

Literature reviews – Lecture notes

7COM1085 – Research Methods

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Introduction

Learning Objectives

1. Understand the role of literature reviews in research.
2. Understand how to conduct a *systematic* literature review.
3. Be able to develop *research questions* related to a research topic.

Background

Why literature reviews?

1. To understand what has been done already.
2. To identify gaps that can be filled by further research.
3. To *synthesize* existing research to create new insights.

Notes:

Synthesis is difficult as it creates new knowledge from existing research. But it can provide insights that are not evident from the primary studies that form the input for the synthesis. Sarah's review on fault prediction is a good example.

It's required for your Interim Progress Report

Module units: 6COM1 | Files | Module units: 7COM1 | Files | MSc Project Handbook | jnoll2 / kanban-lab

https://herts.instructure.com/courses/87019/pages/msc-project-handbook-v9.1.pdf

MScProject_Handbook v9.1.pdf

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MSc Project Handbook

Appendix C: Sample - MSc Interim Progress Report (IPR): feedback and Scores

| | |
|-----------------------------|--|
| Student name | |
| Student registration number | |
| Module code-instance | |
| MSc Project Award | |
| Marker name | |

1. **Background research** (maximum 15)

| 0 | 4 | 8 | 12 | 15 | Score |
|---|--|--|--|--|-------|
| Little or no evidence of literature review | Limited review , overview of few relevant papers with no critical appraisal | Satisfactory review , concise review of relevant papers, limited critical appraisal | Good, concise review of relevant papers, some critical appraisal, set into context of project | Excellent review , concise critical review, set into context of project | |

It's required for your Final Project Report

Module units: 6COM1 | x Files | Module units: 7COM1 | x Files | MSc Project Handbook | jnoll2 / kanban-lab | x

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Supervisor

Programme of study Select the appropriate module code

You should assign numeric values in the marks columns (Section B and C). The form will calculate the weighted mark. Your final mark (Section D) should be the sum of the total for the project report and the total for the project demonstration. In case the final mark is calculated otherwise you should provide the original and the amended mark and indicate the reasons in Section E. Please also use Section E to comment briefly on the student's work and justify your allocation of marks.

Section B. Assessment of Final Project Report

| Criterion | Mark (out of 100) | Weight | Weighted Mark |
|---|-------------------|--------|---------------|
| 1. Specification of the project Abstract; introduction; Project specification; Aims and Objectives; Current issues; Feasibility | | 0.05 | 0 |
| 2. Research Quality of background research; Use of literature; Critical Appraisal; Linkage to aims | | 0.20 | 0 |
| 3. Methodology Choice of methods; justification and support of choices; Data Collection/Project design; Validation; Ethical issues; Consideration of commercial and economic context/Commercial risk and risk management | | 0.20 | 0 |
| 4. Quality and Results Critical analysis; Evidence of practical work; Assessment and solution to technical challenges; Novelty; Interpretation of results; Use of tools and techniques; Appropriate tools for analysis; Linkage to objectives and literature | | 0.20 | 0 |
| 5. Evaluation and Conclusions Critical Evaluation; Summary of achievements; Reflection; Managerial/ Research recommendations; Achievement of objectives; Further work | | 0.10 | 0 |
| 6. Presentation and References Presentation of report; Structure and language; Grammar; Citations and referencing style; Appropriate use of appendices; Word count | | 0.05 | 0 |
| Total | | | 0% |

Section C. Assessment of Project Demonstration

| Criterion | Mark (out of 100) | Weight | Weighted Mark |
|--|-------------------|--------|---------------|
| 1. Demonstration of Practical Work Student attended the demo; Complete and Accurate demonstration | | 0.07 | 0 |
| 2. Clarity of Questions Answered Conciseness and Clarity of answers; Explanations; Handling of challenging questions; Ability to answer questions fully | | 0.08 | 0 |
| 3. Professionalism and Preparation Confidence; General Appearance; Competence | | 0.05 | 0 |
| Total | | | 0% |

Section D. Final Mark

Complete on spreadsheet

| Supervisor | 2nd marker | Final mark | Date |
|----------------------|----------------------|------------|------|
| <input type="text"/> | <input type="text"/> | | |

Please enter your name (and signature if possible)

Research questions are *essential*

The screenshot shows a web browser window with multiple tabs. The active tab is 'MSc Project Handbook'. The address bar shows the URL 'https://herts.instructure.com/courses/87019/pages/msc-project-handbook'. The PDF document is titled 'MScProject_Handbook v9.1.pdf'. The document content includes the following text:

...never forget to allow time for your project work. If you are absent, then plan with your supervisor and adjust your schedule.

Always keep in touch and keep up!

There are eight different project modules, but only TWO really different kinds of project, investigative or development. You must do the type of project specified by the award you seek.

Learning outcomes for ALL students

1. be able to plan and manage a substantial body of work, identify any risks inherent in their chosen approach, and work independently with minimum supervision;
2. be able to both critically evaluate and discuss the outcome of their project work in written and oral form
3. be able to articulate the broader contexts of their work in relation to legal, social, ethical, and professional issues, and assess the economic impact of their project.

2.1.1 Investigative project

This type of project requires you to work on an investigative and practical project. It applies to those of you who study Software Engineering, AI with Robotics, Networking, Cyber Security, Data Science with Analytics or Advanced Computer Science.

"This type of project involves a thorough investigation of a particular area; improving your understanding of that area, identifying strengths and weaknesses within the field, discussing how the field has evolved, and acknowledging areas suitable for further development and investigation. This kind of project will involve some form of literature search and review. A research-based project may well have to do more than establish the field of study." (Dawson, 2009)

You must have a research question or hypothesis to investigate

The search bar at the bottom of the PDF viewer shows the search term 'question' and indicates '3 of 17 matches'.

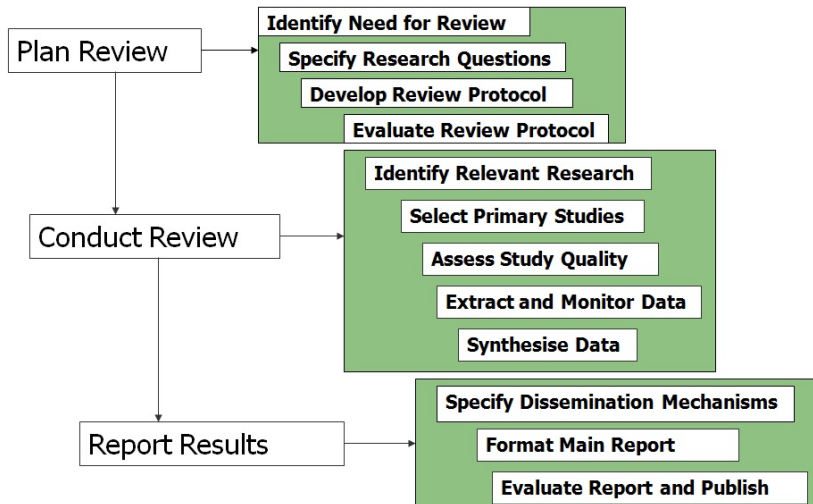
Systematic Literature Reviews

Definition

A *rigorous and auditable* method for evaluating the literature related to a particular research topic.

- ▶ Adapted from evidence-based medicine.
- ▶ Driven by *research questions*.
- ▶ Focus on *synthesis*.
- ▶ *Repeatable*.

Process



Planning the Review

Identify need.

- ▶ Identify effective tools or techniques.
- ▶ Identify gaps that could be filled by a new primary study.
- ▶ Synthesize state of the art into new knowledge.

Specify research question.

The research question is *key!*

- ▶ It shapes the rest of the review.
- ▶ A good one makes the synthesis easier.

Step 1: write a “free” format RQ

A general question about a topic or technology.

- ▶ Asses the effect of a technology.

Does fault prediction work?

- ▶ Assess the frequency or rate of a factor

How many projects fail outright?

- ▶ Identify cost and risk factors

What are the costs of global software development?

- ▶ Identify impact of technology on reliability, performance, cost

Do agile methods reduce development cost?

- ▶ Identify best practices

What (de-)motivates software engineers?

- ▶ Identify problem areas

Step 2: Structure the question

Write a *specific* research question that identifies:

- ▶ context,
- ▶ population,
- ▶ intervention,
- ▶ comparison,
- ▶ outcomes.

This is hard!

Example

What (de)motivates Software Engineers to be more (less) productive?

Context software development (implied)

Population software engineers (explicit)

Intervention (de)motivators (explicit)

Comparison motivated vs un-motivated (implied)

Outcome productivity (explicit)

Example 2

What factors influence classification of images of objects?

Context not specified!

Population images of objects

Intervention “factors”

Comparison among different (combinations of) factors

Outcome classification accuracy

Develop review protocol.

1. Search string
2. Target libraries
3. Inclusion/Exclusion criteria

Search String: Step 1

Identify key terms from RQ(s):

- ▶ software engineer
- ▶ (de-)motivation
- ▶ productivity

Search String: Step 2

Identify synonyms:

Software engineer software developer, programmer

Motivation morale, satisfaction, inspiration, encouragement,
enthusiasm, drive, impetus

(de-)motivate manage, encourage, induce, trigger, spur, cause,
stimulate

Search String: Step 3

For *each* library, create a specific query conforming to the library format:

Example: IEEE Xplore

```
(((((software OR {information technology} OR {information system*} OR
system* OR comput* OR IT OR IS )wn TI AND (engineer* OR
developer* OR professional* OR programmer* OR personnel OR
people OR analyst* OR {team leader}* OR {project manager}* OR
practitioner* OR maintainer* OR designer* OR coder* OR tester*) wn
TI) ) AND ((motivat* OR demotiv* OR de-motiv* OR satisf* OR inspir*
OR prompt* OR morale OR encourage* OR manage OR induc* OR
provoke* OR {trigger off} OR caus* OR incentive* OR drive* OR
morale OR enthusias* OR impetus OR stimul* OR spur OR {driving
force}* OR impuls*)wn AB AND (productiv* OR factor* OR output OR
efficien* OR interact OR yield OR production OR creat* OR prolific OR
industrious OR fruitful OR dynamic OR hinder OR resist* OR increase
OR decrease)wn AB ))
```

Inclusion/exclusion criteria

The search may uncover hundreds or thousands of papers. To narrow them down to a manageable subset, apply

1. inclusion criteria, that define what papers should be included for review.
2. exclusion criteria, that specify which papers that might otherwise be included, should be excluded.

Exclusion criteria apply to papers that pass inclusion criteria.

Inclusion criteria

Include:

- ▶ peer-reviewed publications in journals and/or conferences.
- ▶ publications documenting empirical studies.
- ▶ published from 2009 to present.
- ▶ written in English.
- ▶ directly answer one of the research questions.

Exclusion criteria

Exclude:

- ▶ duplicates of previous work.

Exclusion criteria refine the set that passes the inclusion criteria.
They are *NOT* just a negation of the inclusion criteria!

Evaluate review protocol.

- ▶ Independent examiner verifies correctness and repeatability.
- ▶ Trial search and inclusion/exclusion assessment.

Conducting the review

Process

1. *Identify* relevant research.

Apply the search string.

2. *Select* primary studies.

Apply inclusion/exclusion criteria, to

2.1 Title,

2.2 abstract,

2.3 full text.

3. *Assess* study quality

Often not done in computer science and software engineering.

Extract (and monitor) data.

Extract and Monitor Data

| Paper study results/findings Form (Used only for ACCEPTED papers) | |
|---|-------------------|
| Reviewer Name | |
| Title of Paper | |
| Paper ID | |
| THE FOLLOWING REFER TO OUR RQs: | RECORDED IN PAPER |
| 1. Software engineer characteristics (RQ1) | |
| 2. Software Engineer motivators (RQ2) | |
| 3. Software Engineer 'de-motivators' (RQ2) | |
| 4. External signs or outcomes of motivated engineers (RQ3) | |
| 5. External signs or outcomes of de-motivated engineers (RQ3) | |
| 6. SW Engineering as a motivator (RQ4) | |
| 7. Models that reflect how software engineers are motivated (RQ5) | |
| 8. Other observations | |

Synthesize Data

This is where the real work lies:

- ▶ What are the answers to the research questions?
- ▶ What are the main themes in the surveyed research?
- ▶ What *new* insights did you develop?

insight¹: a clear, deep, and sometimes sudden understanding of a complicated problem or situation.

- ▶ What does the collected body of knowledge represented by your included papers *mean*?

Caution: the number of papers that address a particular result or question is not necessarily an indication of its *importance*.

¹Cambridge Dictionary online, accessed 10 February 2020. Available at

<https://dictionary.cambridge.org/dictionary/english/insight>

Report Results

Specify Dissemination Mechanisms

- ▶ Report to sponsors.
- ▶ Thesis or dissertation.
- ▶ Journal article.

Conferences sometimes publish SLRs, but this is increasingly being discouraged.

Format Main Report

- ▶ Report to sponsors should have:
 1. An executive summary of the key findings.
 2. Research questions.
 3. Detailed discussion of the method.
 4. Presentation of results, including list of papers accepted.
 5. Discussion and synthesis.
 6. Appendices including review protocol and statistics of the search.
- ▶ Thesis should include:
 1. Research question(s).
 2. Search string & inclusion/exclusion criteria.
 3. Results, including list of papers accepted.
 4. Discussion and synthesis.
 5. Review protocol might be included in an appendix.
- ▶ Journal publication should include:
 1. Research questions.
 2. Detailed discussion of the method.
 3. Results, including list of papers accepted, and descriptive statistics.
 4. Discussion and synthesis.

Summary

Learning objectives:

1. Understand *why* literature reviews are important.

They're required!

2. Understand how to conduct a *systematic* literature review.

Follow Kitchenham's guidelines. Easy to say, hard to do.

3. Be able to develop *research questions* related to a research topic.

An iterative process of successive refinement, culminating in a question that comprises the five components (context, population, intervention, comparison, outcome).

End Part 1

Part 2

Part 2

See the tutorial slides for more examples of research questions.