COMP 7036
Applied Research Methods in Software Development

Borna Noureddin, Ph.D.
British Columbia Institute of Technology

Defining the problem

Overview

- Finding and defining problems
- Breaking down the problem
- Hypothesis and research questions
- Defining the terms
- Stating the assumptions
- Writing the proposal - tips
- Starting the literature review

Finding & defining the problem

Basic research

- Enhance basic knowledge about physical, biological, psychological or social world
- Shed light on historical, cultural or aesthetic phenomena

Finding & defining the problem

Applied research

- Address issues with immediate relevance to current practices, procedures or policies
- Make decisions about practical problems
- Address questions in one's immediate work environment (action research)

Finding & defining the problem

Criteria:

1. Address important question
   - answer will make a difference
2. Advance frontiers of knowledge
   - lead to new ways of thinking
   - suggest possible applications
   - pave way for further research

Finding & defining the problem

Things to avoid:

- projects that are ruse for achieving self-enlightenment
- problem whose sole purpose is to compare two sets of data
- calculating correlation coefficient between two sets of data to show relationship between them
- problems that result in yes/no answer

Finding & defining the problem

Ways to find legitimate problem:

- Look around you
- Read the literature
- Attend professional conferences
- Seek advice of experts
- Choose topic that intrigues and motivates you
- Choose topic that others will find interesting and worthy of attention

Finding & defining the problem

Stating the problem:

- State problem clearly and completely
- Think through feasibility of project that problem implies
- Say precisely what you mean

  Absolute honesty and integrity are the rule!

- State problem so it reflects an open mind about its solution
- Edit your work

Subproblems

- **Subproblem:**
  - subparts of main problem
  - integral part of main problem
- **Pseudo-subproblems:**
  - procedural issues
  - involve decisions that must be made before resolving problem and subproblems

Subproblems

- Completely researchable unit
- Clearly tied to interpretation of data
- Add up to totality of problem
- Small in number

Define Terms

- Must precisely define terms in problem and subproblems
- Define each term as it will be used in project
- Make term mean whatever you wish it to mean within context of problem and its subproblems

State Assumptions

- Assumptions are basic to research problem
- All assumptions with material bearing on problem should be openly and unreservedly set forth
- Statement of assumptions necessary for others to evaluate conclusions
- Reveals what researcher may be taking for granted with respect to problem

Hypothesis & research question

- Hypotheses essential to experimental research
- Research questions more common in qualitative research
- Both provide guidance for data to be collected
- Both suggest how data should be analyzed and interpreted

Hypothesis & research question

- Both may originate in subproblems
- Provide position from which researcher may initiate exploration of problem
- Act as checkpoints against which to test findings that data reveal

Hypothesis & research question

Delimit research:

- What you are *not* going to do
- Avoid data extraneous to research problem
- Stick with what is relevant to research problem

Writing a Proposal: Overview

1. State the subproblems
2. Write the hypotheses/questions
3. Write the delimitations
4. Write the definitions of terms
5. Write the assumptions
6. Describe the importance of the study
7. Type the proposal

Writing a Proposal

- Have you conducted thorough literature search to justify time and effort expended on your research project?
- Have you looked at your research problem from all angles to minimize unwanted surprises?
- What research procedures will you follow?
- What research tools are available?
- Can others read/understand the proposal?

Fine-tuning Research Problem

- Conduct a thorough literature review
- Try to see the problem from all sides
- Think through the process
- Use all available tools and resources
- Discuss your research problem with others
- Hold up your proposed project for others to examine and critique
- Remember that your project will take a great deal of time

Literature Review – why?

- Offer new ideas, perspectives, approaches that may not have occurred to you
- Inform you about other researchers who conduct work in same area
- Show you how others have handled methodology/design in similar studies
- Reveal sources of data you may not have known existed

Literature Review – why?

- Introduce you to measurement tools other researchers have developed/used
- Reveal methods of dealing with similar problem situations
- Help you interpret findings and tie results to work of those who have preceded you
- Bolster confidence that topic is one worth studying
  - others have invested considerable time, effort, resources in studying it

Literature Review – why?

In short: the more you know about investigations and perspectives related to your topic, the more effectively you can tackle your own research problem

Literature Review

- Sources:
  - Indexes (keywords)
  - Patent office /govt websites
  - Web (Google scholar)
  - References from previous papers
- Searching
  - Write problem and subproblem statements
  - Identify important words/phrases
  - Translate words/phrases into specific topics to learn about

Literature Review

Doing the search

- Have paper/pencil or database ready
- Track down sources and read them
- Record everything!

Literature Review

- Never take other people's conclusions at face value
- Determine for yourself whether conclusions are justified based on data presented
- Organize ideas encountered during review
- Synthesize:
  - Compare/contrast varying theoretical positions
  - Show how approaches have changed over time
  - Describe general trends in research findings
  - Identify/explain discrepant or contradictory findings
  - Identify general themes that run throughout the literature

Literature Review

- Emphasize relatedness (i.e., how the literature is related to the problem)
- Give credit where credit is due; use appropriate citations
- Review literature, do not reproduce it
- Summarize what you havesaid
- Remember that your first draft will not be your last draft
- Ask others for advice and feedback

Summary

- Finding and defining problems
- Breaking down the problem
- Hypothesis and research questions
- Defining the terms
- Stating the assumptions
- Writing the proposal - tips
- Starting the literature review