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Research Methodology in Computer Science (AI800)

Lecture 4

Research Problem and objective Formulation



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Outlines

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Learning Outcomes

- To understand the importance of research problem formulation and objective formulation in conducting research.
- To identify and define a clear research problem, as well as develop specific and measurable research objectives.
- To align their research objectives with their research problem, ensuring that their study is focused and purposeful.



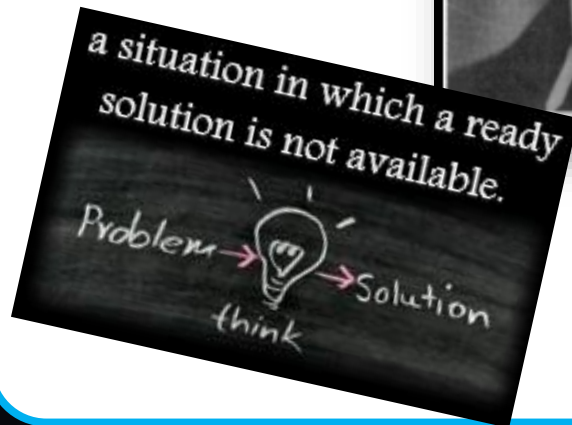
What is Research Problem ?



Research Problem

“ a situation for which we have no ready and successful response by previously acquired habit ”

R.S.Woodworth





What is Research Problem ? (cont.)

Sometimes it's the journey
that teaches you a lot
about your destination.

Problem defines:

- How will you act, and what will you do?
- Will it stand up to a scientific investigation ?
- How you'll carry it out ?
- What might you accomplish ?





What is Research Problem ? (cont.)

The word "problem" is derived from the Greek word "proballein," which means "concern."

- A **research problem** refers to a specific **issue** or **question** that needs to be **investigated** or **explored** through a systematic and scientific **approach**.
- A **research problem** serves as the **foundation** of any research study and guides the researcher in **formulating objectives**, **designing methods**, and **analyzing data** to find meaningful **answers** or **solutions**.
- Identifying a clear and well-defined research problem is crucial for ensuring the relevance, validity, and significance of the study.



Types of Research Problems

- Descriptive Research Problem
- Relational Research Problem
- Comparative Research Problem



Descriptive Research Problems

- *Descriptive Research Problem* refers to the *investigation* of topic with the aim of *providing* a detailed and accurate *description*.
- *Descriptive research problems* are those that ask, “*What is*.....?” to describe the *situation*, *state*, or *presence* of a given phenomenon.
- *Descriptive Research Problem* involves *gathering data* and *analyzing it* to understand the *characteristics*, *behaviors*, or *relationships* within a specific population or sample.
- This type of research is particularly useful when there is *limited existing knowledge* on the subject and when researchers *aim to establish a foundation* for further studies or explore new areas of inquiry.



Relational Research Problems

- *Relational Research Problem* refers to the **identification** and **examination** of the *connections, associations, or correlations* between **variables** or **factors**.
- *Relational Research Problem* seeks to understand how different variables **interact** and **influence** each other, allowing researchers to *explore causal relationships* or *patterns within a specific context*.
- According to this research challenge, **a link** between **two variables** must be studied. The goal is to look at *qualities* or *characteristics* that are linked together in some way.
- This type of research is valuable in fields such as **psychology** and **economics**, as it helps in understanding the *complex dynamics* and *interdependencies* among various elements of a system or phenomenon.



Comparative Research Problems

- *Comparative Research Problem* involves *comparing* two or more *variables*, *factors*, or *phenomena* across different contexts or groups.
- *Comparative Research Problem* aims to *identify similarities* and *differences* between these *variables*, *providing insights* into the underlying *mechanisms* or *processes* that may contribute to these variations.
- This type of research allows researchers to *gain a deeper understanding* of the *factors* that influence outcomes in different settings and can *inform policy decisions* or *interventions* that are tailored to specific contexts.



Research Problem Justifications

Research problems should have, in general, theoretical, conceptual, and contextual justifications.

- *Theoretical justifications* involve establishing a strong foundation in *existing literature* and *theories* that support the need for the research.
- *Conceptual justifications* focus on *identifying gaps* or *limitations* in current knowledge.
- *Contextual justifications* consider the *relevance* and *significance* of the research within a specific social, cultural, or practical context, highlighting its potential impact or benefits.
- These three types of justifications collectively provide a *comprehensive rationale* for conducting the research and help ensure its validity and value.



Research Problem Selection

- Identifying the *gap* in *existing knowledge* : The user can explore how researchers select a research problem by *identifying* areas where there is *a lack of understanding* or *unresolved questions* within their field of *interest*.
- *Importance* and *relevance*: The user could discuss the criteria researchers use to *determine* the significance of a research problem, such as its *potential impact* on *society*, *scientific advancement*, or *practical applications*.
- *Feasibility assessment*: Writing about how researchers evaluate the feasibility of a research problem would involve discussing factors like *available resources*, *time constraints*, and *technical limitations*.



Research Problem Sources

➤ *Existing literature:*

- ❑ One source of research problem can be the *identification of gaps* or unanswered questions in the existing body of literature.
- ❑ Reviewing previous *studies* and *identifying areas* that have not been explored or require further investigation can help in formulating a research problem such as:
 1. *Published works*
 2. *Record of previous research.*
 3. *Research abstracts, Research Bulletins, Research reports and Dissertation abstracts.*
 4. *Conference proceedings and papers presented in technical sessions.*



Research Problem Sources (cont..)

- Practical *observations* or *experiences*:
 - ❑ Another source of research problem can arise from *practical observations* or *experiences* in a particular field or industry.
 - ❑ Discussion with *learned person*.
 - ❑ *Identifying issues, challenges, or trends* through firsthand experience can lead to the *formulation* of a research problem that aims to solve.



Criteria For Research Problem Statements

- The *problem statement* should be *clear* and *concise*.
- Furthermore, it is crucial for the *problem statement* to be *feasible* and *achievable* within the *available resources* and *time constraints*.
- The *problem statement* should be *specific* and *focused*, *narrowing down* the *scope* of the research
- *Importance*: It should be significant enough and involves an important principle or practice.



Criteria For Research Problem Statements (Cont.)

- **Interest:** The problem should be interesting for the investigator himself. If he/she is not interested in it, he /she will not be able to take and overcome the obstacle which comes at every step of research.
- **Empirical verification:** The problem should allow for the potential of empirical testing.
- **Availability of Guidance:** Every research activity needs the support of guide and approval of a competence authority.



- *Experience and creativity*: Good research problem stem form a clear understanding of the theoretical empirical and practical aspects of the subject derived from personal experience and from a thorough review of the literature.
- *Level of Research*: The nature and scope of a study will be determined.



Steps for formulating research problem with examples

1. Identify the Problem Domain:

Define the area or domain within computer science where the problem exists.

Example: "In the field of natural language processing (NLP), there is a need to improve the accuracy of sentiment analysis in social media data."

2. Describe the Problem:

Clearly state the problem you want to address, specifying what makes it a challenge.

Example: "The challenge is that existing sentiment analysis algorithms often struggle to accurately interpret informal language and sarcasm found in social media posts." capture the nuances of sentiment in social media conversations."



Steps for formulating research problem with examples (cont.)

3. Highlight the Significance:

Explain why solving this problem is important and what potential impact it may have.

Example: "Accurate sentiment analysis is crucial for businesses to gauge customer opinions and make informed decisions regarding their products and services."

4. Mention Existing Solutions:

Briefly touch on existing approaches or technologies and their limitations.

Example: "Current sentiment analysis models often rely on basic keyword matching and do not effectively capture the nuances of sentiment in social media conversations."



Steps for formulating research problem with examples (cont.)

5. Justify the Need for Research:

Explain why this problem requires further investigation and how it contributes to the field.

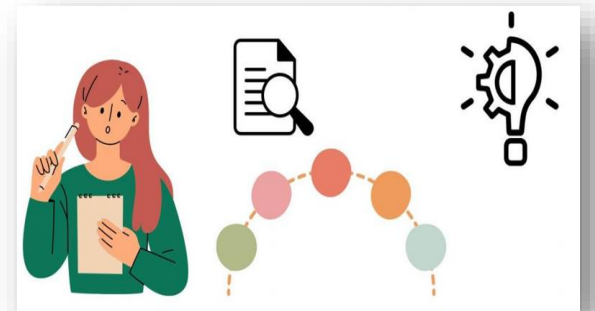
Example: "The limitations of current sentiment analysis models hinder businesses' ability to make data-driven decisions based on social media feedback. Therefore, there is a clear need for improved sentiment analysis techniques."



Bottom line !

A well-defined research problem would allow for a well-defined and cost-effective strategy.

- A well-defined research problem helps you optimize the use of resources like time, funding, and manpower. This ensures that you make the most of what's available and achieve your research goals efficiently.
- Additionally, enables you to focus your research efforts efficiently without wasting time and resources on irrelevant or vague objectives.





Research objectives

- The *research objective* is a *clear statement* of what the researcher or researchers hope to *accomplish* through the research.
- The *research objective outlines* the *specific goals* and outcomes that the *study aims* to *achieve*.
- The *research objective* helps in *providing focus* and *direction* to the research *process, ensuring* that all efforts are aligned towards achieving the desired results.
- The *research objective* helps in *evaluating* the *success* and *relevance* of the study by comparing the *achieved outcomes* with the initially *stated objectives*.



Research objectives (cont.)

good research needs to be both relevant AND methodologically sound!

- The *research objectives* should be broken down into:
 - ❑ *General objective*: outlines the overall aim of the research.
 - ❑ *Specific objectives*: define the specific outcomes or questions to be addressed.
 - ❑ *Operational objectives*: outline the practical steps or methods to achieve the research goals.

- *Research objectives* can also be categorized as:
 - ❑ *Exploratory objectives*: aim to generate new insights or hypotheses
 - ❑ *Confirmatory objectives*: aim to test existing theories or hypotheses.



Characteristics of research objectives

- The *clarity* and *specificity* of research objectives:
 - ❑ Discuss the importance of clearly defining research objectives in order to guide the entire research process effectively.
- *Alignment* with the overall research *question*:
 - ❑ Explore how research objectives should be closely linked to the central research question, ensuring that they contribute towards answering it accurately and comprehensively.
- *Measurability* and *achievability* of research objectives:
 - ❑ Explain how well-designed research objectives should be measurable, allowing researchers to assess their progress and success throughout the study.



Characteristics of research objectives (cont.)

- *Practical implications* of research objectives:
 - ❑ Explore the significance of practicality in shaping impactful research objectives.
- *Importance of setting realistic* research objectives:
 - ❑ Explain the significance of setting objectives that are achievable within the given resources, time frame, and constraints to ensure successful completion of the research project.
- *Factors* to consider in determining *feasibility*:
 - ❑ Discuss the various factors researchers should consider while evaluating the feasibility of their objectives, such as availability of data, expertise required, ethical considerations, and financial implications.
- *Methods for evaluating* research objectives:
 - ❑ Explore various approaches or frameworks that can be used to assess the achievement of research objectives.



Formulate objectives

Start with words like:

- *Identify* the key factors influencing consumer buying behavior in the digital age and their impact on marketing strategies.
- *Describe* the role of social media in shaping political opinions and assess its effectiveness as a tool for political mobilization.
- *Estimate* the economic cost of climate change by analyzing various sectors impacted, such as agriculture, health, and infrastructure.
- *Determine* the relationship between employee satisfaction and productivity levels within an organization using quantitative research methods.
- *Develop* a comprehensive framework to compare different renewable energy sources.



Formulate objectives (cont.)

Start with words like:

- *Compare* the research objectives of different studies conducted on the same topic to identify commonalities and differences in their approaches.
- *Analyze* how the research objectives have evolved over time by examining studies conducted at different periods, highlighting any shifts in focus or emerging trends.
- *Collect* data from various sources to evaluate whether the stated research objectives were effectively achieved and if they provided valuable insights into the subject matter.
- *Evaluate* how well-established theories or frameworks have been utilized as a basis for defining research



Formulate objectives: Example

- To collect social media content for analysis, accounting for informal language and sarcasm.
- To propose and design a robust model capable of accurately interpreting sentiment in social media posts, considering informal language and sarcasm.
- To evaluate model's accuracy, precision, and recall, and refine it to improve its interpretive capabilities.
- To compare the model's performance with other sentiment analysis methods to assess its effectiveness.



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Thank You

