Research Methodology UE18CS400SG
Unit 1

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1 Meaning of Research

- Research (re – search, search – examine carefully and probe) is a careful and systematic study in some field of knowledge, undertaken to establish facts or principles.
- Organized and systematic way of finding answers to questions.
- A careful investigation or inquiry specially through search for new facts in any branch of knowledge.
- **Redman and Mory** – *"Systematized effort to gain new knowledge."*
- **Clifford Woody** –
  - Defining and redefining problems
  - Formulating hypothesis or suggested solutions
  - Collecting, organising and evaluating data
  - Making deductions and reaching conclusions
  - Carefully testing the conclusions to determine whether they fit the formulating hypothesis.
- **D. Slesinger and M. Stephenson in the Encyclopaedia of Social Sciences** – *"The manipulation of things, concepts or symbols for the purpose of generalising to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art."*

1.1 Objectives of Research

- To gain familiarity with a phenomenon or to achieve new insights into it
- To portray accurately the characteristics of a particular individual, situation or a group

- To determine the frequency with which something occurs or with which it is associated with something else
- To test a hypothesis of a causal relationship between variables

1.2 Motivation for Research

- Research Degree
- Challenge in solving unsolved problems
- Joy in doing creative work
- Service to society
- Respectability

1.3 Types of Research

1. **Descriptive vs Analytical**
   (a) Descriptive – description of state of affairs as it exists
   (b) Analytical – Use facts or information already available and analyze these to make a critical evaluation of the material
   (c) **Characteristic** – No control over variables, only report what has happened/happening
   (d) Methods involve comparative and correlation
2. **Applied vs Fundamental**
   (a) Applied Research – Focused on solving immediate problem facing a society or an industrial business organization aimed at conclusions (like health, pollution, environment, safety etc)
   (b) Fundamental – concerned with generalizations and with the formulation of a theory
3. **Quantitative vs Qualitative**
   (a) Quantitative – measurement of quantity, controlled, easy to carry out, objective, repeatable, easy to draw conclusions and decisions
   (b) Qualitative – qualitative phenomenon, discover underlying motives of behaviour, opinion research, difficult
4. **Conceptual vs Empirical**
   (a) Conceptual – related to abstract ideas or theory, used by philosophers and thinkers to develop new concepts/reinterpret existing ones

(b) Empirical – relies on experience or observation, data based and verified by experiments, **control over variables under study**, evidence through empirical studies is considered as the most powerful support for a hypothesis

5. **Other types** – one time, longitudinal, field, laboratory, simulation, clinical, diagnostic, historical etc

1.4 Research Method vs Methodology

- **Method** – technique or method adopted to conduct research - data collection, statistical methods to establish relationship between data and variables, evaluation methods for accuracy of results
- **Methodology** – Way in which research problem is solved systematically

1.5 Research Process

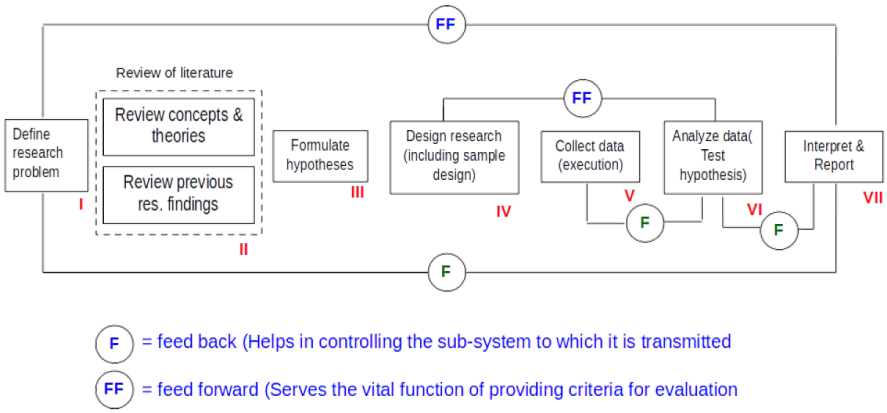

Figure 1: Research Process

1. **Formulating the research problem**
   (a) Understand research problem thoroughly
   (b) Rephrase in meaningful terms
2. **Extensive literature survey** – abstracting and indexing journals, conference proceedings, reports, books, internet for earlier studies on topic
3. **Developing the hypothesis**
   (a) **Working Hypothesis** – temporary assumption made to draw out and test logical consequences

(b) Affect manner of conducting tests

(c) Process – discussion with colleagues, examination of data and records, review similar studies, exploratory personal investigation like field interviews

4. **Preparing the research design** – concerns with how to obtain information, availability and skills of researcher and staff, time and cost factor (financial) for research

5. **Determining sample design** – simple random, systematic, stratified, quota, cluster, sequential etc

6. **Collecting the data** – observation, surveys, personal/telephonic interviews, questionnaires

7. **Execution of the project**

8. **Analysis of data** – coding, tabulation, statistical tests and measures

9. **Hypothesis Testing**

   (a) **Hypothesis** is a proposed explanation for a phenomenon. A hypothesis is scientific if it can be tested. Scientific hypothesis are based on previous observations that cannot be explained with available theories.

   (b) Choose appropriate test like chi-square test, t-test, f-test etc based on nature of research and accept or reject hypothesis

10. **Generalizations and Interpretation** – arrive at certain generalization and interpret and explain findings based on some theory

11. **Preparation of the report or Presentation of the results, i.e., formal write-up of conclusions reached**

    (a) Concise report with clear charts and illustrations

    (b) Introduction, summary of findings, main report, conclusion

1.6 Criteria for Good Research

- Purpose should be clearly defined
- Procedure used should be described in sufficient detail
- Design of research should be carefully planned to yield result as objective
- Report – complete frankness, flaws in procedural design
- Analysis should be sufficiently adequate, method of analysis should be appropriate
- Conclusion should be confined to those justified by data of research

1.7 Properties of Good Research

- **Systematic** – structured with specific steps in sequence
- **Logical** – guided by by rules of logical reasoning, logical procedure for induction and deduction
- **Empirical** – related to one or more aspects of a real situation, deals with data
- **Replicable** – results can be verified by replicating study, builds on sound basis of decision

2 Literature Review

- A broad, comprehensive, in-depth, systematic, and critical review of scholarly publications
- Surveys, summarizes and links together research in a given field
- Laborious but essential (may constitute entire project itself)
- Critical and effective evaluation of available literature on research topic – overview of problem under study
- Leads logically to the research question

2.1 Introduction to Literature Review

2.1.1 Importance of Review of Literature

- Identification, development, refinement of requirements
- Identification of gaps/inconsistencies
- Strength and weaknesses of designs/methods/instruments used in research work
- Development of plan – research methodology
- Development of Research Hypothesis

2.1.2 Purpose of Review of Literature

- Overview and guide to a topic
- Provides solid background for investigation
- Updated with current developments in research field
- Critical look at literature

- Demonstrates relevance of research
- Determines
  - Research Design, method of study – instruments, data collection and analysis
  - Knowns and unknowns
  - Inconsistencies and consistencies
  - Strengths and weaknesses
  - Unanswered questions
  - Refinement of problem, hypothesis and justifications

2.1.3 Functions of Review of Literature

Background information, establish importance, familiarity and make space for future research

2.1.4 Goal of Review of Literature

- Demonstrate mastery over a subject
- Locate area of current research in present literature

2.1.5 Sources of Review of Literature

- **Primary** – written by person(s) who developed theory or conducted research
- **Secondary** – written by person(s) except those who developed theory or conducted research. Used when primary source is unavailable or to look at the problem from different angles

Databases, journals, research reports, books, conference papers, encyclopedias, dictionaries, magazines, newspapers are sources

2.1.6 What to look for in a Review of Literature

- Clearly defined problem
- Goodness of design
- Validity of results
- Flaws in logic
- Ignored problems

2.2 Writing Literature Review

1. Organize Studies
   (a) Chronological – publication date, trend
   (b) Thematic – based on themes
   (c) Methodological – example, qualitative vs quantitative
2. List down
   (a) Facts
   (b) Opinions
   (c) Variables and their relationship with concepts
   (d) Shortcomings and limitations in existing methods
   (e) Relevance of research
   (f) Suggestions for future work
3. Start with introduction, then discussion of sources followed by conclusion with summary of findings relevant to current study
4. After writing, read for coherence and check for errors in logic

2.2.1 Stages of Writing

- Problem formulation – field under study, issues
- Literature search – finding materials
- Data evaluation – determine which literature is a significant contribution
- Analysis and interpretation

2.2.2 Critiquing Criteria for reading Review of Literature

- Uncover gaps and inconsistencies
- Ensure relevancy of concepts and variables
- Reveal relevant components of study, design, strengths, weaknesses, conflicts
- Include concepts, data in present literature
- Include summary
- Follow a logical sequence and signify direction of research (justification of problem and leading up to hypothesis)

2.2.3 Points to Ensure while writing Review of Literature

- Specific and succinct – no details or in-depth analysis
- Selective – important points only
- Focus on current work
- Ensure reliability of sources of evidence
- Reference citations to literature in bibliography

2.2.4 Properties of a good Review of Literature

- Focused – narrow topic
- Concise but developed (don't leave out details)
- Logical sequence of ideas
- Integrative – similarities/difference among literature, how it contributed to topic
- Current – focus on latest work

3 Research Problem

"Research Problem, in general, refers to some difficulty which a researcher experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the same"

- A specific issue, difficulty, contradiction, or gap in knowledge that one must aim to address in their research
- Points to the need for meaningful understanding and systematic investigation

If I is the individual, N is the environment defined by Y_j uncontrolled variables, C is a course of action and O is an outcome, then a research problem exists if,

$$P(O_1|I, C_1, N) \neq P(O_1|I, C_2, N) \tag{1}$$

Different choices must have unequal probabilities for desired outcomes.

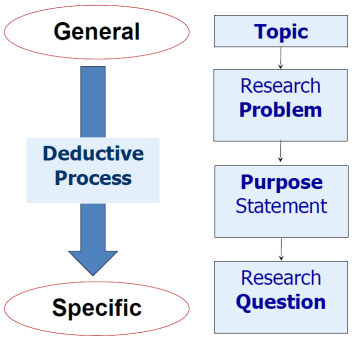

Figure 2: Refinement of Research Topic to Research Process

3.1 Elements of Problem Statement

- Topic – subject area
- Issue – concern/problem needing solution
- Evidence of issue – literature/experience
- Deficiencies in evidence – what do we need to know more
- Remedy of deficiencies – how the solution helps people

3.2 Sources of Research Problems

Experience, existing research and theories, social issues, brainstorming, intuitions, exposure to field situations and consultation with experts

3.3 Selecting a Research Problem

- Subject is not overdone
- Avoid controversial subjects and vague problems
- Subject is familiar and feasible
- Must be preceded by preliminary study

3.4 Defining a Research Problem

"A clearly defined research problem is half solved"

Task of defining a research problem is sequential – state problem, resolve ambiguities, more specific formulation to make it realistic and meaningful

1. State the problem in a general way

2. Understand nature of problem
3. Survey literature
4. Develop ideas through discussion
5. Rephrase research problem
6. Clearly define terms and phrases
7. State basic assumptions and postulates
8. State criteria for selection of problem
9. State suitability of time period and data sources
10. State scope of investigation

3.5 Properties of a well defined Research Problem

- Meaningful
- Paves way for development of working hypothesis
- Helps solve the problem