Systematic Literature Reviews

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Systematic Literature Reviews

- SLR are conducted to identify, analyze and interpret all available evidence related to a specific research question
- Their goal is to give a complete and comprehensive picture of the evidence
- SLR must be conducted in a scientifically and rigorous way

The SLR Process

- The SLR process for Software Engineering was adapted from other areas (mainly medicine)

- It is structured in three steps
  - Planning
  - Conducting
  - Reporting

Planning the Review

Planning the Review

- A SLR can be viewed as a research method for making a literature review

- Planning a SLR include several actions
  - Identification of the need for a review
  - Specifying the research question(s)
  - Developing a SLR protocol

The Need for Review

- Motivation for a researcher
  - To understand the state-of-the-art in a research area
- Motivation for a practitioner
  - To use empirical evidence to support making a decision
- Key questions
  - Is there a pre-existing SLR in the area?
  - Were sufficient data reported?

Specifying Questions

- Research questions must be well planned, discussed and phrased
- They set the focus for
  - The identification of primary studies
  - The extraction of data from the studies
  - The analysis of the data

PICOC

- PICOC aspects to take into account
  - *Population*: people, programs or business
  - *Intervention*: technology, tool under study
  - *Comparison*: how is the treatment defined?
  - *Outcomes*: how practical are the results?
  - *Context*: academia or industry?

Developing a Protocol

- The protocol should be peer-reviewed
- Relevant items to be covered
  - Background and rationale
  - Search strategy for primary studies
  - Study selection criteria
  - Study quality assessment (checklists and procedures)
  - Data extraction strategy
  - Timetable

Conducting the Review

Conducting the Review

- Conducting a SLR means setting the review protocol into practice
- It includes
  - Identification of research
  - Selection of primary studies
  - Study quality assessment
  - Data extraction
  - Data synthesis

Identification Research

- It requires specifying a search string and applying it to databases
- It may include manual and automated search
  - For instance, manual search is performed in websites of authors or local events
- Tuning to avoid too many false positives and duplicates (from different sources)
  - Remove duplicates and grey literature

Selection of Primary Studies

- Define inclusion and exclusion criteria
  - Criteria should be defined before the search, to avoid bias
  - But, they may be adjusted
- It is often sufficient to read title and abstract
  - At least two researchers should assess each paper (and check for agreement)

Study Quality Assessment

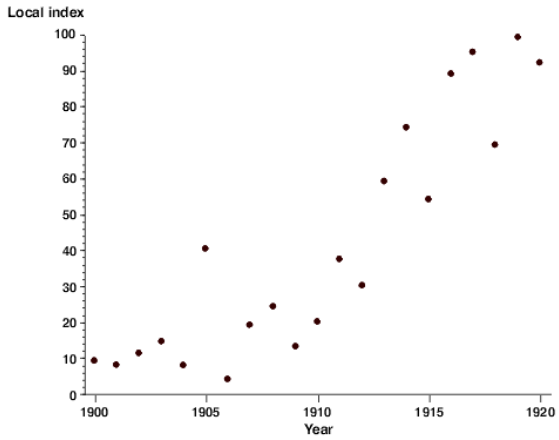
- Published studies may report contradictory results
  - It is important to analyze the causes of contradictions
- Quality assessment may lead to some primary studies being excluded (grey literature)
  - Peer review is usually required to assess the quality of studies

Data Extraction

- Once the list of primary studies is decided, data can be extracted
  - A form is often used to organize data
- Data extraction is based on the research questions
- Analytical synthesis (numerical values)
  - Number of papers, characteristics, date of extraction, publication venue, etc.

Data Synthesis

- Statistic methods and tools should be used to present the extracted data
- Narrative synthesis tabulates data to answer the research questions
- Scatter plots and box plots can be used to visualize the results



Examples of Synthesis Methods

- Thematic Analysis
  - It aims at identifying, analysing and reporting patterns or themes
- Narrative Synthesis
  - It tells “a story” from evidences of primary studies
- Comparative Analysis
  - It aims to explain relations between primary studies

Reporting the Review

Reporting the Review

- Results should be reported targeting different audiences
  - Webpages
  - Short summary leaflets
  - Papers (researchers)
  - Magazines (practitioners)
  - (Extended) Technical report
- Lessons learned are important for the research audience point of view

Mapping Studies and SLR

- Comparing mapping studies to SLR
  - Research questions are broader
  - Field of study is less explored
- A mapping study follows the same principles of SLR, but searches for a broader scope
  - Analysis tend to be more qualitative

Mapping Studies vs. SLR

	Mapping Study	**SLR**
Goal	Classification of a topic	Identify best practice (state of the art)
Research Question	Generic	Specific
Search Process	Defined by a topic	Defined by a research question
Scope	Broader	Focused

Final Remarks

- There is a growth of SLR in recent years
  - Quality of SLR is also increasing
- Search tools (e.g., Google Scholar) make SLR easier
  - It is sometimes required to make SLR manually (e.g., local publications not available online)

Bibliography

- C. Wohlin et al. **Experimentation in Software Engineering**, Springer. 2012.
  - Chapter 4. Systematic Literature Reviews