# Use of Systematic Literature Reviews in Education and Research

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# Organization

- Background and motivation: What is SLR?
- Why do it?
- Implementation and course context
- "Protocol"
- Initial results and lessons learned
- Conclusions

# Background

In my senior/graduate level classes graduate students were required to pick an area and write a "research report" on what they found in the current literature.

My observation: didn't seem very useful and students applied all kinds of ad-hoc "methods". Both the writing and assessment of the resulting report were highly subjective.

Is there some "rigorous" way to do this?

# Narrative vs. systematic

- One problem is that we just "know" what a good review is. How about some order → "taxonomy" = narrative or systematic?

- Narrative type seems prevalent

- Give some characteristics, examples

- Nothing wrong here but one methodological objection relates to reproducibility – would someone else produce the same review given the same constraints?

# Systematic Literature Review: definitions

"A systematic review is a means of evaluating and interpreting all available research relevant to a particular research question, topic area, or phenomenon of interest. Systematic reviews aim to present a fair evaluation of a research topic by using a trustworthy, rigorous, and auditable methodology."

B. Kitchenham, "Procedures for Performing Systematic Reviews," Keele University Technical Report TR/SE-0401.

# Or, this one …

"A systematic review is a review of a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect and analyze data from the studies that are included in the review. Statistical methods (meta-analysis) may or may not be used to analyze and summarize the results."

D. Moher et al. "Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement," PLoS Medicine, Vol. 6, no. 7, July 2009.

# Systematic vs. Narrative

http://libguides.mssm.edu/content.php?pid=417116&sid=3882519

| Systematic Reviews | Narrative Reviews |
|---|---|
| Investigate a clearly defined topic or question. | Intended to provide an overview of an area. |
| Literature is gathered using explicit search protocols. | Explicit, systematic literature search protocol not used. |
| Studies selected using a protocol that specifies inclusion, exclusion criteria. | Studies used to support recommendations are not selected according to an explicit, predetermined protocol. |
| Data from primary study may be synthesized in a meta-analysis. Evidence "grades" may be applied to individual studies. | May use a level of evidence rating system to "grade" the quality and strength of individual studies. |
| When evidence is lacking, the authors usually recommend further research. | When evidence is lacking, the authors make recommendations based on their opinions and experience. |

# PRISMA checklist

- 27 items in 7 areas: Title, Abstract, Introduction, Methods, Results, Discussion, Funding, e.g. :
  - *Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.*
  - *State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).*
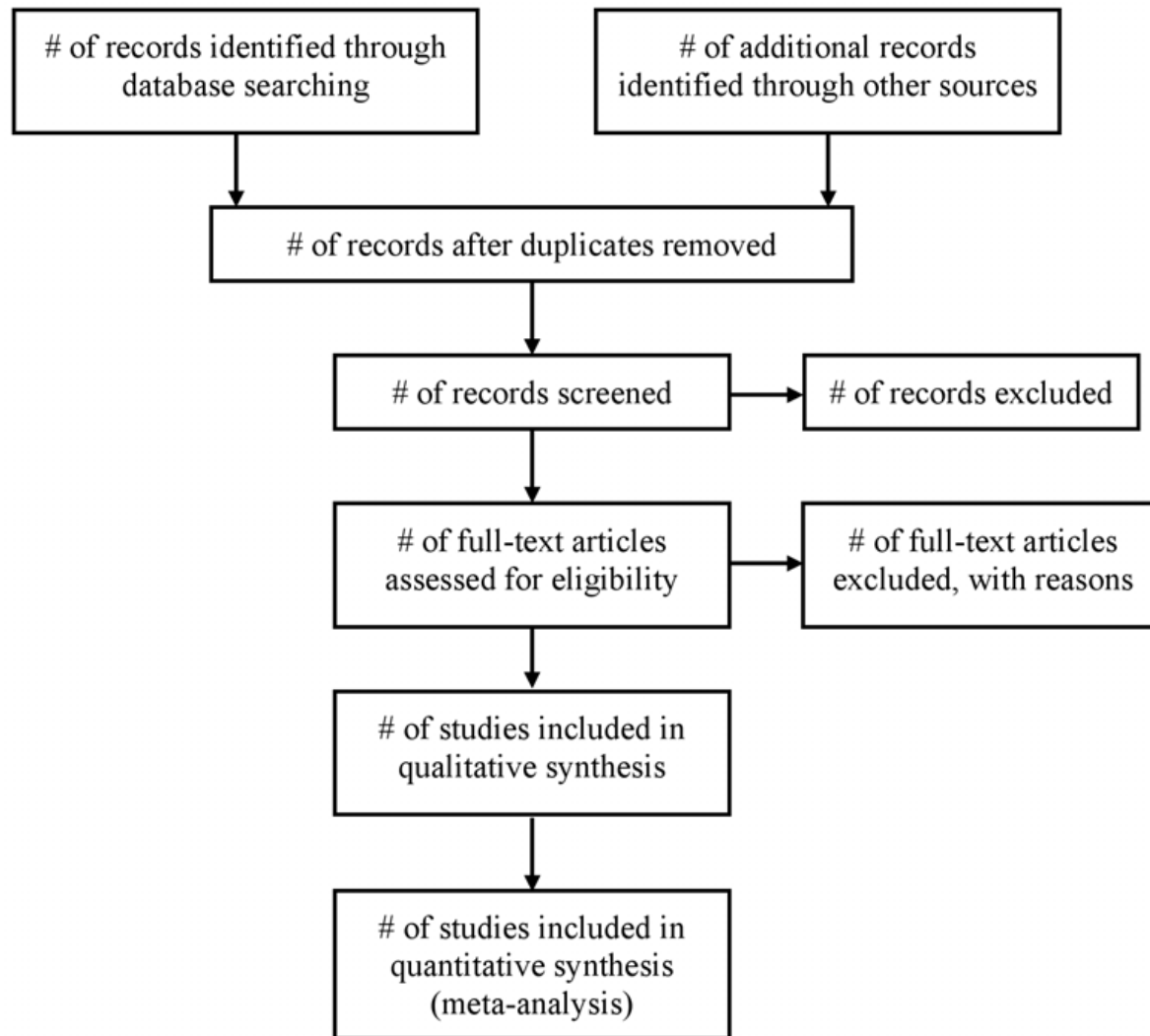
# Is that all?

Several questions / problems:

1. How do we teach this skill (SLR)? (do we?)

2. Tacit assumption: only experts can write SLRs; if that were so, how would we teach it?

3. What are possible educational uses of SLRs?

# Hypotheses

1. SLR can be taught and performed by subject area novices → emphasizing SLR as a general method of inquiry (used in e.g. dissertation proposal preparation)
2. SLR can be a useful learning tool in a given subject area → emphasizing use in specific area (e.g. solid-state physics)
3. Students learn best in specific context
4. Proficiency is attained through repeated performance (practice)

# Example

- ECE 511/611 Solid-state Electronics I – graduate only course, mostly about material properties

- Expanded to cover optical and THz ranges

- Projects involving actual TDS measurements and modeling; simulations.

- Added a recent research topic: thin metal films and TDS

- Why not use SLR of it as a teaching tool?

# Iterative SLR (iSLR)

# Protocol

- Developed specific tasks for 10-week duration with milestones

- Students split in groups of two or three

- Periodic (almost weekly) examination of progress and further refinement

- Engaged Librarian in our technical area

- Utilized Zotero for collaboration, references management and in selection and analysis stages of SLR

# Data, observations, ... (small sample)

- Pre- and post-surveys done

- Students have NO experience in doing anything resembling SLR but they think it would be a valuable skill

- Anecdotally: students were scared of this project. They had no confidence in their abilities to perform the tasks AND they realized they were novices in this area.

- How are they supposed to do this?

# Data, observations, ...

- As quarter progressed students became more comfortable with the idea of reading and analyzing papers in unfamiliar area
- End of term survey: 5 same questions (longitudinal) + barriers/effectiveness
- Improvements in familiarity and confidence
- But, reduction in perception of usefulness
- Zotero very valuable

# Data, observations, ...

- Most time consuming: selection and analysis
- Most challenging/confusing: question formulation and analysis (distributed)
- Best explained in class: <u>search</u> + selection
- Worst explained: synthesis
- → do some simple exercises along the way to help with selection, analysis and synthesis (good/bad papers, scanning titles and abstracts; ?? Writing )
- Allow more time and check progress more carefully and completely (15 to 20 weeks seems better)
- Reorganize course to better fit this project

# Future …

- First time, so many things were intentionally open-ended, e.g. format of the report was left vague → maybe provide more direction?

- TBD: consistency (reliability) – did they come up with same / similar papers? How did they formulate their research question? Did they organize review in similar ways?

- Suggestions …

# Conclusions

1. Work-in-progress but first results are encouraging
2. We have a framework to do iSLR within courses (but tweaking is needed):
   a. Protocol
   b. Rubrics
   c. Software tools
3. iSLR is situated in relevant context and part of an authentic problem → should result in better learning of both the method itself and the topic itself
4. More evidence needed

# If interested – let's collaborate …