Lecture 1: Problem Identification

Problem Identification

Identifying and clearly defining a research problem is one of the most important steps in the research process. While there are countless problems in fields such as family planning and health programs, not every problem is suitable for research. A well-defined research problem leads naturally to the statement of objectives, formulation of hypotheses, identification of key variables, and selection of appropriate methodology. Conversely, a poorly defined problem leads to confusion and weakens the entire research effort.

All research is set in motion by the existence of a problem. A problem is a perceived difficulty, a sense of discomfort with the way things are, or a discrepancy between what is and what should be. However, not all problems require research. A potential research situation arises when the following three conditions exist:

1. A perceived discrepancy between what is and what should be.
2. A question about why the discrepancy exists.
3. At least two possible and plausible answers to the question.

If there is only one possible and plausible answer, then a research situation does not exist.

Example of a Nonresearch Problem

Problem Situation: A recent survey in District A found that 1,000 women were continuous users of contraceptive pills. Last month's service statistics indicate that none of these women are using contraceptive pills.

Discrepancy: All 1,000 women should be using contraceptive pills, but none are.

Problem Question: What factor or factors are responsible for 1,000 women discontinuing their use of contraceptive pills?

Answer: A monsoon flood has prevented all new supplies of pills from reaching District A, and all old supplies have been exhausted.

In this example, the reason for the problem is already known, so there is no need to conduct research on pill discontinuation. However, research might be needed on why the supply system failed during the monsoon.

Example of a Research Problem

Problem Situation: District A is always flooded during the monsoon season. To address this, a new supply logistics system was established: each pill user is given a four-month supply before the monsoon, and small motorboats are available to transport new supplies to distribution centers. Despite these measures, this year there are no pill supplies in District A.

Discrepancy: The new logistics system should assure a continuous supply of pills, but this year there are no supplies.

Problem Question: Why has the new supply logistics system been incapable of delivering contraceptive pills to users?

Possible Answers:

1. An order for new pill supplies was not placed in time before the monsoon rains.
2. The riverboats used to transport the supplies are out of order.
3. Field-workers were not informed about the new system and failed to distribute a four-month supply before the monsoon.

Here, multiple plausible explanations exist, making this a suitable research problem.

Example of a Complex Research Problem

Problem Situation: A recent family planning survey revealed large differences between villages in contraceptive prevalence rates. Despite all villages receiving the same level of services, some have rates as high as 80%, while others are as low as 6%.

Discrepancy: All villages should have approximately the same contraceptive prevalence rate, but there is great variation.

Problem Question: What factors are responsible for the areal variation in contraceptive prevalence rates?

Possible Answers:

1. Socioeconomic differences between villages (e.g., type of community, religion, access to markets, availability of facilities).
2. Differences in institutional support for family planning (e.g., support from local leaders, presence of Mothers' Clubs).
3. Differences in effectiveness and motivation of village-level health and family planning workers.

In such cases, the researcher must devote considerable time and attention to identifying and defining the problem, focusing the research on the most important aspects.

Lecture 2: An Introduction to Research Methodology

Meaning of Research

Research is the systematic gathering and analysis of data and information for the advancement of knowledge in any subject. It aims to answer intellectual and practical questions through the application of systematic methods.

According to Webster's Collegiate Dictionary, research is "studious inquiry or examination; especially: investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws."

Research is often described as a movement from the known to the unknown, driven by human inquisitiveness. This instinct leads us to probe and understand what is not yet known, making research the mother of all knowledge.

Clifford Woody defines research as the process of defining and redefining problems, formulating hypotheses or suggested solutions, collecting, organizing, and evaluating data, making deductions and reaching conclusions, and carefully testing those conclusions to determine whether they fit the formulated hypothesis.

According to D. Steiner and M. Stephenson, research is "the manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art."

In summary, research is an original contribution to the existing stock of knowledge, advancing it through study, observation, comparison, and experiment. It refers to the systematic method of enunciating the problem, formulating a hypothesis, collecting and analyzing data, and reaching conclusions either as solutions to the problem or as generalizations for theoretical formulation.

Objectives of Research

The main purpose of research is to discover answers to questions through scientific procedures. The objectives of research can be broadly grouped as follows:

1. To gain familiarity with a phenomenon or achieve new insights (exploratory or formulative research).
2. To portray accurately the characteristics of a particular individual, situation, or group (descriptive research).
3. To determine the frequency with which something occurs or is associated with something else (diagnostic research).
4. To test a hypothesis of a causal relationship between variables (hypothesis-testing research).

Utility of Research

Research is extensively useful for managers in planning, forecasting, coordinating, motivating, controlling, and decision-making. Academic research supports academic objectives, while social research aids in social prediction, enlightenment, welfare, growth, cohesion, and control.

Key utilities of research include:

- Aiding decision-making and problem identification.
- Facilitating analysis, evaluation, and interpretation of business or social environments.
- Providing a basis for innovation and product development.
- Establishing relationships between variables and functional areas.
- Aiding forecasting and all managerial functions.
- Supporting economic utilization of resources.
- Assisting in market analysis and management information systems.
- Informing policy and strategy formulation.

Research Methods

Research methods are all the techniques used for conducting research. They include:

1. Methods concerned with data collection, used when available data is insufficient.
2. Statistical techniques for establishing relationships between data and unknowns.
3. Methods for evaluating the accuracy of results obtained.

Research methodology is the science of studying how research is done scientifically. It involves understanding the steps adopted by researchers, the logic behind them, and not just the techniques themselves. Researchers must know not only how to use certain methods but also when and why to use them, and what assumptions underlie them.

Need of Research Methodology

It is necessary for a researcher to design a research methodology for the chosen problem. Even if research methods are the same for two problems, the methodology may differ.

A good methodology addresses:

1. Why a particular research study is undertaken.
2. How the research problem is formulated.
3. What types of data are collected.
4. What particular methods are used.
5. Why a particular technique of data analysis is chosen.

Studying research methods trains one to apply them to problems. Studying research methodology provides the necessary training to choose appropriate methods, materials, and scientific tools for the problem at hand, and to justify those choices.

Lecture 3: Approaches and Types of Research

Deduction: Testing Theory

Deduction is a research approach used to test a theory. It involves developing a theory and then subjecting it to a rigorous test through the following stages:

1. Deducing a hypothesis from the theory
2. Expressing the hypothesis in operational terms
3. Testing the operational hypothesis
4. Examining the specific outcomes of the enquiry
5. Modifying the theory in light of the findings, if necessary

This process is cyclical: the revised theory is verified by returning to the first step and repeating the cycle.

Induction: Building Theory

Inductive research seeks to build theory from empirical evidence. The researcher tries to understand the nature of a problem, gathers quantitative and qualitative data, and analyzes them to draw conclusions. The result of this analysis is the formulation of a theory. Thus, in an inductive approach, theory is built from the data, whereas in deduction, data is collected to test a theory.

Characteristics of a Scientific Method

The main characteristics of the scientific method are:

1. **Verifiability:** Conclusions can be verified at any time. The phenomenon under investigation must be observable or measurable, even if only indirectly (e.g., via interviews).
2. **Generality:** Laws derived are universal in their applications and not limited to individual cases.
3. **Predictability:** Results can be predicted with sufficient accuracy, based on established cause-and-effect relationships and the stability of causative factors.

4. **Objectivity:** Results should be free from the investigator's own views or biases; conclusions should be the same for all observers.
5. **System:** Scientific studies follow an accepted, systematic mode of investigation; results from haphazard methods, even if true, are not considered scientific.

Types of Research

Research can be divided into two broad types relative to its purposes: **applied** and **fundamental** research.

1. Applied Research

Applied research is conducted in response to a specific problem that requires a solution. Its major purpose is to answer practical and useful questions about policies, programs, projects, procedures, or organizations. Business executives often commission applied research to find solutions that can be implemented to rectify a problem situation.

Applied research is also called *decisional research* because it is concerned with knowledge that has immediate applications.

Example: The Dairy Development Corporation (DDC) needs to improve productivity to remain competitive. Two strategies are considered: (a) improving all existing brands, or (b) focusing on new brand development. Each has pros and cons. Research is needed to determine which strategy best fits DDC's capabilities and resources. This illustrates the need for applied research to work out a strategy based on strengths and weaknesses, with the goal of making decisions and formulating policies.

The defining quality of applied research is that its results can be applied directly to a specific situation, often resulting in actionable recommendations.

2. Fundamental Research

Fundamental (or basic/pure) research is undertaken to improve understanding of problems that commonly occur in organizational settings, without any practical end-use in mind. Its purpose is to add to generalizable knowledge and to build theories based on research results.

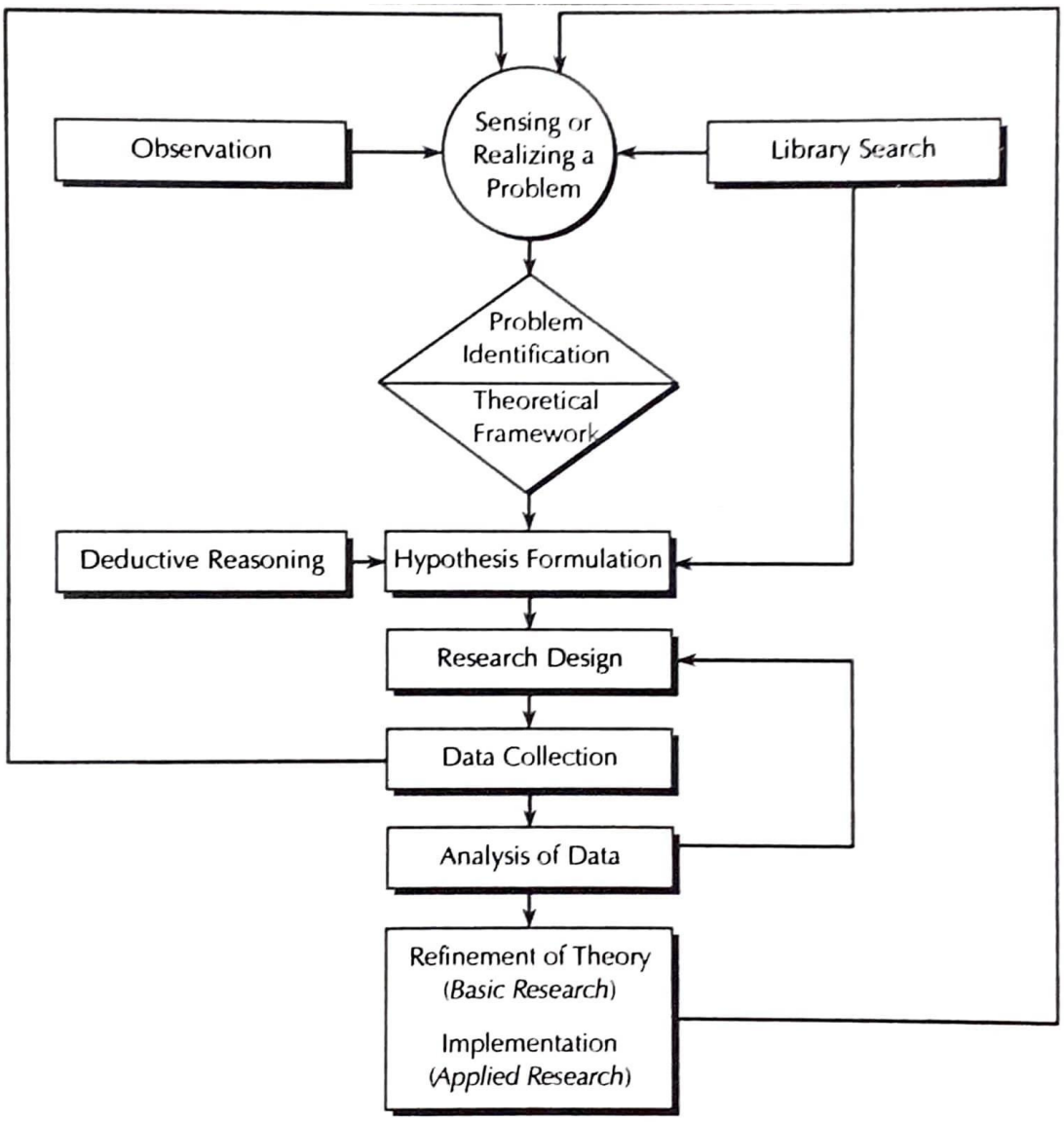
Fundamental research is also concerned with developing, examining, verifying, and refining research methods and techniques. It aims to advance knowledge and to identify and explain relationships between variables.

Example: At an HRD Managers' Conference in Kathmandu, participants discussed employee socialization, training, and commitment. It was observed that productivity of workers over 40 does not improve with socialization and training, though their organizational commitment is higher. Questions arise: Why does this occur? What factors are responsible? What type of training is effective for different age groups? To answer these, basic research is needed to increase knowledge about employee commitment and training, not necessarily to solve an immediate problem. The researcher would design studies in different work settings

to observe the effects of socialization and training on productivity and commitment across age groups.

The main purpose of fundamental research is to advance the level of scientific knowledge.

Scientific Research Process



Scientific research is systematic and follows the steps of the scientific method. From the inception of a research idea to the final report of results, the research process has several crucial steps. However, these steps do not provide a rigid pattern into which you must force your thinking. Thinking simply cannot be scheduled. An investigator does not tackle one step at a time, complete that process and then move on to the next step. Some steps can go simultaneously. Others need proper sequencing and logical arrangement.

Lecture 4: The Scientific Research Process

Scientific Research Process

Scientific research is a systematic process that follows the steps of the scientific method. From the inception of a research idea to the final report of results, the research process involves several crucial steps. However, these steps are not rigidly sequential; some may occur simultaneously or require iteration and logical arrangement. The steps may vary depending on the subject and the researcher, and are often interdependent.

There are eight main steps in the scientific method, covering the full spectrum of a research endeavor—from problem formulation to the refinement of theory or practice. These steps are:

1. Sensing or Realizing a Problem

The first step in any scientific inquiry is to identify an issue to study. This can arise from observing a situation or sensing that something is not functioning as it should. At this stage, the exact nature of the problem may not be clear, but there is an awareness that something is amiss.

2. Problem Identification

With increased awareness, the researcher focuses on the problem and its associated factors by searching for more information. The aim is to identify what exactly are the issues in the situation. As the saying goes, "a problem well defined is a problem half solved."

3. Theoretical Framework

The next step is to logically integrate the information so that the reasons for the problem can be conceptualized. Critical variables are examined, and their associations are identified. By putting all variables and their relationships together, a theoretical framework is developed.

4. Hypothesis Formulation

Hypotheses are formulated as logical conjectures about the relationships between two or more variables, expressed as testable statements. Hypotheses are drawn from the theoretical framework and provide specific answers to the research questions. They are especially useful in quantitative research where statistical analysis is performed.

5. Research Design

At this stage, the researcher devises a plan or strategy for conducting the research. The research design outlines what information is needed and how it will be obtained and analyzed. The choice of design depends on the nature of the research problem and objectives.

6. Collection of Data

Data collection, or fieldwork, involves administering research instruments (such as questionnaires, interview schedules, or observation schedules) to gather data. The procedures used depend on the research design and data sources. This step is crucial to the success of the research project.

7. Data Analysis

After data collection, the data must be summarized and analyzed. Data analysis includes editing, coding, tabulating, and applying statistical techniques. Descriptive statistics provide a summary, while inferential statistics assess the reliability of the data and test the hypotheses.

8. Refinement of Theory or Practice

The final step involves interpreting and generalizing the findings, contributing to the broader body of knowledge. In applied research, this may involve proposing specific strategies to solve the identified problem. Through research, existing theories or practices are refined and modified.

Cyclical Nature of Scientific Research

The scientific research process is cyclical. Research often starts with a problem and ends with a tentative empirical generalization, which then becomes the starting point for further research. This cycle continues indefinitely, reflecting the ongoing accumulation and self-correction of scientific knowledge.

Example: A Case Study

A car dealer received complaints from users about rattling sounds in the dashboard and rear passenger seat after a few thousand kilometers of driving. The dealer:

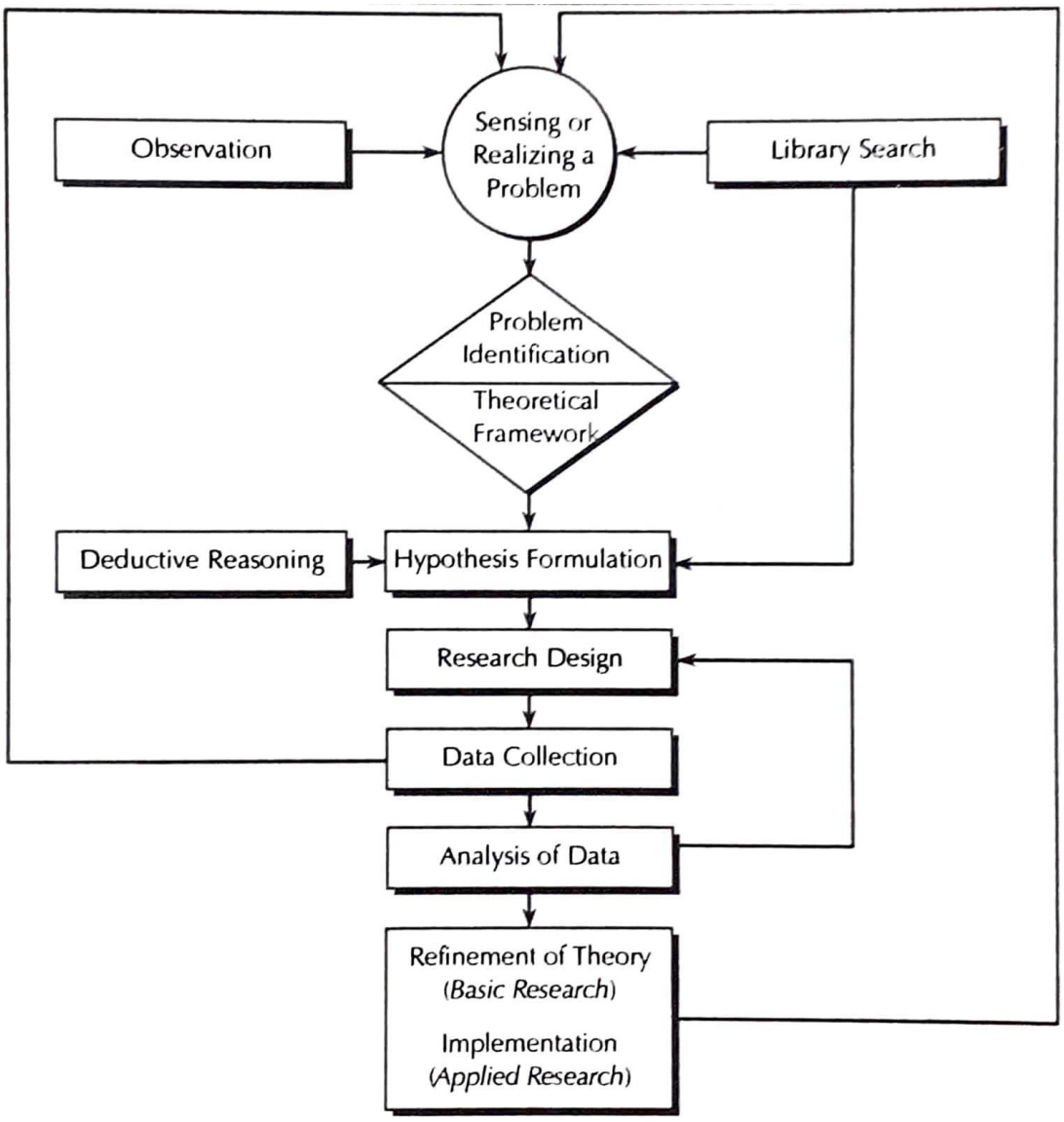
- Gathered information from company workers to identify influencing factors.
- Formulated the problem and generated hypotheses.
- Constructed a checklist and collected data from a representative sample of cars.
- Analyzed the data, interpreted the results in light of the hypotheses, and reached conclusions.

This example illustrates a systematic, step-wise scientific method of inquiry, leading to reliable conclusions.

Key Features

- The research process is systematic and follows a logical sequence.
- Steps may be revisited or occur simultaneously.
- The process is cyclical and self-correcting, with each generalization leading to further research.

Scientific Research Process



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Lecture 5: Case Study, Research Language, and Problem Identification

Case Study: The CIO Dilemma

Observation: The Chief Information Officer (CIO) of a firm notices that the newly installed Management Information System (MIS) is not being used by middle managers as much as expected. Managers often seek help from the CIO or other "computer experts" or make decisions without adequate information. The CIO recognizes a problem.

Information Gathering through Informal Interviews: Informal discussions with middle managers reveal that many lack understanding of what MIS is, what information it provides, and how to access or use it.

Literature Survey: The CIO searches the Internet and finds that many middle managers, especially older ones, are not familiar with computers and experience "computer anxiety." Lack of knowledge about MIS offerings is a main reason for underuse.

Formulating a Theory: Based on these insights, the CIO develops a theory incorporating factors contributing to the lack of MIS use among managers.

Hypothesizing: From the theory, the CIO generates hypotheses for testing, such as: *Knowledge of the usefulness of MIS would help managers to put it to greater use.*

Data Collection: A short questionnaire is developed to assess factors influencing MIS use, including knowledge of MIS, types of information provided, access methods, comfort with computers, and frequency of MIS use in the past three months.

Data Analysis: The CIO analyzes the questionnaire data to identify factors preventing managers from using MIS.

Deduction: Based on the analysis, the CIO concludes that certain factors hinder MIS use. Actions such as organizing training seminars for managers on computers and MIS are recommended.

Research Language: Key Terms

- **Theory**
- **Conceptualization**

- **Operationalization**
- **Variables**
- **Hypotheses**
- **Assumptions**
- **Population**
- **Sample**
- **Validity**
- **Reliability**
- **Data**
- **Research process**
- **Summary**
- **Methodological queries**
- **References**

Concepts and Constructs

- **Constructs** are abstract concepts such as happiness, satisfaction, IQ, or morality. They represent real phenomena that cannot be directly observed but are useful for study.
- **Concepts** are abstractions formed by generalization from particulars (e.g., "weight" as a concept for heaviness or lightness).
- Constructs can be conceptually defined and are meaningful in theoretical terms. They are often not directly observable.
- Examples of concepts: Income, Age, Education Level, Number of Siblings.
- Concepts can be measured through direct observation (e.g., weight, height, hair color) or indirect observation.

Research Problem Identification and Formulation

Formulating and selecting a research problem is the first and foremost step in research. The entire research work can be conducted only if the problem is precisely identified, which may require:

- Basic knowledge in the field, developed through discussion with experts, literature review, or continued activity in the area.
- Careful selection of the research problem, often with guidance from a supervisor.

- Recognizing and defining the exact nature and dimensions of the problem.

Steps in Identifying a Research Problem

1. Determine the field of research of interest.
2. Develop mastery in the area or field of specialization.
3. Review recent research conducted in the selected area.
4. Based on the review, select the priority field of study.
5. Use analogy, insight, or personal experience to identify a problem; consult with supervisors or experts as needed.
6. Pinpoint the specific aspect of the problem to be investigated.

Ways of Understanding a Research Problem

Selecting a suitable research problem is not easy and requires serious consideration. Approaches include:

- Discussion with colleagues, research guides, or experts.
- Intensive reading of available literature (research abstracts, journals, handbooks, international abstracts).
- Personal experience in the field.
- Studying the field intensively to identify specific problems.
- Considering new innovations, technological changes, and curricular developments for new research opportunities.
- Consulting supervisors and experienced individuals in the field.
- Reviewing suggestions for further research found in previous research reports.

Lecture 6: Steps and Criteria in Research Problem Formulation

Steps in Research Problem Formulation

In scientific inquiry, turning a general topic into a specific research problem is called research problem formulation. The researcher must thoroughly understand the problem and rephrase it in meaningful, analytical terms. The following are suggested steps for formulating a research problem:

- Statement of the problem in a general way
- Understanding the nature of the problem
- Surveying the available literature
- Developing ideas through discussion
- Rephrasing the research problem

Criteria of a Good Problem

Fred N. Kerlinger defines a good problem as an inquisitive sentence that asks what relation exists between two or more variables. The research questions, objectives, and hypotheses all rest on the problem statement. An ideal research problem should meet these three main criteria:

1. **Expresses a relation between two or more variables:** The topic should reflect relationships to be examined.
2. **Stated rigidly and unambiguously:** Ambiguity in the problem statement can affect research design, process, and results.
3. **Implies possibilities of empirical testing:** The problem must be testable within the research design and available resources.

A good research problem should be linked with the research design and consider available facilities and capabilities.

Problem Statement

Developing a problem statement involves generating and exploring an issue, then determining worthwhile research questions. A problem statement should:

- Raise a question about a relationship between variables
- Clearly state and explain the relationship between variables
- Suggest a method for researching the question

A problem statement can be written in either declarative or interrogative form.

Examples:

- *Declarative:* Factors contributing to the excessive absenteeism among Nepalese workers.
- *Interrogative:* Why is absenteeism so high among workers in Nepalese organizations?

Other examples of well-defined research problems (interrogative form):

- To what extent do age, education, length of service, level of earning, and place of residence of employees predict occupational aspirations?
- Do long work hours, lack of development opportunities, and discrimination account for the lack of inward mobility of women in civil service?
- Can cultural differences account for the differences in the nature of hierarchical relationships between supervisors and subordinates?

Example from Research Literature

A review of research on leadership and age (Kabacoff & Stoffey, 2001) highlights the importance and controversy in examining the relationship between these variables. Older workers remain employed longer and work alongside younger members in various roles. Modern organizations now have multigenerational teams, and both age groups contribute unique strengths. Leadership is no longer the exclusive domain of older people; flatter organizations encourage interaction between all ages. Understanding and leveraging multigenerational diversity is necessary for high performance in organizations.

Kabacoff & Stoffey (2001) and Kakabedse et al. (1998) found that age and time-related dimensions shape the attitudes and behaviors of senior leaders. In Australia, three leader profiles were identified: radicals (youngest, 26-35 years), bureaucrats (45-55 years), and team players (oldest, 56+ years). Older workers were mature and long-term oriented, while younger workers were competitive, energetic, and open in management style.

Research Questions

Research is intended to help us learn something new. Research questions are the most important element for effective execution of research. They are formulated in interrogative form and describe the ideas in the research objectives. Research questions guide the data

to be collected, the research design, the methods, the analysis tools, interpretation, and reporting. They should address:

- **What?** (description)
- **Why?** (explanation)
- **How?** (intervention or change)

Without clear research questions, the research process may lack direction and face challenges.

Types of Research Questions

Generally, there are three types of research questions:

- **What questions:** Concerned with description.
  Examples: What are the types of community involved in skill transformation? What are the socio-economic characteristics of the community? What are the needs of the community?
- **Why questions:** Concerned with explaining causes or relationships.
  Examples: Why do drug abusers commit thefts? Why does stressful living result in heart attacks? Why do some people use a product while others do not?
- **How questions:** Concerned with bringing about change and outcomes.
  Examples: How has the caste system changed in Nepal in the last century? How does technology create unemployment? How do maternal and child health services affect infant mortality?

Other types proposed by Lin (1993) include Who, Where, How many, and How much.

Identification of Research Question

The main purpose of formulating research questions is to define the scope of the research—what is to be studied and to what extent. Neuman (1997) suggests the following techniques for developing research questions:

- Record all questions that arise after literature review, discussions, or reflection.
- Review and delete questions beyond the study's scope to remove overlap.
- Classify questions by their nature: What, Why, How, etc.
- Examine the scope of questions for feasibility within available time and resources.
- Separate major/key questions (core of the research) from subsidiary questions.

Detailed Summary of Lecture 7: Hypothesis in Research

1. Definition of Hypothesis

A **hypothesis** is a proposed relationship between two or more variables. It is essentially a provisional idea or working assumption that requires evaluation through investigation.

Example: *Political participation increases with education.* This implies a direct relationship between two variables.

Scholarly definitions:

- **Fred N. Kerlinger and H.B. Lee (2000):** "A hypothesis is a conjectured statement that implies or states a relationship between two or more variables."
- **John W. Creswell (2014):** "A hypothesis is a formal statement that presents the expected relationship between independent and dependent variables."

A good hypothesis:

- Clearly states the expected relationship or difference between variables.
- Defines variables operationally and in measurable terms.

2. Functions of a Hypothesis (Kumar, 2011)

- Provides focus by specifying what aspects of the research problem to investigate.
- Guides data collection by indicating what to collect and what to ignore.
- Enhances objectivity in the study.
- Contributes to theory formulation by determining what is true or false.

3. Hypothesis Formulation

Hypotheses can be derived from:

- General culture
- Scientific theory or past research
- Personal experience

- Discussions or intuition

Two justifications:

- **Logical:** Based on theoretical reasoning.
- **Empirical:** Based on reference to existing research.

A hypothesis is more operational than the research problem and is usually derived directly from it.

4. Deductive and Inductive Reasoning

4.1. Deductive Reasoning

Deduction moves from general theory to specific case.

Example 1:

- All books have pages.
- This is a book.
- Therefore, it has pages.

Example 2:

- Lung cancer is caused by smoking.
- John has lung cancer.
- Therefore, John was a smoker.

4.2. Inductive Reasoning

Induction moves from specific observations to general conclusions.

Researchers use both deduction and induction to:

- Organize facts
- Describe results
- Develop relationships
- Suggest new research

5. Hypothesis vs. Research Problem

- A research problem is posed as a question.
- A hypothesis is a testable solution to that question.
- Problems can't be directly tested; hypotheses can be.

Example:

- **Problem:** What is the relationship between population growth in Kathmandu before and after the introduction of family planning?
- **Hypothesis:** There is a significant difference in the population growth in Kathmandu between when family planning was first introduced and five years later.

6. One-sided vs. Two-sided Hypotheses

- **One-sided hypothesis:** Predicts a specific direction (e.g., increase or decrease).
- **Two-sided hypothesis:** Suggests a difference but not the direction.

7. Formats for Stating Hypotheses

7.1. Correlation

- "There is a significant relationship between Variable A and Variable B for Group 1."

7.2. Difference Between Means

- "There is a significant difference between mean levels of Variable A for Group 1 and Group 2."

7.3. Difference Between Frequencies

- "There is a significant relationship between Group 1 and Group 2 for Variable A."
- "There is a significant difference between Group 1, 2, and 3 for Variables A and B."

8. Conclusion

This lecture provides a comprehensive understanding of the concept of hypothesis in research. It discusses its definition, function, formulation, types of reasoning used in its development, and proper formats for stating hypotheses. Mastery of these elements is essential for constructing valid, testable research.

Detailed Summary of Lecture 8: Types of Hypothesis

1. Types of Hypothesis

1.1. 1. Descriptive and Relational Hypotheses

Descriptive Hypotheses state the existence, size, form, or distribution of a single variable. They do not show relationships between variables and thus are not ideal for scientific research hypotheses.

Examples:

- Tribhuvan University is experiencing budget difficulties.
- The Hetauda–Narayangadh sector of the East-West Highway has higher-than-average accident rates.
- Stockholders of Nepal Development Bank favor bonus dividends.

These can be reframed as **research questions**:

- What is the extent of budget difficulties at Tribhuvan University?
- Why is the accident rate higher in the Hetauda–Narayangadh sector?
- Why do bank stockholders prefer bonus dividends?

Relational Hypotheses describe the relationship between two or more variables and include:

- **Correlational Hypotheses:** Describe associations.
- **Explanatory (Causal) Hypotheses:** Imply causation.

Examples:

- Families with higher incomes spend more on recreation.
- Political participation increases with education.

1.2. 2. Explanatory Hypotheses

These state how one variable causes a change in another. Causal relations can be:

- **Unidirectional:** A affects B, but not vice versa.
- **Bidirectional:** A and B influence each other.

Examples:

- Increase in age leads to decreased organizational commitment.
- Productivity increases when workers are given incentive pay.

1.3. 3. Directional and Non-directional Hypotheses

Directional Hypotheses predict the specific direction of the relationship and are tested using a one-tailed test.

Examples:

- Younger workers are less motivated than older workers.
- Higher workload leads to lower job satisfaction.

Non-directional Hypotheses do not specify direction and use two-tailed tests. They are used when prior findings are conflicting or unavailable.

Examples:

- There is a difference in work attitudes between industrial and agricultural workers.
- No relationship between education level and occupational commitment.

1.4. 4. Null and Alternative Hypotheses

Null Hypothesis ($\mathbf{H}_0$): Suggests no relationship or difference exists. It is the default hypothesis tested statistically.

Alternative Hypothesis ($\mathbf{H}_A$): Suggests a relationship or difference exists, contrary to H_0.

Example:

- **$\mathbf{H}_A$:** Productivity increases with incentive pay.
- **$\mathbf{H}_0$:** No significant difference exists between productivity with or without incentive pay.

Statistical Form:

- **$\mathbf{H}_0$:** $\mu_1 = \mu_2$
- **$\mathbf{H}_A$:** $\mu_1 > \mu_2$ or $\mu_1 \neq \mu_2$

More Examples:

- H_0: No relationship between working conditions and job satisfaction.
  H_A: Improved working conditions increase job satisfaction.
- H_0: No gender difference in organizational commitment.
  H_A: Males are more committed than females.
- H_0: Pay and productivity are not related.
  H_A: Pay and productivity are positively related.

2. Stating the Null Hypothesis

- There is no difference between the means of two populations.
- The population means from which the samples were drawn are equal.

3. Criteria of a Good Hypothesis Statement (Mason and Bramble, 1997)

- Should be in declarative form.
- Clearly describes a relationship between two or more variables.
- Should be testable empirically.
- Must be limited in scope.
- Should be clear and precise with no ambiguity.
- Must specify the conditions under which it applies.
- Should be based on prior research, facts, or identified needs.

4. Linkage Between Research and Statistical Hypotheses

Research Hypothesis:

- Focused and derived from research objectives.
- Example: "Female students have higher grades than male students."

Statistical Hypothesis:

- Formally testable using statistics.
- Example: "The mean height of men is 175 cm."

Statistical testing usually focuses on rejecting the null hypothesis (H_0), not directly proving the alternative (H_A).

Detailed Summary: Lecture 9 – Literature Review

1 Introduction to Literature Review

A literature review is a systematic and critical summary of published works on a specific research topic. It provides insight into what others have studied, their findings, and how these findings relate to the current research.

Definitions from scholars (Cardesco & Gatner, Haywood & Wragg, Walliman) emphasize the processes of **summarizing, analyzing, classifying, and comparing** past research. The review prevents duplication and helps identify knowledge gaps.

2 Purpose of Literature Review

The primary goals include:

- Understanding how concepts are defined and measured by others.
- Identifying previous data sources and hypotheses.
- Discovering theoretical frameworks and research approaches.
- Recognizing consistencies, contradictions, and gaps in existing literature.
- Formulating hypotheses and guiding study design.

3 Need for Literature Review

- Demonstrates familiarity with the field.
- Justifies the need for current study by identifying gaps.
- Helps define theoretical and methodological focus.
- Prevents unnecessary repetition.
- Showcases critical understanding of the topic.

4 Types of Literature Review

- **Historical Review**: Tracks development of ideas over time.
- **Methodological Review**: Examines research techniques and their strengths.
- **Theoretical Review**: Focuses on conceptual or theoretical frameworks.
- **Integrative Review**: Summarizes and synthesizes overall knowledge.

Often, these types are combined in academic research.

5 Functions of Literature Review

- Avoids "reinventing the wheel".
- Gives credit to foundational work.
- Shows mastery of the research problem.
- Demonstrates critical evaluation and synthesis.
- Positions new research as a valuable contribution.

6 Encyclopedias as Sources

Useful encyclopedias include:

- **Encyclopedia Britannica** & **Britannica Online**
- **Encyclopedia of Social Sciences** & **International Encyclopedia of Social Sciences**
- **Encyclopedia of Education**
- **McGraw-Hill Encyclopedia of Science and Technology**
- **Business Encyclopedia and Legal Adviser**

7 Internet as a Source

The Internet provides:

- Quick access to primary research and bibliographies.
- Access to professional and academic organizations.
- Updated information not always found in libraries.

Note: Internet sources are often not suitable for citation in formal research.

8 Difference Between Reference and Bibliography

Reference

- Cited sources within the research text.
- Supports specific arguments.
- Based on primary sources.
- Common in theses and dissertations.

Bibliography

- All materials consulted, whether cited or not.
- Includes primary and secondary sources.
- Used in journal papers and broader research.

9 Key Differences Summary

Basis	**Reference**	**Bibliography**
Meaning	Cited sources in text	All consulted sources
Source Type	Primary	Primary and Secondary
Arrangement	Alphabetical/Numerical	Numerical
Use in Argument	Supports argument	Not used directly
Usage	Theses, Dissertations	Journal Papers, Research Work

Detailed Summary: Lecture 10 – Research Design

1 Introduction

A research design is a systematic plan or blueprint outlining how a research study will be conducted. It addresses the approach to the problem, data collection methods, strategies for analysis, and tools used.

Figure 1: Structure of a Research Design

2 Definitions

- **Fred N. Kerlinger (1986):** Research design is the plan, structure, and strategy of investigation to obtain answers to research questions.
- **John W. Creswell (2011):** Research designs are plans and procedures that span from assumptions to methods of data collection and analysis.
- **William Zikmund (2013):** Research design is a master plan specifying methods and procedures for collecting and analyzing needed information.

3 Essential Elements of a Research Design

- Provides a structured plan for the research process.
- Guides data collection, instrumentation, and sampling.
- Acts as a strategy to generalize findings from a sample to the population.
- Involves decisions about strategy (experimental/non-experimental), setting, instruments, and statistical methods.

4 Core Elements of Research Design

(a) Problem definition

(b) Methodology

(c) Data gathering

(d) Data analysis

(e) Report writing

Figure 2: Cycle of Core Elements in Research Design

5 Preparation of Research Design

According to Oliver (2011), a good design answers:

- What type of data is needed?
- Where and how will it be collected?
- What instruments and procedures will be used?
- Who are the data sources?
- Is permission required to collect data?
- When will data collection occur?

- How will data be analyzed?
- Will a theoretical framework be used?

6 Exploratory Research Design

Exploratory research is conducted when prior knowledge is limited. It helps in hypothesis formulation by clarifying problems and discovering new insights.

Purposes

- Diagnose a situation
- Screen alternatives
- Discover new ideas

Characteristics

- No fixed method—flexibility and creativity are key.
- Informal and loosely structured.
- Useful for clarifying understanding and guiding further research.
- Offers low-risk initial inquiry.

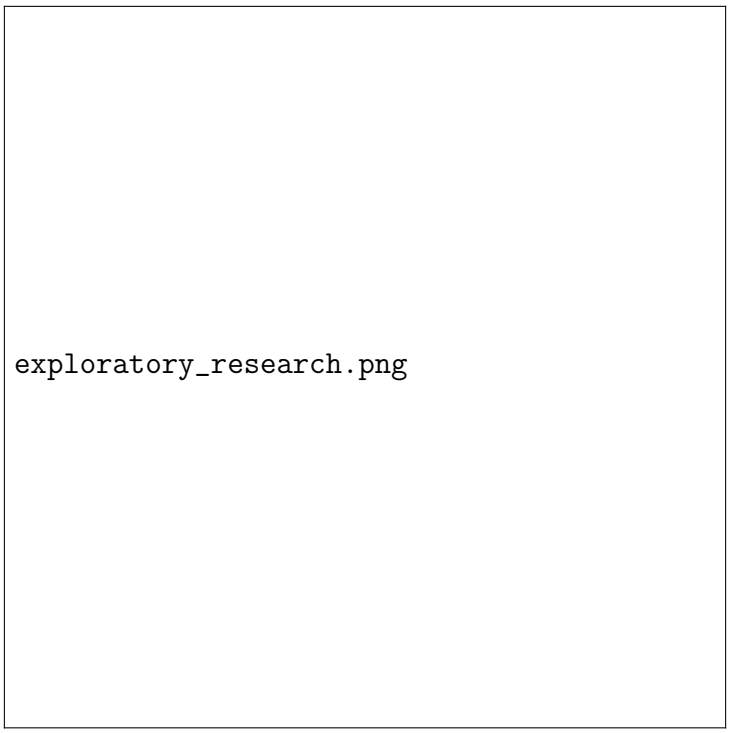

Figure 3: Exploratory Research Framework

7 Descriptive Research Design

Descriptive research describes phenomena systematically, aiming to provide accurate portrayals of conditions or behaviors.

Categories

- Historical
- Descriptive
- Developmental
- Survey
- Case Study

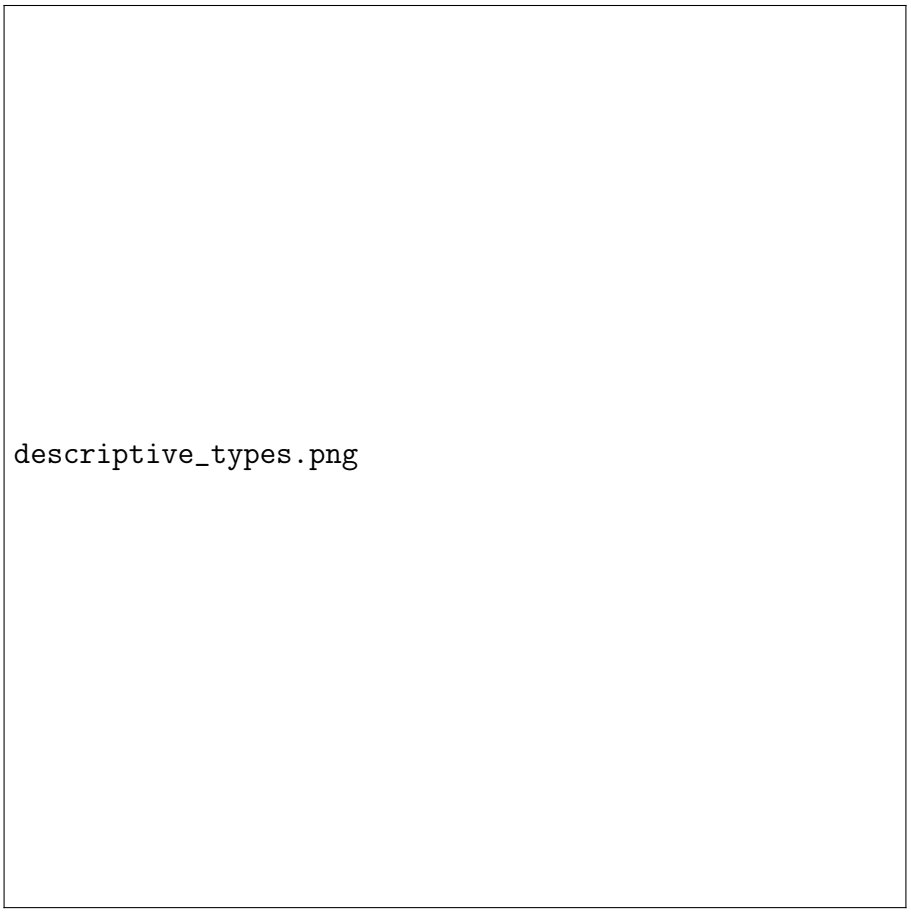

Figure 4: Types of Descriptive Research

8 Historical Research

- Concerned with past events and phenomena.
- Involves evaluation and synthesis of evidence to establish facts.

- Aims to provide relevance of past to the present.
- Depends on primary (firsthand) and secondary (reported) sources.

Characteristics

- Involves critical analysis of source material.
- Systematic and exhaustive in approach.
- Similar to literature reviews but broader in scope.

9 Descriptive Research (Type b)

- Describes current situations, behaviors, and opinions.
- Often used for collecting factual data.
- Can be both quantitative and qualitative.
- Focuses on what exists, not why it exists.

Characteristics

- Literal description of events/situations.
- Builds a factual database without testing hypotheses.
- May serve as groundwork for future predictive or explanatory research.

Purposes

- Gather factual data about existing phenomena.
- Identify problems and justify practices.
- Make evaluations and comparisons.
- Learn from similar cases to inform future planning.

Lecture 11: Developmental, Survey, and Case Study Research

Developmental Research

Developmental research aims to predict future trends by studying variables, their rates of change, directions, sequences, and interrelated factors over time.

(1) **Longitudinal Study:**

- Studies phenomena over time, collecting data from the same group at two or more points.
- Mostly quantitative, not cross-sectional.
- **Trend Study:** Collects data at intervals to establish patterns and predict future conditions, often using regression analysis.
- **Cohort Study:** Follows a group sharing a common characteristic (e.g., birth year) at different times; rare due to difficulty maintaining contact.
- **Panel Study:** Studies the same individuals repeatedly to understand why changes occur.

(2) **Cross-sectional Study:**

- Observes items from a population at a single point in time.
- Measures rates of change by sampling different subjects across groups.
- Often employs surveys; faster and less expensive than longitudinal studies.

Characteristics:

- Focuses on patterns, rates, directions, and sequences of growth.
- Longitudinal studies face sampling and attrition challenges and require sustained resources.
- Cross-sectional studies involve more subjects but fewer growth factors; comparability across age groups can be an issue.

Survey Research

Survey research systematically gathers information from a population to understand or predict behaviors and attitudes.

Types:

- **Exploratory:** Early-stage, forms basis for deeper studies, sometimes uses previous data.

- **Confirmatory:** Tests specific theories or hypotheses.
- **Descriptive:** Describes distributions in a population, aiding theory development.

Surveys can be written, oral, or electronic, and distributed in various formats (face-to-face, mail, telephone, online). They allow data collection from large or small populations using standardized questionnaires.

Case Study Research

A case study is an in-depth, empirical investigation of a real-life phenomenon within its context, using multiple data sources.

Definition: "An empirical inquiry that investigates contemporary phenomenon within its real-life context" (Yin, 1994).

Types (Jensen and Rodgers, 2001):

- **Snapshot:** Detailed study of one unit at one time.
- **Longitudinal:** Studies the same unit at multiple time points.
- **Pre-post:** Two time points separated by a critical event.
- **Cross-cut:** Multiple cases for comparison.

Sampling:

- Often uses information-oriented sampling (e.g., extreme, critical, exemplar cases) rather than random sampling.

Characteristics:

- In-depth investigation of a social unit, resulting in a complete, well-organized picture.
- Examines a small number of units across many variables.
- Useful for hypothesis generation and exploring complex realities.
- Does not allow generalization to the population without further research.

Limitations:

- More expensive due to depth and exploratory nature.
- Generalizations from a single case are limited.
- Potential for subjectivity and bias.

Analytical Research Design

Analytical Research designs can be experimental or observational and each type has its own features. A study design is critical to the research study because it determines exactly how we will collect and analyze our data. If we aim to study the relationship between two variables, then an analytical study design is the right choice. It's necessary to have a clear plan before we begin data collection. Analytical study designs can be experimental or observational and each type has its own features.

A study design is a systematic plan, developed so we can carry out our research study effectively and efficiently. Having a design is important because it will determine the right methodologies for our study. Using the right study design makes our results more credible, valid, and coherent.

Descriptive vs. Analytical Research

Study designs can be broadly divided into either descriptive or analytical. Descriptive studies describe characteristics such as patterns or trends. They answer the questions of what, who, where, and when, and they generate hypotheses. They include case reports and qualitative studies.

Analytical study designs quantify a relationship between different variables. They're used to test hypotheses and make predictions.

Experimental and Observational

Analytical study designs can be either experimental or observational. In experimental studies, researchers manipulate something in a population of interest and examine its effects. These designs are used to establish a causal link between two variables.

In observational studies, in contrast, researchers observe the effects of a treatment or intervention without manipulating anything. Observational studies are most often used to study larger patterns over longer periods.

Experimental Research Method

The experimental method of research is used as the classical method in physical sciences. It is based on observation or experiments. It deals with actual experiments to determine the relationship between cause and effect of various experimental treatments. It is defined as "the research method in which a researcher objectively observes phenomenon which is made to occur in a strictly controlled situation where one or more variables are varied and others are kept constant".

The purpose of experimental research is to investigate cause and effect relationship by exposing one (or more) experimental groups to one (or more) treatment conditions and comparing the result to one (or more) control groups not receiving the treatments. In this method, the researcher undertakes control or manipulation (vary) of various variables under study. The usual approach is to hold all variables constant except one in controlled condition. By varying this one variable, the outputs (the effects) are studied and documented.

Actually, in social sciences, in natural sciences, in biological phenomena and the human behavior, control of variable is hardly possible. However, in physical sciences and experimental technology the investigation in controlled condition is highly acceptable.

Experiment is a test of a causal proposition, such as:

i) Do changes in variable 'A' cause changes in variable 'B' keeping other variables constant?

ii) How do the changes in the value of one variable (called independent variable) affect another variable (called dependent variable)?

The mathematical form of the experimental method is given below: If $x_1, x_2, x_3, x_4, \ldots, x_n$ are n independent variables taken as the inputs of the process and y is the output of the process (a dependent variable), then y is defined as a function of x and denoted by,

$$y = f(x)$$

where x means $x_1, x_2, x_3, x_4, \ldots, x_n$ and f denotes the function.

Suppose for example, yield (y) of a product in an agricultural field is influenced by the following four different independent variables:

- x_1 – seed quality (qualitative variable say, S_1, S_2)
- x_2 – amount of fertilizer (quantitative variable, in kg)
- x_3 – irrigation scheme (categorical variable say, I_1, I_2, I_3)
- x_4 – labor input (quantitative variable, in number)

The production or yield, which depends upon these four variables, can be related mathematically as

$$Y = f(x)$$

or

$$Y = f(x_1, x_2, x_3, x_4)$$

By taking any three (say x_1, x_2, x_3) constant one can observe the effect of x_4 in Y; x_4 may vary as researchers will, so it is said to be a controlled variable.

The various factors in an experiment are divided into two groups: independent variables and dependent variables. The first set of factors are called an experimental group and the second set of factors are called control group. Control group is also known as a group of individuals, items or objects used as a standard for comparison or accepted norm.

To make the experimental method of research effective and distinct from normal activity, the method of local control (blocking) and statistical control methods are used. Control is necessary to reduce variations. In some experiments, some variables may be eliminated.

Types of Experiment

Experiment is the scientific investigation in which an investigator manipulates and controls one or more independent variables and observes the dependent variables for variation concomitant to the manipulation of the independent variable. There are four different types of experiments:

1. **Positive and Negative Experiment:** If the subject of an experiment is such that (i) the phenomenon and (ii) its cause both are present, the experiment is said to be positive. For example, a bell rings in the air. Here both the sound and cause of its propagation are present; but if, on the other hand, a bell is rung in a vacuum, there will be no phenomenon of a sound because the cause of the propagation, namely air, is absent. Such experiment is called negative experiment.

2. **Natural Experiment:** These experiments are to be observed in natural phenomenon. In most of the natural state experiments, the controlling of variable is unnecessary to obtain the real information about the phenomena. In such case, the whole phenomenon is divided into control group and experimental group to study the effects of seen and unseen variables.

3. **Laboratory Experiment:** These are the experiments performed in physical sciences with full control of external conditions. A laboratory experiment is an artificially created situation in which the researcher controls one or more variables while manipulating other variable at will. The method of lab experiment is used in the experiments, mainly related to the physical, chemical, microbiological, clinical and such other sciences. If it is difficult to conduct an experiment outside or in the field or in the society then one tries to carry out it in the laboratories.

4. **Field Experiment:** Field experiments are the experiments conducted in the field or in natural setting. Research study in a realistic situation in which one or more independent variables are manipulated by the experimenter under carefully controlled conditions as the situation will permit. In the social, managerial, agricultural, environmental researches, the method of field experiment is widely used. Some of the field experiments like agricultural or business field the controlling of the variable is possible but in the careful condition.

Purposes of Experimental Method

- To determine the effect of various treatments and to compare the differences of effects as significant or non-significant.

- To estimate the interaction effects of various treatments and to compare them.

- To establish the mathematical relationship between various treatments and their effects.

Problems in Experimentation

- **To single out one factor from the phenomena:** It is always difficult to single out one factor from a social phenomenon for the purpose of measurement, because in any event there may be many factors interacted.

- **Controlling the factors:** Control of factors sometimes is not possible, because some factors may be unknown and uncontrollable. It is better to select several random samples as experimental and control groups. One solution here is the adoption of the control group technique.

- **To get data from the control groups:** There are difficulties in getting data from the control groups. The remedy may be found in matching the control and experimental groups on as many points as possible.

- **To assign the level of significance:** The determination of the required level of significance of the differences between the experimental and control groups is also fraught with difficulty. What difference can be taken as significant? There is the problem of value judgment. But the scientific criterion is the determination of the statistical test of significance. However, this requires a reliable and valid socio-metric scale.

- **Change in response of people:** In field experiment related with human behaviors (society and clinical setup), when data collected through human interaction due to changes in time, situation, environment and types of questions to be asked people often change their responses.

- **Change in theme of trialing:** Due to change in behavior of the respondents and unsatisfactory management of the investigator, theme of trialing of the area under experiment (in social and clinical setup) may change at the end of the experiment from what it was started. Because of the changes made by experimentation may give different responses which may lead to wrong conclusion.

- **Problem of handling or operation:** In social setup and to the medical trials, if the people under study area is not aware, attentive and responsive about the inquiry, true response cannot be possible.

Steps in Experimental Methods

1. **Statement of the problem, research questions and the objectives:** The first step in the application of field techniques is related to mentioning of problem, research questions and specific objective. The hypothesis, at this stage, should be stated explicitly in general terms.

2. **Examination of possible outcomes and events through literature:** The second step consists in setting up the field experiment by thorough reading of the available literature. The factors to be controlled must be assessed, the cooperation between the researcher and the subject must be set up.

3. **Design of experiment:** The next step is the choice of experimental design regarding its size, material, control groups etc. The choice of material should be based on the criterion of maximum possible accuracy. The basic problem of design relates to control. Control and experimental groups should be matched on all important factors.

4. **Performing experiment:** The next step of this method is to perform the experiment in predefined circumstances. The principles of randomization, replication and blocking should be implemented as much as possible. The sensitiveness of experiments can be augmented by neutralizing the biases through random choice, by increasing the replication, improving the quantitative technique and by refinements of techniques.

5. **Analysis of experimental outcomes statistically:** The analysis of the experimental data should be done starting from stating the descriptive nature of the data, measuring relationship between them and modeling data into some mathematical models. The analysis of variance permits a study of complex interrelationship, which is not possible by simpler designs. It permits more reliable conclusions about more hypotheses with fewer cases than if hypotheses were tested in separate design.

6. **Drawing conclusions by measuring reliability:** For an experimental research the conclusions are drawn based on the statistical significance testing. The tests can be performed as required level of design

by the use of different statistical techniques. The results obtained then are put to test their reliability and the conclusions are made.

7. **Testing the validity of the conclusion:** The validity of the results should be measured before disseminating the results and reports. The validity of the experimental results is checked by comparing with other similar phenomenon or to the standards.

8. **Evaluation of the entire investigation through practice:** The success of the experimental study can be measured only through putting into practice the experiments many times. If the repeated experiments give similar or better results, then the experimental results may be considered satisfactory.

Ethical Issues in Experimental Research Design

The following practices are considered unethical:

- Putting pressure on individuals to participate in experiments through coercion, or applying social pressure.
- Deceiving subjects by deliberately misleading them as to the true purpose of the research.
- Exposing participants to physical or mental stress.
- Not allowing subjects to withdraw from the research when they want to.
- Using the research results to disadvantage the participants, or for purposes not to their liking.
- Not explaining the procedures to be followed in the experiment.
- Not debriefing participants fully and accurately after the experiment is over.
- Not preserving the privacy and confidentiality of the information given by the participants.

- Withholding benefits from control groups.

Research Guides

Research Guides are librarian-curated pathways to information, videos, databases, and other resources for your discipline. That is, they pull many different types of resources on a subject or topic together in one place.

Hand Book

A handbook is a compilation of miscellaneous information in a compact and handy form. It contains data, procedures, principles, etc. Tables, graphs, diagrams, and illustrations are provided. Scientists and technologists use handbooks in their fields.

A treatise on a special subject; often nowadays a simple but all-embracing treatment, containing concise information, and being small enough to be held in the hand; but strictly, a book written primarily for practitioners and saving for constant revision or reference. Also called a 'Manual'.

Examples:

- Britain, 1948/49-, an official handbook, London, Stationery Office, 1948-, Annual.
- Handbook of Chemistry and Physics: A ready reference book of chemistry and physical data, 52nd ed, Cleveland, Ohio, Chemical Rubber, 1971.

Citation

A "citation" is the way you tell your readers that certain material in your work came from another source. It also gives your readers the information necessary to find the location details of that source on the reference or Works Cited page. A citation must include a set of parentheses.

APA

APA is the style of documentation of sources used by the American Psychological Association. This form of writing research papers is used mainly in the social sciences, like psychology, anthropology, sociology, as well as education and other fields.

IEEE

The Institute for Electrical and Electronics Engineers (IEEE) is a professional organization supporting many branches of engineering, computer science, and information technology. In addition to publishing journals, magazines, and conference proceedings, IEEE also makes many standards for a wide variety of industries.

IEEE citation style includes in-text citations, numbered in square brackets, which refer to the full citation listed in the reference list at the end of the paper. The reference list is organized numerically, not alphabetically.

Citation Index

Citation indexes allow researchers to trace the impact of an article upon later publications. Besides including the bibliographic information about an article (author, article title, journal title, date, etc.), citation indexes also provide each article's references or bibliography (the list of sources cited).

SCIFinder

SciFinder is a database focused on the literature in chemistry. It is produced and published by CAS: Chemical Abstracts Service, a division of the American Chemical Society. CAS has, as its objective, "to find, collect and organize all publicly disclosed chemical substance information."

SCOPUS

Scopus Indexed Journals are considered better sources for citation as compared to other databases. Scopus publications enjoy a good reputation among peer researchers due to their rigid selection procedure that ensures high-quality content and reliable data. In addition, the journal database is recognized by scholars in research and academia.

ScienceDirect

ScienceDirect is a website which provides subscription-based access to a large database of scientific and medical research. It contains the world's largest electronic collection of full-text and bibliographic information on science, technology and medicine.

Impact Factor

In any given year, the two-year journal impact factor is the ratio between the number of citations received in that year for publications in that journal that were published in the two preceding years and the total number of "citable items" published in that journal during the two preceding years:

$$\mathbf{IF}_y = \frac{\text{Citations}_y}{\text{Publications}_{y-1} + \text{Publications}_{y-2}}$$

For example, Nature had an impact factor of 41.577 in 2017:

$$\text{IF}_{2017} = \frac{\text{Citations}_{2017}}{\text{Publications}_{2016} + \text{Publications}_{2015}} = \frac{74090}{880 + 902} = 41.577$$

H-Index

The h-index is defined as the maximum value of h such that the given author/journal has published at least h papers that have each been cited at least h times.