

Research Methods

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Course Modules

- Module 1: Formulating a research question
 - Outcome: Understanding of how to construct and evaluate a research questions
- Module 2: Literature Review
 - Outcome: Understand of what constitutes a good literature review and why research project needs one.
- Module 3: Planning and Managing research
 - Outcome: Awareness of the skills required to enhance one's research
- Module 4: Producing a research proposal
 - Outcome: A plan of action of complete the research

Course Modules

- Editing softwares
 - LaTeX
 - WinEdt
- Download and install these software for later use. You can use other editors of your choice, but I will use these for classroom demonstrations.

What is research

- It is about adding a very small but original contribution to the body of knowledge.
 - It may start with a question and possibly ends with a question
 - It must be systematic as it could possibly be
 - Try to find out something beyond the data itself.
 - Sometimes there's a need to rethought an answer in the context of trends that change or contemporary events or processes.

What is research cont.

- A systematic inquiry that helps to make sense of the world. That tends to make sensible the debates and interpretations that we have of issues of contemporary significance.

Suggestions by the domain experts

- It must be a balance between what's achievable and the contribution it is going to make
- It must have a finite end at some point. (realize this at the beginning)
- Want to be good at research? Try to be a good:
 - Reader -> Thinker -> Writer

What is a research question

- It must have 3 attributes:
 - It has to
 1. address something of significance, some issue, problem, puzzle question that relates to the interests of a broad community of scholars that arises in the real world or arises in the context of the sort of theories and frameworks that we are always endeavoring to develop in order to understand the real world.
 2. be researchable. Something that you can answer by doing research. So, that would let out metaphysical questions or questions that are so broadly formulated, one wouldn't know where to look or what sort of information to gather that would enable us to give a systematically researched answer to it.
 3. address a question that hasn't been definitively answered. (That's what differentiates research from an essay), or something that can strengthen existing answers.

Research Question discussion

- How to embed and hide electronic patient record in its medical image?
 - Is it possible to use Wavelet packets transform in the embedding of electronic patient record in the respective medical images.
 - Is it possible to use Wavelet packets in the prediction error expansion-based information hiding in the context of EMR data in medical images.
 - Can UML be used for threat modelling?
 - Why do we protect/secure our computer/network system from dark web and how it could be possible?

What is a Literature review?

- Imagine yourself sitting around a table and talking to other people about a topic or a questions.
- The term, 'Literature review' is often misunderstood, one is not just reviewing but you are situating your work in the literature by identifying gaps and problems with that literature
- It should be driven by a research questions.

Literature review cont.

- It helps the researcher to familiarize him/herself with the current field
- Figure out current/past trends
- It helps the researcher develop a broader understanding of the field
- Try to figure out, where am I, in relation to what has been done already and taking it further.
- Enables one to learn how the field developed over a period of time.

Activity-2

- Identify what you consider to be *the* most important elements of a literature review in no more than 200 words.

Research approach

- Research approaches are plans and the procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation.
- It also depends on the nature of problem or issue being addresses, researcher's personal experiences, and audiences for the study.

Approaches of research

1. Qualitative
2. Quantitative
3. Mixed

- The first two are two ends of continuum and are not entirely discrete, a study tends to be more qualitative than quantitative or vice versa.
- Mixed methods approach resides in the middle of this continuum.

Qualitative approach

- Qualitative research is an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem.

Activities

1. Revise your research questions
2. Do activity-2 mentioned on previous slide (due in a week)
3. Read the research approach handout.
4. Select your approach about the question/s you want to investigate in this course.

Research Questions Types

- Effectiveness questions
 - What effect does intervention X, compared with intervention y, have on outcome Z?
What are the relative cost-benefits of x versus y?
- Methodology questions
 - What research methods have previously been used to investigate phenomenon X?
What are the respective strengths and weaknesses of such methods?
- Conceptual questions
 - How has phenomenon X been identified and defined? Which theories have been used to explain phenomenon X? Which theory provides the best fit to findings from empirical studies? What are the main unresolved controversies? What are the underpinning epistemological and ontological foundations for the discipline?

What is the place of theory in literature review?

- ‘creates a firm foundation for advancing knowledge. It facilitates *theory development* closes areas where a plethora of research exists, and uncovers areas where research is needed’.

Webster and Watson (2002)

Problem statement

- A problem statement is a concise description of an issue to be addressed or a condition to be improved upon. It identifies the gap between the current (problem) state and desired (goal) state of a process or product

Research synthesis

- After reading some of the researches, one might have to integrate the studies into a single piece.
- Group them together like the pieces of a puzzle
 - Each piece should identify what is its place and role, and what are its side pieces
- Organize them into ideas not just study by study.
 - Organize according to topic/sub-domain rather than presenting each Study independently.



J.K. Rowling's Outline for "Harry Potter and the Order of the Phoenix"

NO	TIME	TITLE	PLOT	PROPHECY / Hall of Prophecy	Cho/Ginny	D.A.	O.G.P.	Snapes / Harry + father	Harry's group
13	OCT	Plots and Resistance	Harry, Ron & Hermione go to Hogsmeade, meet Lupin and Tonks - talk about the prophecy - pass note. Harry recruiting for O.G.P. Hagrid from injuries	Harry uses Vol still formulating his plans. Needs to get in + Des able to get in +	Cho in Hogsmeade - wants to join O.G.P.	Tonks + Lupin	recruiting	Harry's lesson to recruit for O.G.P.	Planned to still be in - injured - black stains -
14	NOV	The Order of the Phoenix	First meeting of the Order of the Phoenix	Harry's plan to get in + Ron's snake on the eyes -	Cho + Ginny both present	Underage now learning to use magic	First meeting	Harry still recruiting -	He's feeling better - that's not his -
15	NOV	The Dirtiest Tackle	Quidditch versus Hufflepuff - Harry's team - after Cedric's death - first night, after Cedric's death - first night, after Cedric's death -	Nazini attacks W.W.	Cho now ready in love	Firehead			
16	NOV	Black Marks	Row 13: skipping Snape's lesson - Harry's team in the night - Harry's team in the night - Harry's team in the night -	Nazini got in, Vol has confirmation of Bode's story - only he + Harry can touch the prophecy	Cho kiss? Ginny's about father	Row + rest of Ws called in to the school of father's injury	reactions - on the meeting?	How about Harry not going	Harry's still getting injuries
17	DEC	Rita Returns	Snape's lesson - Hogsmeade / Xmas shopping - they meet Rita	Rita's information - Missy's shipkiss	Harry now considering Cho + Ron - Ginny + Cho - Cho?		O.G.P.	Another lesson	Harry's hospital wing
18	DEC	St. Mungo's Hospital for Magical Maladies and Injuries	St. Mungo's visit Xmas Eve - see Bode (Machair's visit) - see Lockhart - see Mr. Weasley - Neville	NOW VOL IS ACTIVELY TRYING TO GET HARRY TO H.G.P. - very vivid - could see his name	Ginny + Dad	around			
19	DEC	(Xmas)		Bode dead - H.G.P. again	Harry + Ron + Ginny + Hermione	Snape's here - Big reunion			
20	JAN	Extended Powers of Elvira Umbridge	Harry meets match v. Hufflepuff - Order of the Phoenix now suspected by Umbridge - why were they not? match	Harry fighting increasingly strong visions but not successfully	Valentine's date with Cho - v. Umbridge - Harry's team could row	get to know Ginny + Lupin	O.G.P. boys meeting	Snape's lesson - H.G.P. can mention H.G.P. Prophecy	Harry's team of hospitalized now going into forest - small with spikes etc
21	FEB	(Valentine's day)	with Cho - Hogsmeade - The last night out - a financial replacement in the night - Rita reports back on the day - Rita reports back on the day -				O.G.P.		
22	FEB	Cousin Granger	Umbridge now really going for Harry - Firenze teaching - Harry's team + prophecy - H.G.P. go to the Hogsmeade in the night -				O.G.P.	Snape's going to see Harry - become the last day -	
2	MARCH	(Treason)	Easter - discovery of O.G.P. - Dumbledore's plan - Harry's team - Azkaban	Harry's team to set it - black	Cho wants to talk with Harry - another row	going west		Snape's team - Harry's team -	
2	APRIL	(Guidance)	Careers consultation - Harry's team - Harry's team - Harry's team - Harry's team -	Harry's team to set it - black		firehead	See plot meeting - Harry's team - Harry's team -	Harry's team - Harry's team -	Harry's team - Harry's team -

Synthesis Matrix

	Source 1	Source 2	Source 3	Source 4	My Commentar y/Thoughts
Idea 1					
Idea 2					
Idea 3					
Idea 4					

Thesis vs Dissertation

- A thesis which usually shows a student's understanding towards the topic – required for an MS degree
- A dissertation is an organized representation of the original research ideas.

Major Components of a Research Proposal

- Chapter 1 Introduction
 - Introduction
 - Background
 - Problem Identification
 - Problem Statement
 - Research Questions
 - Significance of the Study
 - Limitations of the Study
- Chapter 2 Literature Review
- Chapter 3
 - Hypotheses
 - Research Model

Introduction

- Establish the context of your research by introducing key information about the domain.
- Start with a broader introduction to the domain and gradually narrow it down around your (sub)-sub-domain
- Citations are essential to this portion of the proposal

Background

- The background of the study establishes the context of the research
- Justifies the need for conducting the study
- The background section, therefore, should provide general information about the topic of your research and emphasize the main aims of the study.
- Please ensure that you only discuss the main and relevant aspects of the studies that have led to your aims. Do not elaborate on them as this should be done in the literature review section.

Background - structure

- In this section, the author usually outlines the historical developments in the literature that led to the current topic of research concisely.
- If the study is interdisciplinary, it should describe how different disciplines are connected and what aspects of each discipline will be studied.
- Additionally, authors should briefly highlight the main developments of their research topic and identify the main gaps that need to be addressed.
- Try to build a story around the central theme of your research.

Background - Common Mistakes

- Don't write a background that is too long or too short.
- Don't be ambiguous. Express yourself keeping in mind that the reader does not know your research intimately.
- Don't discuss unrelated themes. Highlight the gaps in the literature, state the novelty of the study, and the need to conduct the study.
- Don't be disorganized. Discuss in a chronological manner about the progress in the field.

Problem Statement

- The ultimate goal of a statement of the problem is to transform a generalized problem (something that bothers you; a perceived lack) into a targeted, well-defined problem; one that can be resolved through focused research and careful decision-making.

Problem Identification

- A research problem is a specific issue, difficulty, contradiction, or gap in knowledge that you will aim to address in your research.
- It points to the need for further understanding and investigation
- You might look for practical problems aimed at contributing to change, or theoretical problems aimed at expanding knowledge.

Literature review

- A literature review is a comprehensive overview of all the knowledge available on a specific topic till date
- Literature review is one of the pillars on which your research idea stands since it provides context, relevance, and background to the research problem you are exploring.

Literature review

- Supports the background section by providing evidence for the proposed hypothesis.
- It is more comprehensive and thoroughly describe all the studies that you have mentioned in the background section.
- It should also elaborate on all studies that form evidence for the present study and discuss the current trends.
- Present a more focused survey of the specific studies that are associated with the precise objective of your study. It would be ideal to organize them thematically and discuss them chronologically so that readers are aware of the evolution and progress in the field.

Literature review

- Literature review essentially involves two steps:
 1. Surveying and critically reading the existing literature: this step is commonly referred to as experimental literature review.
 2. Summarizing and actually penning down the gist of your review in an organized manner: this is known as theoretical review.

Literature review - Search

- A literature review should begin with a thorough literature search using the main keywords in relevant online databases such as Google Scholar, PubMed, etc. Once all the relevant literature has been gathered, it should be organized as follows:
 1. Background literature about the broad research topic to introduce the readers to the field of study.
 2. Recent progress on the study topic which can be organized thematically or chronologically. Ideally, separate themes should be discussed in a chronological manner to describe how research in the field has evolved over time and to highlight the progress in the field.

Literature review – Search cont.

3. The review should include a comparison and contrast of different studies. Discussing the controversial aspects helps to identify the main gaps that need to be worked upon. This is essential for defining the problem statement of the study and highlighting the significance of the research under question.
 4. Once a problem statement has been defined, the strengths and pitfalls of other studies that have tackled the problem statement should be discussed. This is important for outlining the need and novelty of the research.
- A literature review should not be a mere recounting of all the available information. It should be a critical and analytical summary of the selected literature that guides the readers through the central theme of the research.

Significance of the Study

- Explain how your thesis contributes to the field.
- There are four main areas of contribution: theory development, tangible solution, innovative methods, and policy extension. One of these contributions must be identified as the basis of your primary contribution to the field.
- In contrast to reports for industry, theory development is an expected and required contribution; for PhDs in particular, it must be 'original'.