Research Methodology in CSE, MTech-I (1st semester)

Chapter 1-3: Steps in Research Process & Research Skills

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Chapter 1: Topics of Study

- Introduction [DCJ]
  - What Is Research? Definition, Characteristics, Motivation and Objectives, Research Methods vs Methodology. Research as an integral part of professional practice. A way to gather evidence for practice. Evidence-based practice. Applications of research in practice. Development and policy formulation. [3 hours]
  - Overview of the research process: its characteristics and requirements. Types of research: Descriptive vs Analytical, Applied vs Fundamental. Research Designs: Quantitative vs Qualitative vs Mixed Methods Designs. Conceptual vs Empirical. [2 hours]
- Research Process & Methodology [DCJ]
  - The research process as an eight step model. Deciding what to research. Planning how to conduct the study. Conducting the research study. [1 hour]
  - Overview of Research Skills *would be covered in the next chapter on Problem Solving Skills* [1 hour]

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Research Process

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- here, a model that is generic in nature and can be applied to a number of disciplines in the social sciences - is proposed.
- it is based upon a practical and step-by-step approach to research enquiry that at each step provides a smorgasbord of methods, models and procedures to choose from.

Research process as an eight step model

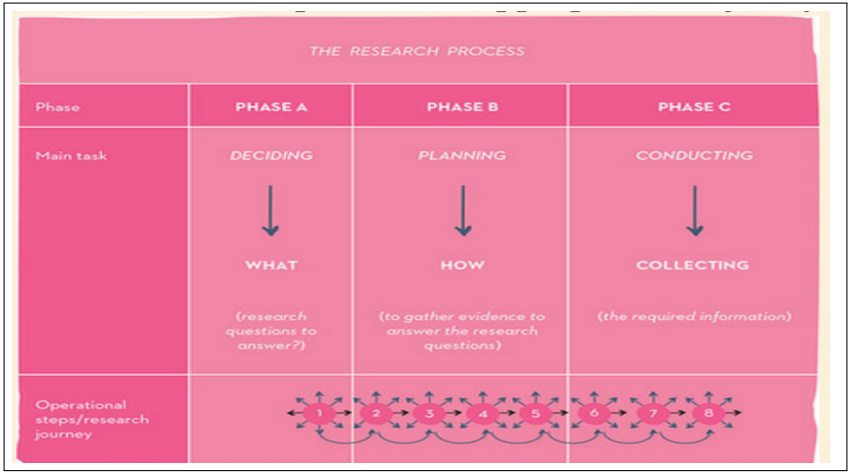

Figure: The research journey: methods and procedures appropriate for the journey

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The research process: An eight step model ...

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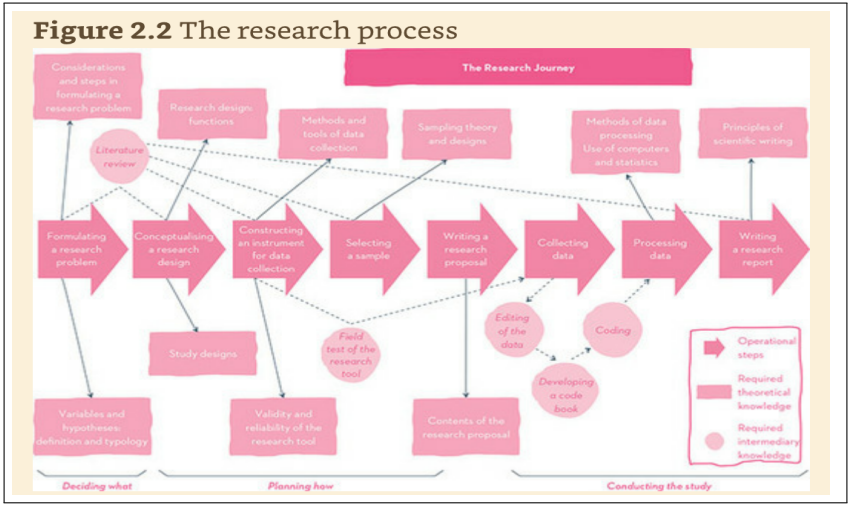

Figure: Eight steps in the research process [Src: Kumar, Ranjit.]

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- This same setting is described formally in the following.....

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  - that is, we can say that the choices must have unequal efficiencies for the desired outcomes.

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  - this means that research must answer the question concerning the relative efficiency of the possible alternatives.
- there must be some environment(s) to which the difficulty pertains.

Revisited : The research process: Deciding what to research...

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- Defining the research problem consists of the following tasks to be done, that have to be studied.
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  2. Controversial topics should not become the choice of an average researcher.

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- The task is a difficult one.
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- Thus, a research supervisor can at the most only help a researcher choose a subject.
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  7. The selection of a problem must be preceded by a preliminary study. Especially important if the the field of inquiry is relatively new and does not have available a set of well developed techniques.

Revisited : The research process: Deciding what to research...

- Deciding what to research is part of *Defining the research problem*
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- Only when the answers to the questions above are known the research problem has been well defined and justified.
- Thus, defining a research problem properly is a prerequisite for any study and is a step of the highest importance.

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- A Tutorial: What could be the refined or narrowed down version of the above research problems?

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  - Avoid weak phrases such as *as a minimum*, *be able to*, *capable of*, and *not limited to*. These phrases are subject to different interpretations and also set the stage for future changes to the requirements

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- All available literature concerning the problem at hand must necessarily be surveyed, chrunedm digested and examined before a definition of the research problem is given.

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- Write a paper critiquing the existing solutions, present at the conferences.

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- a straight forward statement of the value of the investigation (i.e., the criteria for the selection of the problem) should be provided.

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- the suitability of the time-period and the sources of data available must also be considered by the researcher in defining the problem.

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- the appropriate models must be clearly articulated e.g. the adversary model, the systems model - that help delimit the scope of the research problem

Chapter 1: Topics of Study

- Introduction [DCJ]
  - What Is Research? Definition, Characteristics, Motivation and Objectives, Research Methods vs Methodology. Research as an integral part of professional practice. A way to gather evidence for practice. Evidence-based practice. Applications of research in practice. Development and policy formulation. [3 hours]
  - Overview of the research process: its characteristics and requirements. Types of research: Descriptive vs Analytical, Applied vs Fundamental. Research Designs: Quantitative vs Qualitative vs Mixed Methods Designs. Conceptual vs Empirical. [2 hours]
- Research Process & Methodology [DCJ]
  - The research process as an eight step model. Deciding what to research. Planning how to conduct the study. Conducting the research study. [1 hour]
  - Overview of Research Skills *would be covered in the next chapter on Problem Solving Skills* [1 hour]

Overview of Research skills

- Thinking

- Thinking
  - Knowing

- Thinking
  - Knowing
  - Comprehension

- Thinking
  - Knowing
  - Comprehension
  - Problem Solving

- Thinking
  - Knowing
  - Comprehension
  - Problem Solving
  - Critical Thinking

- Thinking
  - Knowing
  - Comprehension
  - Problem Solving
  - Critical Thinking
  - Creative Thinking

- Thinking
  - Knowing
  - Comprehension
  - Problem Solving
  - Critical Thinking
  - Creative Thinking
- Problem finding

- Thinking
  - Knowing
  - Comprehension
  - Problem Solving
  - Critical Thinking
  - Creative Thinking
- Problem finding
  - Literature Review and Search

- Thinking
  - Knowing
  - Comprehension
  - Problem Solving
  - Critical Thinking
  - Creative Thinking
- Problem finding
  - Literature Review and Search
- Technical Communication

- Thinking
  - Knowing
  - Comprehension
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  - Critical Thinking
  - Creative Thinking
- Problem finding
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- Technical Communication
  - Oral

- Thinking
  - Knowing
  - Comprehension
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  - Critical Thinking
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- Technical Communication
  - Oral
  - Written

- Thinking
  - Knowing
  - Comprehension
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  - Critical Thinking
  - Creative Thinking
- Problem finding
  - Literature Review and Search
- Technical Communication
  - Oral
  - Written
  - Publishing/Patents

- Thinking
  - Knowing
  - Comprehension
  - Problem Solving
  - Critical Thinking
  - Creative Thinking
- Problem finding
  - Literature Review and Search
- Technical Communication
  - Oral
  - Written
  - Publishing/Patents
- Experimentation and Modeling

- Thinking
  - Knowing
  - Comprehension
  - Problem Solving
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  - Creative Thinking
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- Time & Stress Management

- Thinking
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- Time & Stress Management
- Professional Ethics

Reading Material and Discussions on Research

This article is to be read and digested by the students. There would be discussions/Q&A on this article in one of the lectures in the class.

- You and Your Research By Richard W Hamming, Bell Communications Research Colloquium Seminar.
  `https://www.cs.virginia.edu/~robins/YouAndYourResearch.html`

Degrees and Research

- Bachelors: General Education: Finding answers to the known questions
- Masters: Pursuit of Advanced knowledge
- Doctorate:
  - an objective and systematic effort to gain new knowledge based on research
  - trying to find answers to those questions that have not yet been formulated; so formulate them, prove their worth and then find answers; prove the uniqueness, usefulness to the society/community in general.

Degrees and Research...

- Bachelors vs Doctorate/Research
- Doctorate:
  - well-defined problems vs unknown problems
  - learning managed by teachers vs that self-managed
  - directed learning vs independent thinking
  - blurred distinction between the researcher and the supervisor

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  - answer is useful and unknown
  - for which the question may not be known or articulated before the research/answer

Next Chapter : Approaches for Problem Solving

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