Research Methodology

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In this lecture

- Define what is a research problem;
- Identify five factors to consider in selecting research problems;
- List the steps involved in formulating a research problem; and
- Describe sub-problems and their characteristics

Defining a Research Problem

"In research process, the first and foremost step happens to be that of selecting and properly defining a research problem. A researcher must find the problem and formulate it so that it becomes susceptible to research. Like a medical doctor, a researcher must examine all the symptoms concerning a problem before he can diagnose correctly. To define a problem correctly, a researcher must know: what a problem is?"

Definition

A 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.

The Importance of Formulating a Research Problem

- The formulation of a research problem is the first and most important step of the research process.
- Is like identifying a destination prior to beginning a journey.
- A research problem is like the foundation of a building. The type and architecture of the building depends on the foundations.
  - If the foundation is well designed and strong, you can expect the building to be strong as well.
- You must have a clear idea with regard to what it is that you want to find out but not what you think you must find.

In IoT, with new emerging technologies, many research problems may be churned from issues in performance, reliability and daily user applications.

Finding Research Projects

- The heart of every research project is the problem. To see the problem with unwavering clarity and to state it in precise and unmistakable terms is the first requirement in the research process.
- The research problem should address an important question, such that the answer can actually **make a difference** in some way.
- The research problem should **advance** the frontiers of knowledge, perhaps by leading to new ways of thinking, suggesting possible applications, or paving the way for further research in the field.

Guidelines for Finding a Legitimate Problem

- Find topics that might make important contributions to the field
- Look around you
- Read the literature
- Attend professional conferences
- Seek the advice of experts
- Choose a topic that intrigues and motivates you
- Choose a topic that others will find interesting and worthy of attention

Stating the Research Problem

- After identifying a research problem, you must articulate it in such a way that it is carefully phrased and represents the single goal of the total research effort
- State the problem clearly and completely. Your problem should be so **clearly stated** that anyone can read and understand it
- Think through the feasibility of the project that the problem implies
- Say precisely what you mean. The basic rule is that **absolute honesty and integrity are assumed in every statement a scholar makes**

Stating the Research Problem

- Edit your work
  - Editing is sharpening a thought to a gemlike point and eliminating useless verbiage
  - Choose words precisely
  - Doing so will clarify your writing and improve your thinking and prose
- Review your statement of the research problem
  - Is the problem stated in a complete, grammatical sentence?
  - Is it clear how the area of study will be limited or focused?
- On the basis of your answers to questions above, edit and revise your written statement.

Stating the Research Problem

- Review again your edited/revised statement.
- Does the answer to this problem have the potential for providing important and useful answers and information?
- Will the result be more than a simple exercise in gathering information, answering a yes/no question, or making a simple comparison?
- Is the problem focused enough to be accomplished with a reasonable expenditure of time, money, and effort?
- Is the problem worth investigating?

Sub problems: Main Characteristics

- Each sub problem should be a completely researchable unit
  - Should be stated in the form of a question
- Each sub problem must be clearly tied to the interpretation of the data
- The sub problems must add up to the totality of the problem
- Sub problems should be small in number
  - Ask further questions such as whether they are necessary, can be combined, etc.

> To derive at sub problems you can write potential sub problems or use brainstorming

Stating the Hypotheses

- Hypotheses are tentative propositions set forth to assist in guiding the investigation of a problem or to provide possible explanations for the observations made.
- Data from research may or may not support the hypothesis.
- Hypotheses have nothing to do with proof. Rather, their acceptance or rejection is dependent on what the data – and the data alone– reveal.
  - If you discover that your data do not support your research hypothesis, it means that your educated guess about the outcome of the investigation was incorrect.

Null Hypothesis vs. Research Hypothesis

- The scientific or research hypothesis represents the predicted relationship among the variables being investigated.
- The null hypothesis represents a statement of no relationships among the variables being investigated

Delimitations in Research & Defining Terms

- What the researcher is not going to do is stated in the delimitations.
- The limits of the problem should be as carefully bounded for a research effort as a parcel of land is for a real estate transfer.
- Each term must be defined operationally; that is, the definition must interpret the term as it is used in relation to the researcher's project.
- A formal definition contains three parts:
    i) the term to be defined;
    ii) the general class to which the concept being defined belongs; and
    iii) the specific characteristics or traits that distinguish the concept being defined from all other members of the general classification.

Stating Research Problem

The task of defining a research problem, very often, follows a **sequential pattern**—the problem is stated in a general way, the ambiguities are resolved, **thinking and rethinking** process results in a more specific formulation of the problem so that it may be a **realistic** one in terms of the available data and resources and is also analytically meaningful. All this results in a well defined research problem that is not only meaningful from an operational point of view, but is equally capable of paving the way for the development of working hypotheses and for means of solving the problem itself.

The End