Instruction for final thesis reports

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ABOUT THIS INSTRUCTION

This instruction covers the chapters and sections that must be contained in a final thesis report, and gives important advice on the actual content. At the end there is a table that illustrates the differences between a final thesis on bachelor level versus master level.

Read this instruction carefully before starting the thesis project and make use of it continually during the writing process.

REPORT STRUCTURE

A final thesis report shall contain the following chapters/sections. Note that the report may also contain other chapters/sections (if there are good reasons), so the list below shall be regarded as the minimum level.

- Abstract
- Introduction
- Background (*optional*)
- Theory
- Method
- Results
- Discussion
- Conclusions
- References

These chapters are now described in detail.

ABSTRACT

An abstract is a short and concise description and motivation of the studied problem, the method, as well as result and conclusions. The thesis project's contribution to the main area of study shall be made clear. What does the report say about the main area of study that was not known before? Examples of contributions could be an effect of a specific algorithm or software development method has in a certain application area.

An abstract shall normally be maximum 150 words long, and not contain any references or line breaks.

INTRODUCTION

The introduction shall be divided into these sections.

Motivation

This is where the studied problem is described from a general point of view and put in a context which makes it clear that it is interesting and well worth studying. The aim is to make the reader interested in the work and create an urge to continue reading.

Aim

What is the underlying purpose of the thesis project?

Research questions

This is where the research questions are described. Formulate these as explicit questions, terminated with a question mark. A report will usually contain several different research questions that are somehow thematically connected. There are usually 2-4 questions in total.

Examples of common types of research questions (simplified and generalized):

- How does technique X affect the possibility of achieving the effect Y?
- How can a system (or a solution) for X be realized so that the effect Y is achieved?
- What are the alternatives to achieving X, and which alternative gives the best effect considering Y and Z? (*This research question is normally broken down in to 2 separate questions*.)

Observe that a very specific research question almost always leads to a better thesis report than a general research question (it is simply much more difficult to make something good from a general research question.)

The best way to achieve a really good and specific research question is to conduct a thorough literature review and get familiarized with related research and practice. This leads to ideas and terminology which allows one to express oneself with precision and also have something valuable to say in the discussion chapter. And once a detailed research question has been specified, it is much easier to establish a suitable method and thus carry out the actual thesis work much faster than when starting with a fairly general research question. In the end, it usually pays off to spend some extra time in the beginning working on the literature review. The thesis supervisor can be of assistance in deciding when the research question is sufficiently specific and well-grounded in related research.

Delimitations

This is where the main delimitations are described. For example, this could be that one has focused the study on a specific application domain or target user group. In the normal case, the delimitations need not be justified.

BACKGROUND

Sometimes a thesis project is based on a specific assignment, making it difficult to provide the whole context in the introduction chapter without elaborating too much (the introduction is meant to make the reader interested). In such cases a background chapter can be used to provide a more detailed description of the assignment. For example, by providing a requirement specification, etc.

This chapter is only used when needed.

THEORY

The main purpose of this chapter is to make it obvious for the reader that the report authors have made an effort to read up on related research and other information of relevance for the research questions. It is a question of trust. Can I as a reader rely on what the authors are saying? If it is obvious that the authors know the topic area well and clearly present their lessons learned, it raises the perceived quality of the entire report.

After having read the theory chapter it shall be obvious for the reader that the research questions are both well formulated and relevant.

The chapter must contain theory of use for the intended study, both in terms of technique and method. If a final thesis project is about the development of a new search engine for a certain application domain, the theory must bring up related work on search algorithms and related techniques, but also methods for evaluating search engines, including performance measures such as *precision*, *accuracy* and *recall*.

The chapter shall be structured *thematically*, not per author.

A good approach to making a review of scientific literature is to use *Google Scholar* (which also has the useful function *Cite*). By iterating between searching for articles and reading abstracts to find new terms to guide further searches, it is fairly straight forward to locate good and relevant information.

Having found a relevant article one can use the function for viewing other articles that have cited this particular article, and also go through the article's own reference list. Among these articles on can often find other interesting articles and thus proceed further.

It can also be a good idea to consider which sources seem most relevant for the problem area at hand. Are there any special conference or journal that often occurs one can search in more detail in lists of published articles from these venues in particular. One can also search for the web sites of important authors and investigate what they have published in general.

This chapter is called either *Theory*, *Related Work*, or *Related Research*. Check with your supervisor.

METHOD

In this chapter, the method is described in a way which shows how the work was actually carried out. The description must be precise and well thought through. Consider the scientific term *replicability*. Replicability means that someone reading a scientific report should be able to follow the method description and then carry out the same study and check whether the results obtained are similar. Achieving replicability is not always relevant, but precision and clarity is.

Sometimes the work is separated into different parts, e.g. *pre-study*, *implementation* and *evaluation*. In such cases it is recommended that the method chapter is structured accordingly with suitable named sub-headings.

RESULTS

This chapter presents the results. Note that the results are presented factually, striving for objectivity as far as possible. The results shall not be analyzed, discussed or evaluated. This is left for the discussion chapter.

In case the method chapter has been divided into sub-headings such as *pre-study*, *implementation* and *evaluation*, the result chapter should have the same sub-headings. This gives a clear structure and makes the chapter easier to write.

In case results are presented from a process (e.g. an implementation process), the main decisions made during the process must be clearly presented and justified. Normally, alternative attempts, etc, have already been described in the theory chapter, making it possible to refer to it as part of the justification.

DISCUSSION

This chapter contains the following sub-headings.

Results

Are there anything in the results that stand out and need be analyzed and commented on? How do the results relate to the material covered in the theory chapter? What does the theory imply about the meaning of the results? For example, what does it mean that a certain system got a certain numeric value in a usability evaluation; how good or bad is it? Is there something in the results that is unexpected based on the literature review, or is everything as one would theoretically expect?

Method

This is where the applied method is discussed and criticized. Taking a self-critical stance to the method used is an important part of the scientific approach.

A study is rarely perfect. There are almost always things one could have done differently if the study could be repeated or with extra resources. Go through the most important limitations with your method and discuss potential consequences for the results. Connect back to the method theory presented in the theory chapter. Refer explicitly to relevant sources.

The discussion shall also demonstrate an awareness of methodological concepts such as *replicability*, *reliability*, and *validity*. The concept of replicability has already been discussed in the method section. Reliability is a term for whether one can expect to get the same results if a study is repeated with the same method. A study with a high degree of reliability has a large probability of leading to similar results if repeated. The concept of validity is, somewhat simplified, concerned with whether a performed measurement actually measures what one thinks is being measured. A study with a high degree of validity thus has a high level of credibility. A discussion of these concepts must be transferred to the actual context of the study.

The method discussion shall also contain a paragraph of source criticism. This is where the authors' point of view on the use and selection of sources is described.

In certain contexts it may be the case that the most relevant information for the study is not to be found in scientific literature but rather with individual software developers and open source projects. It must then be clearly stated that efforts have been made to gain access to this information, e.g. by direct communication with developers and/or through discussion forums, etc. Efforts must also be made to indicate the lack of relevant research literature. The precise manner of such investigations must be clearly specified in a method section. The paragraph on source criticism must critically discuss these approaches.

Usually however, there are always relevant related research. If not about the actual research questions, there is certainly important information about the domain under study.

The work in a wider context

There must be a section discussing ethical and societal aspects related to the work. This is important for the authors to demonstrate a professional maturity and also for achieving the education goals. If the work, for some reason, completely lacks a connection to ethical or societal aspects this must be explicitly stated and justified in the section *Delimitations* in the introduction chapter.

In the discussion chapter, one must explicitly refer to sources relevant to the discussion.

CONCLUSIONS

This chapter contains a summarization of the purpose and the research questions. To what extent has the aim been achieved, and what are the answers to the research questions? The consequences for the target audience (and possibly for researchers and practitioners) must also be described. There should be a section on future work where ideas for continued work are described. If the conclusion chapter contains such a section, the ideas described therein must be concrete and well thought through.

REFERENCES

This chapter contains a list of the used sources. Note that the most common reference formats distinguish between:

- Books
- Articles in a scientific journal
- Articles from a conference (published in a so-called *conference proceeding*)
- Technical reports such as final thesis reports or dissertations
- Manuals
- Web links

There are different available formats prescribing how sources must be listed and referred to. Discuss this with your supervisor to decide which format works best for your work. See some examples of reference formats below.

MLA Kujala, Sari, et al. "UX Curve: A method for evaluating long-term user experience." *Interacting with Computers* 23.5 (2011): 473-483.

APA Kujala, S., Roto, V., Väänänen-Vainio-Mattila, K., Karapanos, E., & Sinnelä, A. (2011). UX Curve: A method for evaluating long-term user experience. *Interacting with Computers*, *23*(5), 473-483.

Chicago Kujala, Sari, Virpi Roto, Kaisa Väänänen-Vainio-Mattila, Evangelos Karapanos, and Arto Sinnelä. "UX Curve: A method for evaluating long-term user experience." *Interacting with Computers* 23, no. 5 (2011): 473-483.

Sources must be selected with care. There is no room for using everything one can find. The selected sources must be the ones that are most relevant for the work at hand. It is also important to have good balance between scientific sources and web material. A final thesis project is a scientific work, and the authors must be able to review and select suitable scientific material. After all, the work is an in-depth study within some part of the main area of study.

This concludes the presentation of the chapters contained in the final thesis report.

A NOTE ON LANGUAGE

Make sure to use the word processor's functions for spelling and grammar corrections. This must be done before each new report draft is handed in for correction.

APPENDIX: FINAL THESIS PROJECTS ON DIFFERENT LEVELS

The following table describes the main differences between a final thesis project on bachelor level and master level. The column for master level is to be interpreted as additional requirements extending the requirements for the bachelor level.

Moment	**Bachelor level**	**Master level**
Research questions	Research questions of interest for the customer. Scientifically well formulated study.	Scientifically interesting and independently formulated research questions.
Theory	The work is characterized by knowledge application, i.e. application of tried and tested theories in new contexts. Sufficient theoretical breadth and depth for the problem at hand. Critical interpretation of relevant information. Important information about the chosen methods are considered.	Extensive survey of related research indicating breadth and considerable depth. The presentation of related research is written so that it reflects independent critical thinking and an ability to systematically evaluate and analyze complex information. Alternative methods are considered.
Method	Extensive presentation of the method which to a reasonable extent allows replication.	The choice of method is justified in relation to alternative methods in a way that indicates good methodological awareness.
Results	Correct and clear presentation of results. Decisions are justified.	
Discussion	The results are analyzed and connected to the theory. The discussion considers other perspectives with respect. The method is critically discussed in a way that demonstrates good methodological awareness. Potential consequences of limitations are discussed. Relevant ethical and societal implications are discussed.	The discussion is characterized by originality and creativity.
Conclusions	The conclusions are well grounded theoretically and empirically. The results are generalized with care.	The work is characterized by knowledge development. Conclusions are related to practical and/or theoretical implications with a starting point in the theory.
References	Sound balance between web sources and scientific sources. For the scientific sources there must be a good balance between primary and secondary sources[1].	Substantial amount of sources, chosen with care. Mainly primary sources.
Structure and formalia	Clear structure and formal language with good precision. Good balance between presentation of studied material and elaborations of own thoughts and ideas.	The academic form is flawless.

[1] A *primary source* is a research article. A *secondary source* is e.g. a textbook (which in turn is based on primary sources).