Unit I

Define research

- Research is defined as the systematic and creative process of investigating and studying information or data to generate new knowledge or enhance existing knowledge.

- Research aims to answer quesions so solve problems by collecting, and analyzing data.

- Research is a systematic process of collecting, analyzing, and interpreting information to answer questions or solve problems. It involves a careful and organized inquiry aimed at discovering new facts, verifying existing knowledge, or developing new theories.

Objectives of research: /characteristic

1. **Discover new knowladge:**
Research aims to uncover new facts, or insights that expand the existing body of knowledge.

2. **Solve problems:**
Research seeks to find solutions to specific problems or challenges by systematically investigating possible causes and effects.

3. **Explain phenomena:**
Research attempts to understand and explain why and how certain events or setuations occur by discovering relationship between variables.

4. **Test hypotheses:**
Research test assumption hypotheses to validate or disprove them based on empirical evidence.

5. **Describe characteristic:**
Research helps in describing the characteristic feature of a particular population events or phenomenon in details.

6. **Predict outcomes:**
Research can make prediction about future events or behaviour based on current data and trends.

7. **Develop theories and modules:**
Research contributes to the development or refinement of theories and conceptual frameworks that explain obser

Significance:

- **Knowledge Advancement:** It builds the foundation of knowledge in every field.
- **Policy Making:** It provides the data necessary for governments and organizations to make informed decisions.
- **Problem Solving:** It helps in solving operational and planning problems of business and industry.

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Types of research:

1. **Fundamental or Basic Research:**
Seeks to expand knowledge without immediate practical application. Its goal is to understand fundamental principles. Example: Studying atomic structure.

2. **Applied Research:**
Focuses on solving specific practical problems. It aims to find solutions that can be directly applied. Example: Developing a new drug for a disease.

3. **Qualitative Research:**
Gathers non-numerical data like opinions, feelings, and experiences. Example: Conducting interviews or focus groups to understand customer preferences.

4. **Quantitative Research:**
Collects numerical data for statistical analysis. Example: Surveys with rating scales or experiments measuring variables.

5. **Experimental Research:**
Tests hypotheses by manipulating variables to establish cause-and-effect relationships. Example: Testing the effect of a new teaching method on student performance.

6. **Historical Research:**
Examines past events to understand their causes and effects.

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Research process

1. **Identifying the research problem**
The first step involves selecting and clearly defining the research problem.

2. **Literature review**
An extensive survey of existing literature is carried out to understanding what has already been researched on the topic. This helps in identifying research gap.

3. **Formulating hypotheses**
Based on the literature review researches may form hypotheses proposed explanations or predictions that can be tested hypothesis provide a clear direction for data collection and analysis.
A hypothesis is a precise, testable statement that predicts the relationship between two or more variables in a study. It is an educated guess or tentative explanation made before collecting data, which guides the research by stating what the researcher expects to find. A good hypothesis is specific, clear, testable, and based on existing knowledge or prior

research. It usually follows an "if-then" format to show the expected cause-and-effect relationship.
For example: "If students study more hours, then their exam scores will increase."

4. Research design
Research design is the overall plan or strategy that guides a researcher on how to conduct a study effectively. It outlines the methods and procedures for collecting and analyzing data to answer research questions or test hypotheses. Think of it as a roadmap that shows what steps to take from start to finish, ensuring the research is organized, systematic, and credible.

5. Data collection
At this stage, relevant data is gathered using appropriate techniques like surveys, interviews, aobservations and experiment.

6. Data analysis
Data analysis in research is the process of organizing, examining, and interpreting the data collected to find useful information, patterns, and insights. It involves cleaning the data (removing errors or irrelevant parts), transforming it into a suitable format, and applying statistical or logical methods to summarize the findings and test hypotheses. The goal is to understand the data clearly to make informed decisions or draw valid conclusions based on evidence.

7. Interpreting the results
carefully examining the data analysis outcomes to understand what they reveal about your research questions. This involves relating the findings back to the original questions and comparing them with existing knowledge or previous studies to see if they support or challenge what was expected.

8. Conclusion
Drawing conclusions is the step where you summarize the main insights from your research, stating clearly what the results mean in practical or theoretical terms. Based on these conclusions, you may offer recommendations for future research, policy, practice, or decision-making.

9. Reporting and presentation:
reporting the research involves writing a detailed and organized document, such as a thesis, article, or report, that presents the entire research process, findings, and conclusions. This allows others to understand, evaluate, and build upon your work, ensuring transparency and contribution to the knowledge base in your field.

Literature survey and its need:

A literature survey in research methodology is a systematic examination and summary of previously published research and literature related to a specific research problem or topic. It involves critically analyzing earlier studies to understand what has been done, identify gaps or insufficiencies in knowledge, and position the new research within the existing body of knowledge.

The need for a literature survey includes:

- Understanding the significance of new research by connecting it to earlier work.
- Avoiding duplication of research efforts already done.
- Providing a theoretical background and context for the research.
- Identifying research methodologies, main findings, and conclusions from previous studies.
- Demonstrating differing viewpoints, research results, and methodological approaches.
- Helping to focus the research problem and clarify research objectives.
- Preparing a foundation for new research and contributing to scholarly dialogue.

Formulation of Hypothesis: A hypothesis is a tentative assumption made in order to draw out and test its logical or empirical consequences.

- *Null Hypothesis (H0):* Statements of "no difference" or "no relationship."
- *Alternative Hypothesis (H1):* The statement the researcher wants to prove.

Conceptual Framework: A visual or written product, one that "explains, either graphically or in narrative form, the main things to be studied—the key factors, concepts, or variables—and the presumed relationships among them.

Criteria of good research:

1. **Systematic approach:**
Good research follows a structured and planned procedure with specific steps taken in sequence, avoiding guesswork

2. **Clear purpose:**
The research objectives should be clearly defined with commonly understable concepts to provide focus.

3. **Logical reasoning:**
Logical reasoning ensures the study is rational and conclusions are well-supported by evidence.

4. **Reliability:**
The research produces consistent and dependable results, showing that outcomes are stable across different trials or measurements, which is essential for trust in research findings

5. **Thorough Literature Review:**
   It should acknowledge previous research to avoid duplication and build on existing knowledge.
6. **Detailed Procedure:**
   The research procedures must be described in sufficient detail to allow other researchers to replicate the study.

7. **Ethical Consideration:**
   Research must be conducted ethically, including honest reporting of flaws or limitations and respect for participants.

8. **Objectivity:**
The research design must aim to minimize personal bias in selecting and recording data.

Unit II – Research Design

Meaning of Research design:

Research design is a comprehensive plan or blueprint that outlines how a research study will be conducted to answer specific questions or test hypotheses. It encompasses the overall approach, methods, and procedures used for collecting, analyzing, and interpreting data to ensure the study's validity, reliability, and ethical compliance.

Need:

- To minimize the expenditure of effort, time, and money.
- To facilitate the smooth scaling of the various research operations.
- To ensure the data collected is relevant to the problem.

Basic Principles of Experimental Design

1. **Principle of Replication:** The experiment should be repeated more than once. This allows the researcher to estimate the experimental error and improves precision.
2. **Principle of Randomization:** Variations caused by extraneous factors are essentially "averaged out" by random assignment. It protects against bias.
3. **Principle of Local Control:** Eliminate the effect of extraneous variables by blocking or grouping homogeneous units.

Types of Research Designs

- **Exploratory Design:** Used when the problem is not clearly defined. Focuses on gaining insights and ideas. (Flexible, unstructured).

- **Descriptive Design:** Used to describe the characteristics of a population. (Rigid, structured).

- **Experimental Design:** Used to establish cause-and-effect relationships. The researcher manipulates the independent variable to observe the effect on the dependent variable.

Components of Research Design

- **Objectives:** What is the goal?
- **Hypotheses:** What are we testing?
- **Variables:**
  - *Independent Variable:* The cause (manipulated).
  - *Dependent Variable:* The effect (measured).
  - *Extraneous Variable:* Variables that might affect the outcome but aren't the focus.

- **Methods of Data Collection:** Survey, observation, etc.
- **Sampling Design:** Who will be studied?

Validity and Reliability

- **Validity:** Does the test measure what it is supposed to measure?
  - *Internal Validity:* Is the observed effect actually caused by the independent variable (and not a confounding one)?
  - *External Validity:* Can the results be generalized to the real world or other populations?

- **Reliability:** Is the measurement consistent? If I repeat the test, do I get the same result?

Unit III

Data Collection: Primary vs. Secondary

Feature	Primary Data	Secondary Data
Definition	Data collected for the first time by the researcher.	Data already collected by others.
Source	Surveys, Observations, Experiments.	Government census, Books, Journals, Websites.
Cost/Time	Expensive and time-consuming.	Economical and quick.
Reliability	High (specific to current problem).	Variable (must verify source).

Methods:

- **Surveys:** Questionnaires sent to a large audience. Good for breadth.
- **Interviews:** Direct conversation. Can be Structured (fixed questions) or Unstructured (open-ended). Good for depth.
- **Observations:** Recording behavior as it happens. Non-intrusive.
- **Case Studies:** Deep dive into a single unit (person, company, event).

Sampling Concepts

- **Population:** The entire group you want to draw conclusions about (e.g., All college students in India).
- **Sampling Frame:** The list from which the sample is drawn (e.g., The registry of university students).
- **Sample:** The subset of the population actually studied.
- **Sample Size:** The number of observations. Determining this depends on the *margin of error* and *confidence level* required.

Sampling Techniques

Probability Sampling (Random): Every member of the population has a known chance of being selected.

- **Simple Random Sampling:** Lottery method. Everyone has an equal chance.
- **Stratified Sampling:** Divide population into subgroups (strata) based on a characteristic (e.g., gender) and sample from each.

Non-Probability Sampling (Non-Random): Used when a random list isn't available.

- **Purposive (Judgmental) Sampling:** Researcher selects participants based on specific criteria/expertise.
- **Convenience Sampling:** Selecting whoever is easiest to access (e.g., asking friends).
- **Snowball Sampling:** Asking current participants to refer others. Used for hard-to-reach populations (e.g., drug users, rare diseases).

Unit IV

Data Analysis:

**1. Descriptive Statistics:** Summarizes the data.

- *Measures of Central Tendency:* Mean (Average), Median (Middle), Mode (Most frequent).
- *Measures of Dispersion:* Range, Standard Deviation (how spread out the data is).

2. Inferential Statistics: Makes predictions about the population based on the sample.

- *T-tests/ANOVA:* Comparing means between groups.
- *Hypothesis Testing:* Calculating P-values to accept or reject H0.

3. Regression and Correlation:

- **Correlation:** Measures the strength and direction of a relationship between two variables (e.g., height and weight). It does *not* prove causation.
- **Regression:** Predicts the value of a dependent variable based on the independent variable (e.g., predicting sales based on ad spend).

Correlation Coefficient

(A) Positive Correlation   (B) Negative Correlation   (C) No Correlation
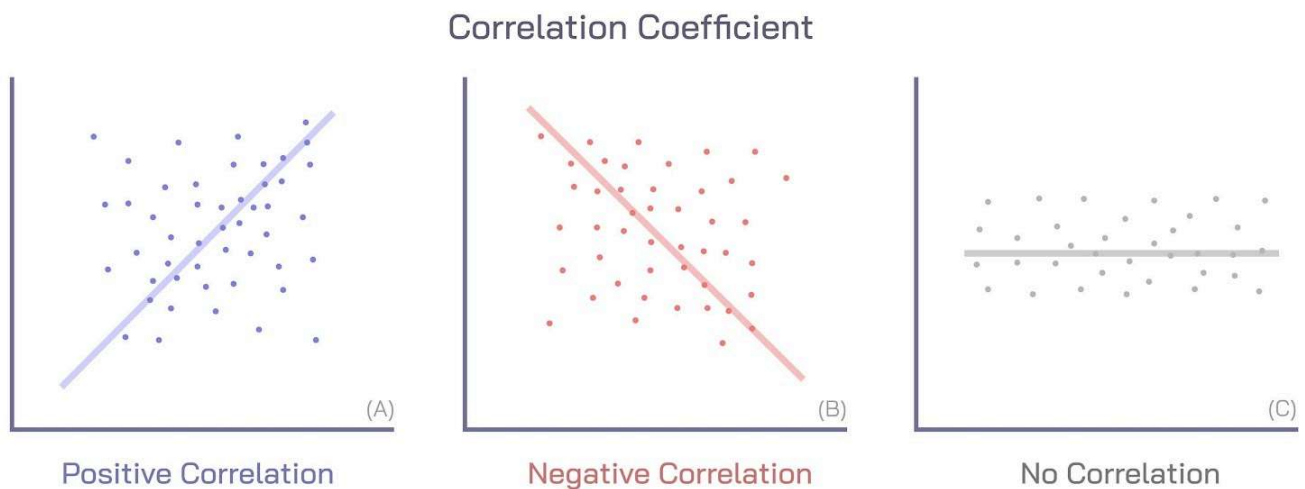
4. Data Visualization: Using charts (Bar, Pie, Histogram, Scatter Plot) to make data understandable at a glance.

Research Ethics

Ethics ensures the protection of participants and the integrity of the study.

- **Informed Consent:** Participants must know what they are getting into and agree voluntarily.
- **Confidentiality/Anonymity:** Protecting the identity of participants.
- **Plagiarism:** Presenting someone else's work or ideas as your own.
- **IPR (Intellectual Property Rights):** Legal rights given to creators (Copyrights, Patents).
  - *Patent:* Exclusive right granted for an invention.
  - *Copyright:* Protection for literary/artistic works.

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Scholarly Publishing: IMRAD

The standard structure for scientific papers:

- **I - Introduction:** What is the problem?
- **M - Methods:** How did you study it?
- **R - Results:** What did you find?
- **A - And**
- **D - Discussion:** What does it mean?

Unit V

Research Report Overview

A research report is a document that presents the research findings to a specific audience. It serves as a permanent record of the research and validates the study.

Types of Reports

- **Technical Report:** Detailed, emphasizes methods and data. Written for fellow researchers.
- **Journal Paper:** Condensed version of research for publication in academic journals.
- **Case Study:** Narrative report regarding a specific instance or entity.
- **Thesis/Dissertation:** Academic requirement for degrees (PhD/Masters). Very comprehensive.

Components of a Research Report

1. **Title:** Concise and descriptive.
2. **Abstract:** A summary of the whole report (approx. 200 words).
3. **Keywords:** Terms for indexing/searching.
4. **Introduction:** Background, problem statement, objectives.
5. **Literature Review:** Summary of existing knowledge.
6. **Methodology:** Steps taken to do the research.
7. **Results & Discussion:** Data presentation and interpretation.
8. **References:** List of sources cited.

Formatting & Citation Styles

- **APA (American Psychological Association):** Common in Social Sciences.
  - *Example:* Author, A. A. (Year). Title of article. *Title of Journal*, volume number(issue number), pages.
- **IEEE (Institute of Electrical and Electronics Engineers):** Common in Engineering/CS. Uses numbers in brackets [1].
- **MLA (Modern Language Association):** Common in Humanities/Literature.

Finalizing the Report

- **Proofreading:** Checking for grammar, flow, and clarity.
- **Plagiarism Check:** Using software (like Turnitin) to ensure originality.
- **Peer Review:** Having experts in the field review the work before publication to ensure quality.