University of Hertfordshire UH

Literature reviews – Lecture notes

7COM1085 – Research Methods

Dr. John Noll

University of Hertfordshire

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

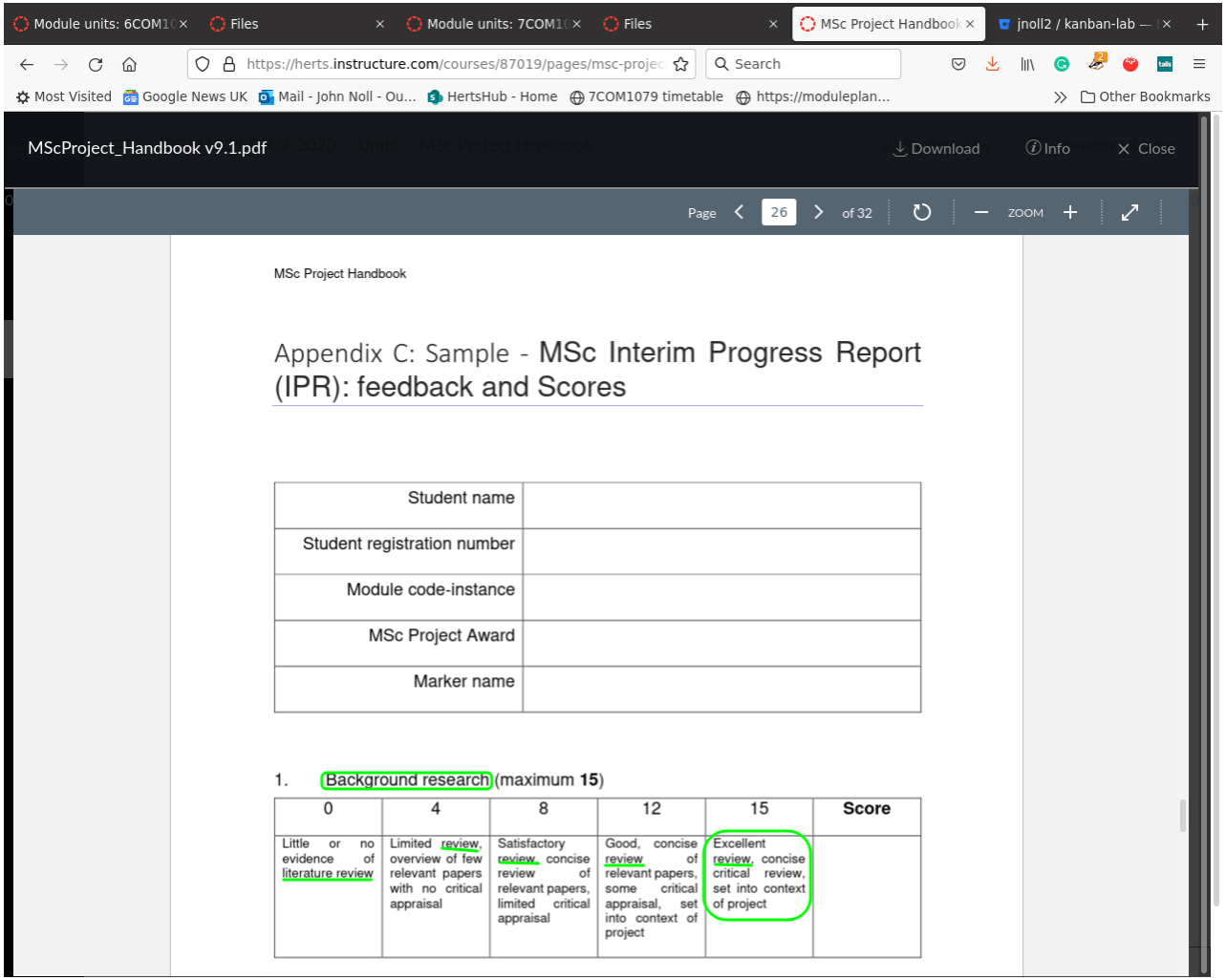
Why literature reviews?

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

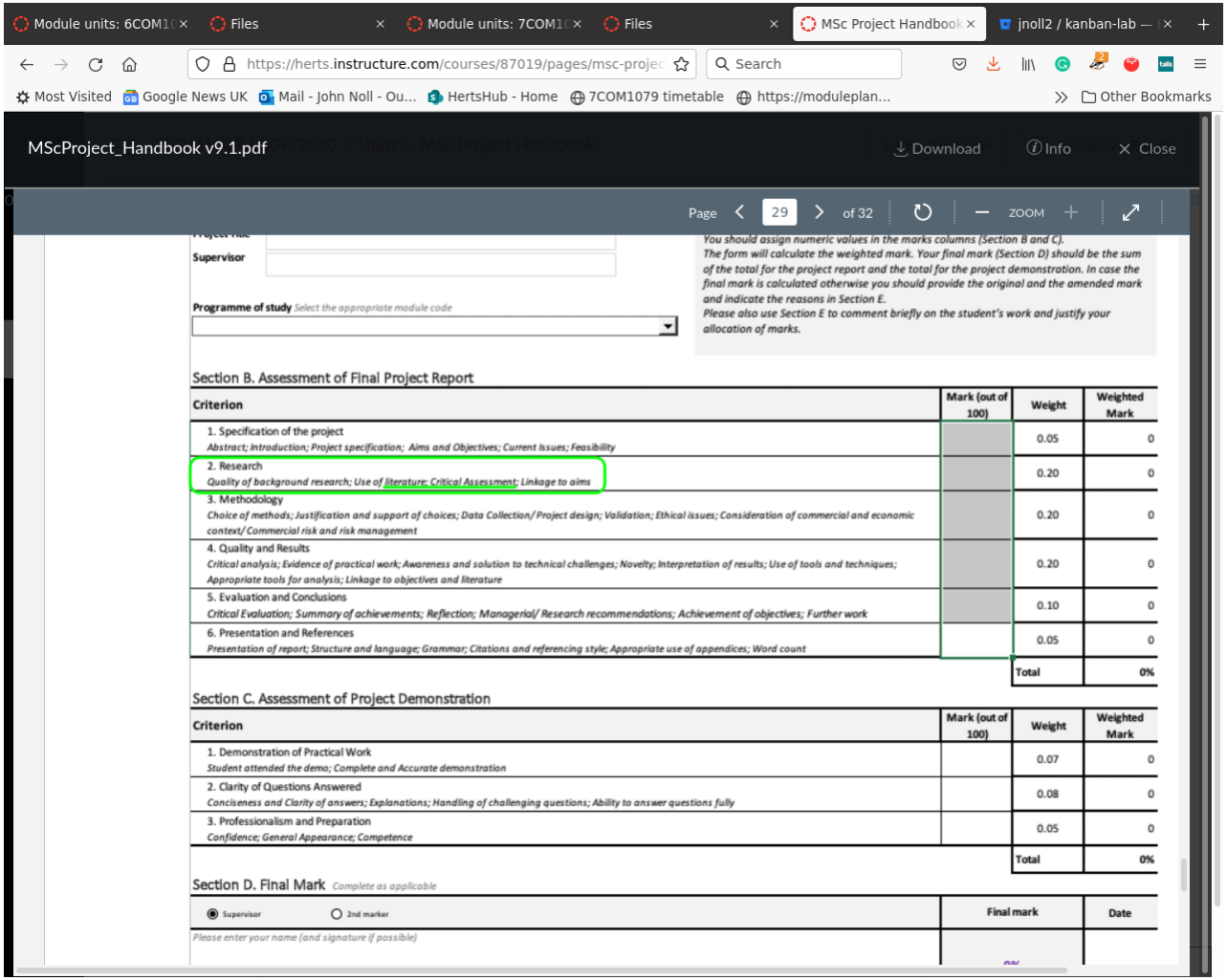
Notes:

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.

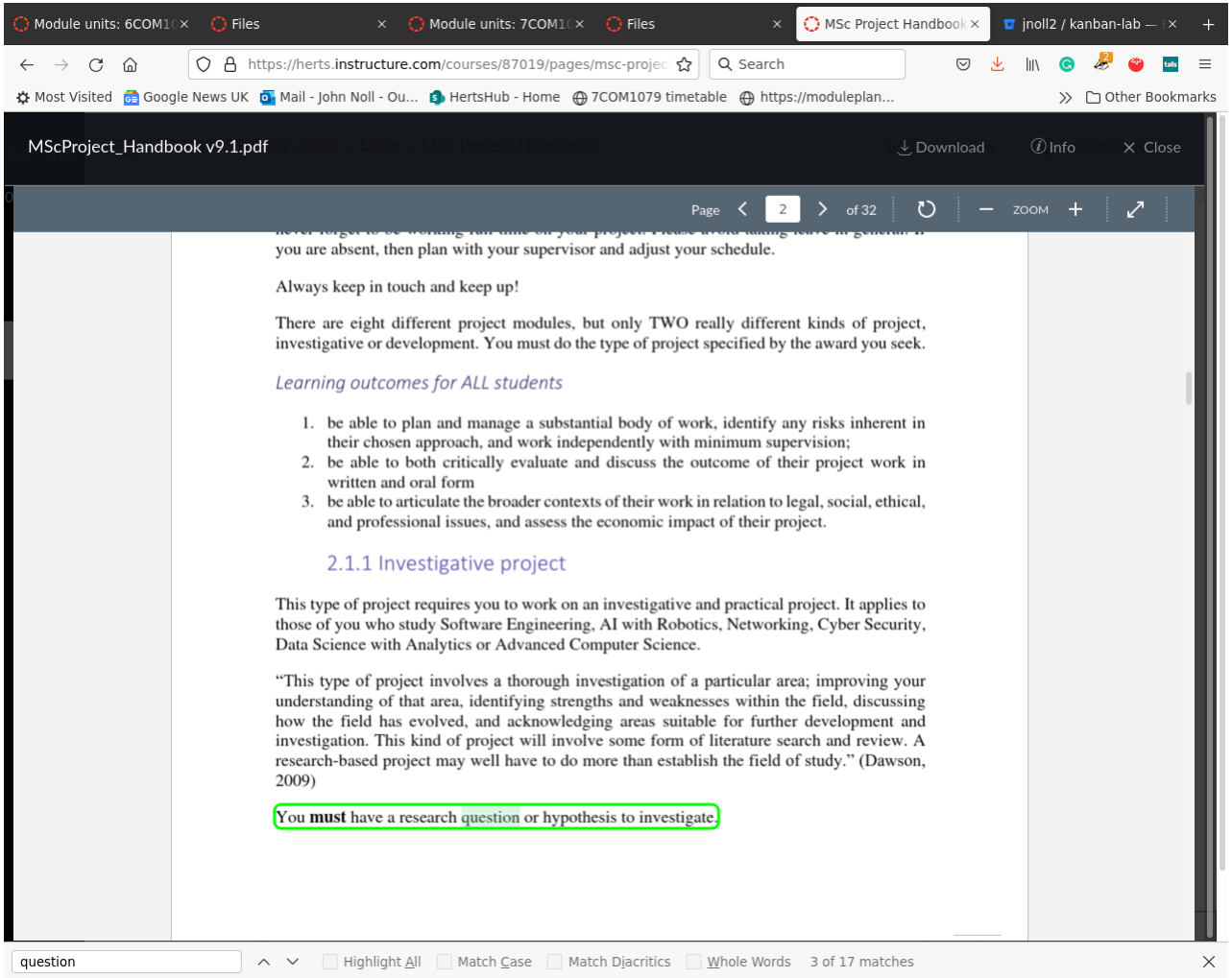
It’s required for your Interim Progress Report



It’s required for your Final Project Report



Research questions are *essential*



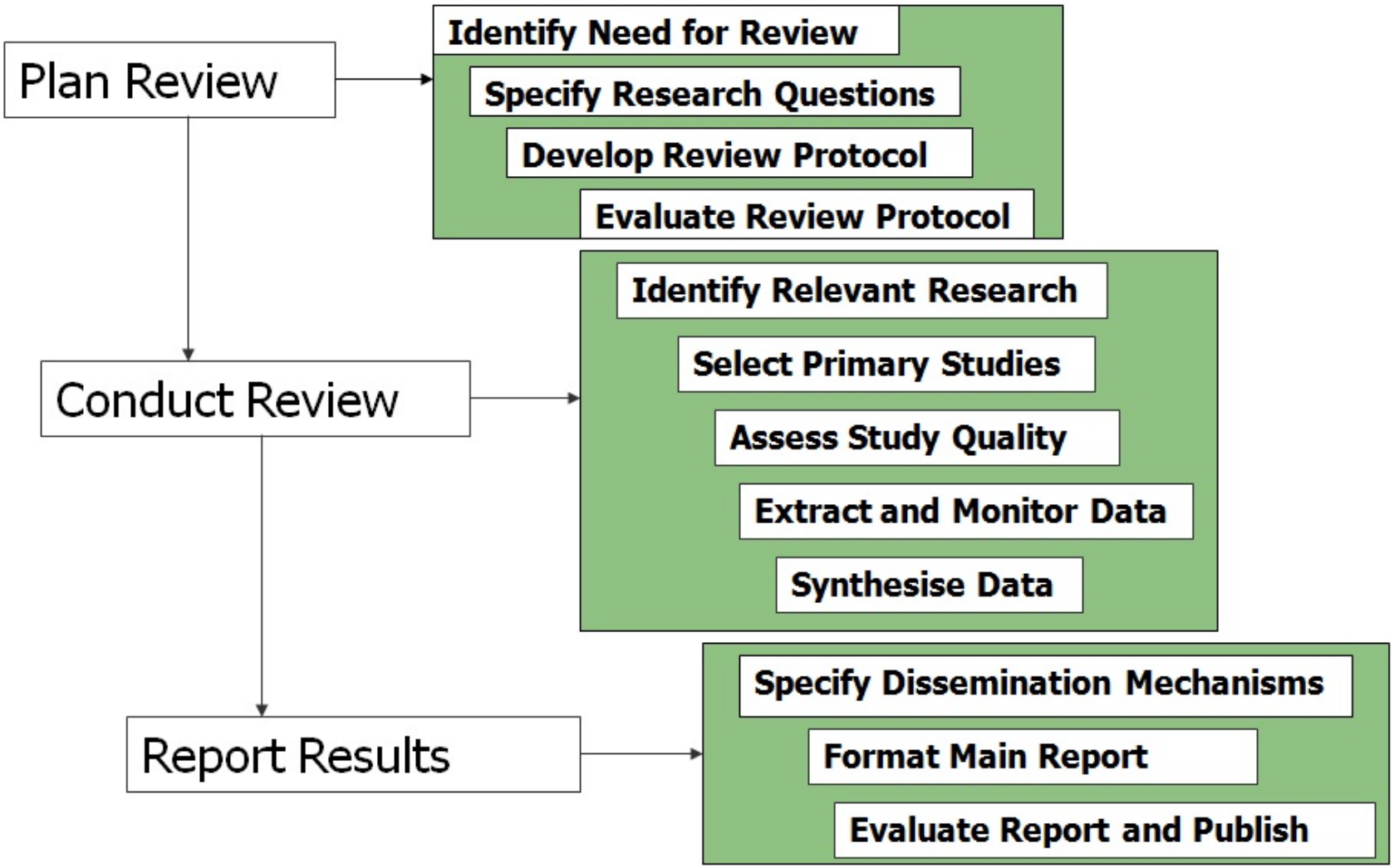
Systematic Literature Reviews

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


Plan Review
Identify Need for Review
Specify Research Questions
Develop Review Protocol
Evaluate Review Protocol
Conduct Review
Identify Relevant Research
Select Primary Studies
Assess Study Quality
Extract and Monitor Data
Synthesise Data
Report Results
Specify Dissemination Mechanisms
Format Main Report
Evaluate Report and Publish

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?

  insight[1]: 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.*

[1] Cambridge 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.