Assignments for Evidence-Based Software Engineering

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1. Consuming Evidence: Rapid Review (Group - 40%)

Due: December 14th

Design and execute a Rapid Review to address a practical problem. This problem can be either:

a) One you select based on your current ideas and interests about a topic that you would like to obtain deeper knowledge, as (aspiring) software engineers. Rapid Reviews are meant to address real problems in software development practice.

b) One of the pre-selected problems (see below), in case you lack inspiration for a). Variations of these problems are also possible.

Your proposed problem needs to be approved by your coach <u>two days after the first lecture</u>. When formulating Research Questions, based on the problem, there should be at least one qualitative question (what? why? who? when?) and at least one quantitative (how much?), leading respectively to qualitative and quantitative data analysis.

Consider the following advice:

- Rapid Reviews follow the same process as Systematic Literature Reviews (as covered in the lecture), but they require less time and effort by omitting and/or simplifying certain steps. Use the guidelines for Rapid Reviews proposed by Cartaxo et al. 2020 (which are based on the guidelines by Kitchenham and Charters 2007).

- The deliverable for this assignment is the report of executing the Rapid Review, which includes the Rapid Review protocol. The protocol (i.e. the study design) can be developed using the aforementioned guidelines; an example of an SLR protocol can be found in Galster et al. 2014 (also presented in the lecture). The results of the Rapid Review can follow the structure of an Evidence Briefing (see Cartaxo et al. 2020). An example of a Rapid Review can also be found in Cartaxo et al. 2018.

- To ensure that the Rapid Review can be completed within the allocated time-budget, the *scope* needs to be decided and documented in the protocol, e.g. by limiting the data sources or the publication years. All scoping decisions must be made explicit. We advise to:
    - Aim for selecting a set of approx. 20 primary studies.
    - Either perform search using an electronic database or snow-balling (but not both)
    - Use one criterion only for quality assessment (e.g. rankings of conference/journals)

- We advise, as a minimum, the following tools to be used for the Rapid Review: spreadsheets (especially shared ones like Google Sheets) and Reference Managers (e.g. Mendeley, Zotero).

- The assignment corresponds to the first 4½ weeks of the course. This means that each student member of the group is expected to spend approx. 54 hrs. of work. This should be registered in the time sheets.

- The work is meant to be conducted iteratively (as opposed to waterfall-style). The following deliverables and activities are strongly indicated (but not mandated) at the end of the corresponding weeks.

End of Week	Report (incl. Protocol)	Execution
1	Background and Research Questions Draft search strategy	Pilot search results
2	First version (complete)	First round of study selection
3	Second version	Completed study selection & Quality

		assessment, 1st iteration of data extraction
4½	Final version	Completed data extraction, synthesis, threats to validity, and report

List of pre-selected practical problems:
- How to use generative AI for automated code repair?
- What are the strengths, weakness, opportunities and threats of AI-based code generation?
- How to use agile processes in a (business-, mission-, safety-) critical system?
- What tools and techniques can be used to manage architecture-level technical debt?
- How can I optimize the carbon footprint of my software system?
- What does team diversity impact software development?
- What techniques/tools can be used to mine software repositories for software architecting?

2. *Producing Evidence: Empirical Study (Group - 60%)*

Due: February 4th

Choose a non-trivial software engineering research dataset (possibly linked to a research goal), and subsequently design and execute a study based on that dataset and goal. Consider the following guidelines:

- You can either choose one of the pre-selected datasets (see Brightspace) or pick one available on the internet. In the former case, a research goal is also provided. In the latter case, both the dataset and the research goal need to be approved by the group's coach, before the first review meeting to make sure it's a realistic one. It is also possible to create your own dataset (i.e. collect data from scratch) – this is more effort-intensive, but you will be rewarded with bonus points. Some sources for datasets are:
  - https://zenodo.org/communities/seacraft/
  - https://zenodo.org/communities/spec-rg
  - Any of the primary studies you came across while performing the Rapid Review
- Based on the research goal, design a study that can address it. The goal should be refined into at least two research questions. If the dataset is linked to an existing publication, ensure the proposed new research questions are sufficiently different from existing ones. Confirm those questions with the coach to make sure they are answerable and non-trivial. Subsequently execute the study design and report on the results.
- The deliverable for this assignment is the report of the study execution, which includes the study design (protocol). Depending on the type of study, corresponding guidelines should be followed to write both the protocol and the results (e.g. the guidelines of Wohlin et al. 2012 for controlled experiments or those of Runeson et al. 2012 for case studies). These guidelines are covered during the lectures.
- If the dataset contains quantitative data, we advise the use of R-Studio to perform the analysis (download the free version at https://www.rstudio.com/products/rstudio). Of course, you are free to use other analysis tools (e.g. Python, SPSS).
- If the dataset contains qualitative data, we advise the use of ATLAS.ti. This can be downloaded from the RUG website.
- The assignment corresponds to the last 5½ weeks of the course. This means that each student member of the group is expected to spend approx. 66 hrs. of work. This should be registered in the time sheets.
- The work is meant to be conducted iteratively. The following deliverables and activities are strongly indicated (but not mandated) at the end of the corresponding weeks.

End of Week	Report (incl. Protocol)	Execution
5	Selection of dataset and goal. Formulation of Research Questions.	Setting up of analysis tool, Selection of research method.
6	First version (complete) of protocol	Dataset cleanup, Initial data analysis
7	Second version of protocol	Completed data analysis for most RQs
8	Final version of protocol	Completed data analysis for all RQs
9	First version of results	Mitigated threats to validity, Reporting
10	Final version of results	Reporting

A word of caution: Do not underestimate the time it takes to conduct the data analysis. It is not a matter of executing a couple of R scripts. Please make sure you work iteratively and incrementally with appropriate time-boxing in order to spend sufficient time on it. Make sure

that deadlines from other courses in this period do not interfere with your progress in this assignment.

General remarks for both assignments

- Read the assignment descriptions thoroughly as they contain the answers to most of the initial questions you may have.
- Both assignments are made by **groups** of 2 or max. 3 students that are self-organized, i.e. you get to pick your own team-mates. Each group is expected to assign a coordinator, who can notify the coach of the group composition, exactly after the first lecture.
- Assignment **deliverables** should be uploaded on Brightspace each week, no later than 18:00 hours on Monday. All files delivered should be in PDF, and should be named as <GroupNumber>_<AssignmentNo>.pdf
- To support the coach in providing optimal feedback in both assignments, the **changes in the document** since the last version should be clearly visible. There are different options you can use to edit your document according to your experience and preferences: Google Docs, LaTeX + Git, Overleaf, OpenOffice or MS Word, etc.
- The **participation of all members** of the groups in the weekly presentations of both Assignments in the classroom is mandatory, i.e. each group member is expected to handle part of the presentation.
- The **time-plan** of the course including the lectures, reviews, presentations and delivery deadlines is illustrated in the following table. For reference, week 46 of 2023 is November 13-19. It is highly recommended to use a shared agenda like in Google Calendar to mark all dates and deadlines.

Deliver					As. 1					As. 2
Coaching		1a	1b	1c	1d	2a	2b	2c	2d	
Present		1	2	3	4	1	2	3		
Lecture	1	2	3	4	5	6	7	8		
Quarter week	1	2	3	4	5	6	7	8	9	10
Calendar week	46	47	48	49	50	51	2	3	4	5

Grading rubric

	Assignment 1	Assignment 2
Quality of deliverables	10% Study design and study results	30% Study design and study results
	5% Artifacts (e.g. spreadsheets)	5% Artifacts (e.g. code scripts or qualitative analysis on Atlas.ti)
Execution	7% Related Work, Background and Research Questions	5% Choice of research method and formulating research questions
	18% Search and Study selection	5% Background and Related Work
	5% Quality Assessment	15% Data analysis
	15% Data extraction	15% Results
	15% Data synthesis	5% Threats to validity
	5% Threats to Validity	15% Data collection (optional - bonus points if performed)
Process and presentations	10% Presentations: content and style, answering questions	10% Presentations: content and style, answering questions
	10% Process: Teamwork & meeting deadlines, Motivation, Initiative and Creativity, Following feedback	10% Process: Teamwork & meeting deadlines, Motivation, Initiative and Creativity, Following feedback