5	4	5	4.57
8	1	1	1	21	2	3	1	65.7	61.52	43	2	5	5	5	5	1	3	4	4.00
9	1	1	1	21	1	2	3	64.7	45.67	38.11	2	2	5	5	5	3	3	4	3.86
10	2	1	1	22	2	4	1	82	77	36	2	5	3	3	4	5	3	3	3.71
11	2	1	5	25	1	4	1	61.7	68.94	49	3	4	4	4	4	3	3	4	3.71
12	1	1	1	21	2	4	1	70.3	75.08	51	4	4	3	4	4	5	4	3	3.86
13	2	1	2	23	1	1	1	58.8	67.38	39	4	3	4	3	4	5	4	4	3.86
14	2	1	1	20	1	1	1	69	64	39	4	4	4	3	4	3	3	3	3.43
15	2	1	2	22	1	4	2	60	70	78	4	3	3	3	4	4	2	2	3.00
16	1	1	1	23	2	2	1	54	48	39	2	5	5	5	5	4	5	4	4.71
17	1	1	6	24	1	1	1	50	62	38	2	4	5	4	5	5	3	4	4.29
18	2	1	1	21	2	1	1	70	63	50	4	4	3	3	2	2	2	5	3.00
19	2	1	2	21	2	4	1	63.2	72.28	52.11	4	4	4	4	4	3	3	4	3.71
20	2	1	1	21	2	4	4	68.7	66	51	3	4	4	4	4	3	4	3	3.71

MBA-II																			
Sr.	Gender	Class	Graduation	Age	Vicinity	Parents Profession	Annual Family Income	HSC	Graduation	CET	Your Future Plan	a1	a2	a3	a4	a5	a6	a7	Summated Score
1	1	2	1	25	2	4	2	61	64	25	2	3	4	4	4	5	4	4	4.00
2	2	2	5	22	2	2	1	70.3	59.14	35	4	5	4	4	5	4	4	4	4.29
3	1	2	1	22	2	4	1	64.5	58	91	4	4	4	4	5	5	4	4	4.29
4	2	2	5	24	1	4	1	60	60.13	38	4	1	2	2	3	4	5	4	3.00
5	2	2	2	22	1	1	1	55	62	51	4	5	4	4	5	5	5	5	4.71
6	1	2	2	23	1	1	1	51.4	57.56	31	4	4	4	4	5	5	5	4	4.43
7	1	2	2	23	1	1	1	63.5	59	48	4	3	4	4	4	4	5	3	3.86
8	2	2	4	23	1	1	1	58	71	60	4	2	2	5	2	3	3	4	3.00
9	1	2	1	22	2	2	4	80	69	23	2	4	4	3	4	5	3	4	3.86
10	2	2	1	23	1	1	2	75.7	61.61	52	4	4	4	3	4	3	4	4	3.71
11	2	2	4	24	2	4	1	80.5	59	79	4	4	4	4	4	3	3	4	3.71
12	2	2	2	22	1	4	2	60.3	73.36	36	4	4	2	2	4	4	4	2	3.14
13	1	2	2	23	2	2	1	63	71	46	2	2	3	4	3	2	2	2	2.57
14	2	2	2	23	2	2	1	57	58	45	3	3	2	4	4	2	4	4	3.29
15	2	2	2	23	2	4	1	64.5	65.12	52	4	4	4	5	5	4	5	5	4.57
16	1	2	3	24	1	2	2	72	65	40	2	4	4	4	3	3	4	4	3.71
17	1	2	3	23	1	4	1	55	69	55	4	4	4	4	4	4	3	4	3.86

18	1	2	5	24	1	1	1	54.9	51	54	4	4	4	4	5	4	4	4	4.14
19	1	2	5	22	1	1	2	60	61.74	48	2	3	4	4	5	4	3	4	3.86
20	2	2	1	22	1	1	2	83	65	41	4	4	4	4	4	4	4	5	4.14

Summary

Report is written at the end of research but its planning is done at the beginning of which mention is made in the research design. Research report is a systematic process of unfolding entire research using different sections or chapters for lucidity. Report writing is science as well as art. Science mean it has a specific way to write the aspects and art mean the way of presentation and language should be clear to make understand researcher's views or facts in understandable manner. Report is written owing to reporting facts to lay persons, which may be read in absence of researcher hence, while writing a report precaution is to be taken that in absence of researcher the facts, figures, explanation mentioned in report should clearly be followed by readers. Research report often comes along with executive summery. Executive summery is a synoptic presentation of entire research carried by researcher. The quality report also comes with quality of language uses as well as quality of layout of report.

UNIT V

SELF ASSESMENT QUESTIONS

Answers for Check Your Progress

Fill in the blanks.

1. Time sequence report has greater emphasis on ..... Element.
2. Academic research reports are of …… report type.
3. Pattern of presentation of ..... type of report flows from more important to less important.
4. Executive summery is a ……. Of research report.

5 ..... is a list of references used for study undertaken.

1. Time
2. Inductive
3. Deductive
4. Crux
5. Bibliography

Exercise:

1. What is data analysis and interpretation?
2. Define the measures of central tendency with their formula to calculate.
3. Define the measures of dispersion with their formula to calculate.
4. Narrate the concept of correlation with its types.
5. Describe the process of attempting regression problem.
6. Narrate five step methods to test the hypothesis.

7. Describe the process of using independent sample‘t’ test.

8. Define Report. Give the types of report.

9. Explain the layout of report.

10. What is chapterization? What are the contains of chapters?

GLOSSARY

- Analysis of data: Data analysis means searching and showing the relationship between or among the tabulated data. Analysis shows the pattern of correlation between the data.
- Interpretation of Data: Interpretation is drawing inferences from the data.
- Measure of Central Tendency: Measures of central tendency are a value attempt to describe the central position of the set of data.
- Statistical tools of Measures of Central Tendency: mean, median and mode.
- Measures of Dispersion: Dispersion refers to the spread of the data how one data point is spread from another data point.
- Variance: The variance is the square of standard deviation and is denoted by σ^2.
- Statistical tools to measure dispersion: Range, Coefficient of range, standarddeviation, coefficient of standard deviation, Variance.
- Correlation: Correlation is a statistical tool which studies the relationship between two variables.
- Regression: Regression is a statistical measure that attempts to determine the strength of the relationship between one dependent variable (Y) and a series of other changing variables (independent variables) (X).
- Five steps of hypothesis testing: first is formulate the practical problem in terms of hypothesis, second is calculate statistics, third is choose a critical region fourth is decide the size of critical region and the last is conclusion i.e. compare calculated test statistics with table statistics.
- Degrees of freedom: $\mp\sum$ for one sample it is (n-1) and for two and more samples it is (C-1)*(R-1).

- The formula to calculate independent sample‘t’ is, t= ($\bar{X}$ i - $\bar{X}$ ii/S.E.)
- The formula to calculate standard error is, S.E. = s * √1/n1 + 1/n2
- Types of Reports: on the basis of approach – journalistic report, business report and memorandum, project report, dissertation, enquiry reports and thesis.
- On the basis of nature of presentation – inductive report, deductive report, step by step report, time sequence report.
- Layout of Project Report – introductory section includes title page, certificate and declaration, acknowledgement, executive summery and table of contents.
- Main body includes, opening section, section headings and concluding section.
- Final section or supplementary section includes appendix, technical aspects and bibliography.
- Chapterization – contains five chapters, introduction to the study, profile of company, theoretical background, data presentation and analysis and last chapteris findings and suggestions.
- Executive summery- crux of entire report.

Reference for further study:

1. V.P.Michel, Research Methodology in Management, Himalaya Publishing House, Delhi.
2. Aczel Amil D and Sounderpandian Jayavel, Complete Business Statistics, . The MacGraw-Hill Companies, 6th edition, 2006, Mumbai.
3. Arora P.N., Arora Sumeet, Arora S., Comprehensive Statistical Methods, S.Chand, 2007, New Delhi
4. Sachdeva J.K., Business Research Methodology, Himalaya Publishing House, 2nd revised edition 2011, Mumbai.
5. Kothari C.R. & Gaurav Garg, ‘Research Methodology – Methods and Techniques, New Age International Publishers, 3rd edition, 2014, New Delhi.

Answer Key

Ans: Multiple Choice Questions

MCQ	1	2	3	4	5	6	7	8	9	10
Ans:	c	d	a	a	c	b	a	a	d	a

Ans. Case Example 1:

Mean	47.5	Median	47	Mode	48 & 52		
Range	68	Coefficient of Range	0.5996	Standard Deviation	15.90	Coefficient of s.d.	0.3347
Variance	3.987						

Multiple Choice Questions:

Question number	Answer option
1	a
2	b
3	c
4	d
5	d

Case	Problem	Answer
1	Correlation between HSC and graduation marks	0.130
2	Correlation between graduation marks and CET Score	- 0.246
3	Correlation between CET score and HSC marks	0.028
4	Regression analysis	a = 29.8568 x1 = 0.5219

MCQ's	1	2	3	4	5
	a	b	c	a	c

Hypothesis: $H0_3$: There is no association between the income of parents and stay of vicinity.

5% level of Significance.

Again the variables income of parents and stay of vicinity have measured on Solution Case 1:

nominal scale and hence, to check the association between these two variables Chi- Square test has been used.

Observation Table

Vicinity of Stay * Annual Family Income of Samples Household Cross tabulation.

			Annual Family Income of Samples Household				Total
			Below 5 Lakhs	5 to 10 Lakhs	10 to 15 Lakhs	15 to 20 Lakhs	
Vicinity of Stay	Rural	Count	17	6	1	0	24
		Expected Count	17.4	4.2	1.2	1.2	24.0
	Urban	Count	12	1	1	2	16
		Expected Count	11.6	2.8	0.8	0.8	16.0
Total		Count	29	7	2	2	40
		Expected Count	29.0	7.0	2.0	2.0	40.0

Calculation:

Sr.No.	Oi (Observed frequency)	Ei (Expected frequency)	(Oi-Ei)	$(Oi-Ei)^2$	$(Oi-Ei)^2/Ei$
1	17	17.4	-0.4	0.16	0.0092
2	6	4.2	1.8	3.24	0.7714
3	1	1.2	-0.2	0.04	0.0333
4	0	1.2	-1.2	1.44	1.2
5	12	11.6	0.4	0.16	0.0138
6	1	2.8	-1.8	3.24	1.1571
7	1	0.8	0.2	0.04	0.05
8	2	0.8	1.2	1.44	1.8
Total	N=40				$(Oi-Ei)^2/Ei$= 5.0348

from above table we can calculated

$$\chi^2_{cal} = \sum_{i=1}^{n} \frac{(oi-Ei)2}{Ei}$$

=5.0346

2) χ^2_{tab} = (R-1) (C-1), α

= (2-1) (4-1), 0.05

= (1) (3), 0.05

= 3, 0.05

χ^2_{tab} = 7.815

……. Value calculated by using chi-square table at 5%

level of significance

Result: $\chi^2_{cal} = 5.0348 < \chi^2_{tab} = 7.815$

Hence, H_{03} (Null hypothesis) is accepted at 5% level of significance.

Interpretation:

There is no association between the income of parents and stay of vicinity.

Solution Case 2:

H0: There is no significant difference between the agreement on output of MBA syllabus among MBA-I and MBA-II Year students. 5% level of significance.

This hypothesis is same as above where both variables have been measured using ratio scale data which is considered to be very pure data in statistics. Since the MBA-I and MBA-II students are different and we have to check the statistical difference between these two data series, we are applying independent sample‘t’ test.

Solution:

The data given is presented in column 1 and 2. The squares of data have been worked out in column 3 and 4.

MBA1	**MBA2**	**Square of Column 1**	**Square of Column 2**
(1)	**(2)**	**(3)**	**(4)**
3.29	4	10.82	16.00
4.14	4.29	17.14	18.40
4	4.29	16.00	18.40
4.57	3	20.88	9.00
3.29	4.71	10.82	22.18
3.43	4.43	11.76	19.62
4.57	3.86	20.88	14.90
4	3	16.00	9.00
3.86	3.86	14.90	14.90
3.71	3.71	13.76	13.76
3.71	3.71	13.76	13.76
3.86	3.14	14.90	9.86
3.86	2.57	14.90	6.60
3.43	3.29	11.76	10.82
3	4.57	9.00	20.88

4.71	3.71	22.18	13.76
4.29	3.86	18.40	14.90
3	4.14	9.00	17.14
3.71	3.86	13.76	14.90
3.71	4.14	13.76	17.14
Total of all columns			
76.14	76.14	294.43	295.96

Calculate means of two series

MBA-I = 76.14/20 = 3.807

MBA-II = 76.14/20 = 3.807 (see here means of both the series are same, if you remember the formula of independent sample‘t’ test then in numerator we have to make subtraction of both means, in this case the subtraction is going to be zero (0) and zero is divided by any value comes to zero hence the value of‘t’ is going to be zero only. Let’s calculate.

Calculation of standard deviations

MBA-I = $(\sqrt{(294.43/20)-(76.14/20)^2}) = (\sqrt{14.72-14.49}) = 0.48$

MBA-II = $(\sqrt{(295.96/20)-(76.14/20)^2}) = (\sqrt{14.80-14.49}) = 0.57$

Calculation of standard error

Calculation of s

$S = \sqrt{(20*0.48^2)+(20*0.57^2)/20+20-2} = \sqrt{(4.61+6.50)/38} = 0.2923$

Calculation of standard error

$= 0.2923*\sqrt{1/20+1/20}$

$= 0.09243$

Calculation of‘t’ test

$= (3.807-3.807)/ 0.09243$

$= 0$

Result:

$t_{cal} = 0 < t_{tab} = 2.093$

Hence $H0_5$ is accepted at 5% level of significance.

Interpretation:

There is no significant difference between the agreement on output of MBA syllabus among MBA-I and MBA-II year students. 5% level of significance.

Answers to check your progress

- Time
- Inductive
- Deductive
- Crux
- Bibliography

E-Content and Web references:

1. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/ln_research_method_final.pdf

2. https://ccsuniversity.ac.in/bridge-library/pdf/MPhil%20Stats%20Research%20Methodology-Part1.pdf
3. https://prog.lmu.edu.ng/colleges_CMS/document/books/EIE%20510%20LECTURE%20NOTES%20first.pdf
4. https://www.statisticssolutions.com/academic-research-consulting/data-analysis-plan/

Here are some direct links to web resources that can help you with research methodology:

1. **Research Methodology Guide from MIT Libraries**:
    - MIT Libraries Research Methodology Guide
2. **Research Methods Knowledge Base**:
    - Research Methods Knowledge Base
3. **Scribbr - Research Methodology Guide**:
    - Scribbr Research Methodology Guide
4. **Qualitative Research Resources**:
    - Qualitative Research Resources
5. **Statistics Solutions - Quantitative Research Methods**:
    - Statistics Solutions
6. **BMJ Ethical Guidelines for Research**:
    - BMJ Ethical Guidelines
7. **APA Ethical Principles of Psychologists and Code of Conduct**:
    - APA Ethical Principles

These links should provide you with a solid foundation and practical guidance on various aspects of research methodology, from design and data collection to ethical considerations and analysis technique

Key Terms for Remembrance

UNIT I

Here are the key points for an introduction to research methodology

1. **Definition of Research**:
    - Research is a systematic investigation into a subject to discover facts, theories, or principles.
2. **Objectives of Research**:
    - To explore and understand phenomena.
    - To verify existing knowledge.
    - To develop new theories or practical applications.
3. **Motivations for Research**:
    - Curiosity and desire for knowledge.
    - Solving practical problems.
    - Academic requirements (e.g., thesis, dissertation).
4. **Types of Research**:
    - **Basic Research**: Seeks to expand knowledge (fundamental theories).
    - **Applied Research**: Aimed at solving practical problems.
    - **Quantitative Research**: Uses numerical data and statistical analysis.
    - **Qualitative Research**: Focuses on understanding behaviors, motivations, and meanings.
5. **Maintaining Objectivity in Research**:
    - Minimizing bias through rigorous methodology.
    - Using reliable and valid measures.
    - Ensuring transparency in data collection and analysis.
6. **Criteria of Good Research**:
    - Relevance to the field of study.
    - Clear research questions or objectives.
    - Rigorous methodology and analysis.
    - Ethical considerations.

7. **Applications of Research in Business**:
    - Product development and innovation.
    - Market analysis and consumer behavior.
    - Strategic decision-making.
    - Process improvement and efficiency.
8. **Formulating a Research Problem**:
    - Identifying an area of interest.
    - Narrowing down to a specific problem or question.
    - Ensuring the problem is researchable and significant.
9. **Literature Review**:
    - Examining existing research and scholarly articles related to the topic.
    - Understanding the current state of knowledge.
    - Identifying gaps and areas for further research.
10. **Reasons for Literature Review**:
    - To build a theoretical framework.
    - To avoid duplication of effort.
    - To support the research rationale.
11. **Reference Management Tools**:
    - Software (e.g., EndNote, Zotero) to organize citations and references.
    - Helps maintain consistency and manage large volumes of sources.
12. **Identification of Research Gap**:
    - Areas where existing research is limited or conflicting.
    - Opportunities for new contributions to knowledge.
    - Often identified through a thorough literature review.
13. **Framing Objectives**:
    - Clear and specific goals for the research.
    - Derived from the research problem and literature review.
    - Provide direction for the study and guide data collection and analysis.

These key points provide a foundational understanding of research methodology, essential for conducting effective and meaningful research in various fields

Key Terms for Remembrance

UNIT II

Here are the key points for hypothesis testing and research design:

1. **Hypothesis**:
    - A hypothesis is a statement or assumption about a population parameter.
    - **Formulation of Hypothesis**:
        - **Null Hypothesis (H0)**: Assumes no relationship or no difference.
        - **Alternative Hypothesis (H1 or Ha)**: Suggests a relationship or difference.
2. **Testing of Hypothesis**:
    - Involves statistical procedures to evaluate the validity of the hypothesis.
    - **Steps**:
        - State the null and alternative hypotheses.
        - Choose a significance level (alpha).
        - Collect data and perform statistical tests.
        - Make a decision based on the test statistic and p-value.
3. **Type I and Type II Errors**:
    - **Type I Error**: Rejecting the null hypothesis when it is actually true (false positive).
    - **Type II Error**: Failing to reject the null hypothesis when it is actually false (false negative).
    - **Significance Level**: Probability of committing a Type I error (typically set at 0.05 or 0.01).
4. **Research Design**:
    - **Definition**: Structure or plan for conducting research.
    - **Types**:
        - **Experimental Design**: Manipulates variables to observe effects (randomized controlled trials).

        - **Quasi-Experimental Design**: Similar to experimental but lacks random assignment.
        - **Descriptive Design**: Describes characteristics of a population or phenomenon.
        - **Correlational Design**: Examines relationships between variables without manipulation.
        - **Exploratory Design**: Investigates a topic when little is known.
5. **Methods of Data Collection**:
    - **Census**: Collects data from the entire population.
    - **Sample Survey**: Collects data from a subset (sample) of the population.
    - **Case Study**: In-depth examination of a single instance or case.
6. **Sampling**:
    - **Steps in Sampling Design**:
        - Define the target population.
        - Choose a sampling frame.
        - Select a sampling method (random, stratified, etc.).
        - Determine sample size.
        - Execute sampling and collect data.
    - **Methods of Sampling**:
        - **Probability Sampling**: Each member of the population has a known chance of being selected (e.g., simple random sampling, stratified sampling).
        - **Non-Probability Sampling**: Members are selected based on subjective judgment (e.g., convenience sampling, snowball sampling).
7. **Testing of Reliability and Validity**:
    - **Reliability**: Consistency and stability of measurement over time and across different conditions.
    - **Validity**: Accuracy and meaningfulness of a measurement in relation to the concept it is supposed to measure.

8. **Sampling Errors**:
    - **Definition**: Discrepancies between a sample statistic and the population parameter it estimates.
    - **Types**:
        - **Sampling Bias**: Systematic error due to sample selection process.
        - **Sampling Variability**: Random error due to chance in selecting a sample.

These key points provide a comprehensive overview of hypothesis testing, research design, data collection methods, sampling techniques, and considerations for reliability, validity, and sampling errors in research methodology.

Key Terms for Remembrance

UNIT III

Here are the key points related to data collection:

1. **Variable: Meaning and Types**:
    - **Variable**: A characteristic or attribute that can vary and be measured.
    - **Types**:
        - **Independent Variable**: The variable that is manipulated or controlled in a study.
        - **Dependent Variable**: The variable that is observed or measured to determine the effect of the independent variable.
        - **Categorical/Nominal Variable**: Qualitative variables that represent categories (e.g., gender, type of car).
        - **Numerical/Continuous Variable**: Quantitative variables that represent measurable quantities (e.g., age, income).
2. **Techniques of Data Collection**:
    - **Primary Data Collection**: Gathering data directly from the source.
    - **Secondary Data Collection**: Using existing data that has already been collected by others.
3. **Primary Data**:
    - **Meaning**: Data collected firsthand by the researcher for a specific purpose.
    - **Advantages**:
        - Specific to research needs.
        - High reliability if collected carefully.
        - Current and up-to-date.
    - **Limitations**:
        - Time-consuming and costly.
        - Requires effort to ensure quality and reliability.
        - May have limited scope due to sample size.
4. **Techniques for Collecting Primary Data**:

- **Interviews**: Face-to-face or structured conversations to gather detailed information.
- **Schedules**: Structured questionnaires filled out by the interviewer based on respondent answers.
- **Questionnaires**: Self-administered written surveys to collect standardized responses.
- **Observation**: Directly watching and recording behaviors, actions, or events.

5. **Secondary Data**:
    - **Meaning**: Data collected by others for their own purposes, which can be reused for another research study.
    - **Sources**:
        - Internal sources (e.g., company records, sales reports).
        - External sources (e.g., government publications, academic journals, online databases).

These key points provide a foundational understanding of data collection methods, both primary and secondary, including their meanings, advantages, limitations, and various techniques involved.

Key Terms for Remembrance
UNIT IV

Here are the key points related to data analysis, covering uni-variate, bi-variate, and multi-variate analysis techniques:

Uni-variate Analysis:

1. **Percentile**: Divides data into hundred equal parts.
2. **Mean**: Average of all data points.
3. **Median**: Middle value in a dataset when arranged in ascending order.
4. **Mode**: Most frequently occurring value in a dataset.
5. **Standard Deviation**: Measure of dispersion from mean.
6. **Range**: Difference between maximum and minimum values.
7. **Minimum**: Smallest value in a dataset.
8. **Maximum**: Largest value in a dataset.
9. **Independent Sample t-test**: Compares means of two independent groups to determine if there is a significant difference between them.

Bi-variate Analysis:

1. **Simple Correlation**: Measures strength and direction of association between two variables.
2. **Simple Regression**: Predicts dependent variable based on independent variable.
3. **Chi-square Test**: Tests independence between categorical variables.
4. **Paired Samples t-test**: Compares means of paired samples to determine if there is a significant difference between them.
5. **ANOVA (Analysis of Variance)**: Tests differences in means among multiple groups.
6. **Man-Whitney Test**: Non-parametric test to compare two independent groups.
7. **Wilcoxon Signed Rank Test**: Non-parametric test for comparing paired samples.

8. **Kruskal-Wallis Test**: Non-parametric alternative to one-way ANOVA for comparing more than two independent groups.

Multi-variate Analysis:

1. **Multiple Correlation**: Examines relationship between multiple independent variables and a single dependent variable.
2. **Multiple Regression**: Predicts dependent variable using multiple independent variables.
3. **Factor Analysis**: Reduces variables into smaller sets of factors.
4. **Friedman's Test**: Non-parametric alternative to repeated measures ANOVA.
5. **Cluster Analysis**: Groups similar objects into clusters.
6. **Confirmatory Factor Analysis (CFA)**: Validates a theoretical model by confirming the structure of relationships between variables.
7. **Structural Equation Modeling (SEM)**: Examines relationships between variables to test a hypothesized model.
8. **Multiple Discriminant Analysis**: Identifies combination of variables that best distinguish between two or more groups.

Key Points:

- **Purpose**: Data analysis techniques help in summarizing and interpreting data to extract meaningful insights.
- **Statistical Tests**: Chosen based on data type, research questions, and assumptions about data distribution.
- **Non-parametric Tests**: Useful when data does not meet assumptions of parametric tests (e.g., normal distribution).
- **Interpretation**: Results should be interpreted in context of study objectives and limitations of chosen methods.
- **Software Tools**: Statistical software (e.g., SPSS, R, SAS) are commonly used for conducting data analysis efficiently and accurately.

These key points provide a comprehensive overview of various data analysis techniques used in research and their applications in different scenarios.

Key Terms for Remembrance

UNIT V

Here are the key points related to the preparation of a research report:

Report Preparation:

1. **Guidelines and Precautions for Interpretation**:
    - Ensure data interpretation aligns with research objectives and findings.
    - Provide clear explanations and avoid misrepresentation of results.
    - Use visual aids (tables, graphs) effectively to support interpretations.
2. **Steps in Report Writing**:

- **Title Page**: Includes title, author(s), institutional affiliation, and date.
- **Abstract**: Summary of the research objectives, methods, results, and conclusions.
- **Introduction**: Background, research problem, objectives, and significance.
- **Literature Review**: Review of relevant literature to support research context.
- **Methodology**: Description of research design, data collection methods, and analysis techniques.
- **Results**: Presentation of findings, including tables, figures, and statistical analyses.
- **Discussion**: Interpretation of results, implications, limitations, and future research directions.
- **Conclusion**: Summary of key findings and their significance.
- **References**: List of sources cited in the report (formatted according to chosen style guide).
- **Appendices**: Additional materials such as raw data, survey instruments, or supplementary analyses.

Style of Research Reports:

- **APA (American Psychological Association)**: Commonly used in social sciences, psychology, and education.
- **MLA (Modern Language Association)**: Used in humanities, literature, and arts.
- **Chicago**: Used in history, economics, and some social sciences.
- **Harvard**: Common in business, management, and economics.

Mechanics of Report Writing:

- Use clear and concise language.
- Maintain logical flow and organization.
- Ensure accuracy in grammar, spelling, and punctuation.
- Use appropriate headings and subheadings to guide readers.

Ethics in Research:

- **Avoiding Plagiarism**: Cite sources properly and use quotation marks for direct quotes.
- **Plagiarism Checker Tools**: Tools like Turnitin, Grammarly, and Copyscape help detect unintentional plagiarism.
- **Ethical Considerations**: Respect participant confidentiality, obtain informed consent, and adhere to ethical guidelines set by institutions and funding agencies.

Funding Agencies for Business Research:

- Examples include governmental bodies (e.g., NSF, NIH), private foundations, industry associations, and corporate sponsors.
- Agencies provide financial support for research projects based on relevance, innovation, and potential impact.

Key Points:

- **Clarity and Precision**: Ensure the report communicates findings effectively to both specialists and non-specialists.
- **Critical Analysis**: Provide balanced interpretations of findings and discuss limitations honestly.
- **Professionalism**: Follow institutional guidelines and ethical standards throughout the research and reporting process.

These key points serve as a guideline for preparing a comprehensive and ethically sound research report, ensuring clarity, accuracy, and adherence to appropriate style and formatting guidelines.