

# Guidelines for Study Projects and Final Theses at IWU-WG

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INSTITUTE FOR WATER AND ENVIRONMENT  
WATER QUALITY MANAGEMENT



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A significant part of this guideline has been taken from the corresponding versions of the Institute of Concrete Structures and Building Materials (Department of Building Materials) and the Institute of Geography and Geoecology. The authors appreciate their help and the provision of the material.

More detailed information regarding scientific writing is available at the SchreibLABOR of the House of Competence (HoC):

Karlsruher Institut für Technologie (KIT)

Fritz-Erler-Str. 23

Geb. 01.86

76133 Karlsruhe

Homepage: <https://www.hoc.kit.edu/schreiblabor.php>

# 1 Topic selection – basic considerations

Topics for study projects and final thesis are selected by the students based on their personal interest. A final thesis may be a follow-up of a study project conducted in a previous semester or it could result from a student's assistant activity at the institute. In general, students can also propose a topic by themselves. In order to enjoy a broad education, it is recommended and in the students' own interest, to prepare their Bachelor and Master theses not on the same topic and not with the same working methods.

**Study projects (module of the master's degree program “Water Science and Engineering”)** can be theoretical or experimental work, either to conduct laboratory experiments or to develop processing routines at the computer. It should be noted that due to the frequently required high amount of data, most of it can be collected by third parties. Experimental setup and methodology should be available before starting the study. The student should be able to demonstrate based on his/her experimental work that he/she can evaluate the experimental process and most importantly, the data obtained in the results.

**Bachelor's and Master's theses (final theses)** should additionally include non-experimental work. It is also possible that results from previous studies or from measurements carried out by the student himself in a well-defined period are further evaluated as part of the thesis. A thorough and critical review of the literature covering the research topic is usually necessary to evaluate one's own results.

**Most topics are mainly related to ongoing research projects within the institute. It is likely that results of final theses are to be included in final reports. Students should be aware of their responsibility during writing.**

When writing a manuscript the rules governing the **scientific writing** prevail and need to be followed (cf. among others Hirsch-Weber and Scherer, 2016). These concern specially:

- 1 the principle of objectivity and honesty,
- 2 clear definition of new terms if these do not belong to technical terminology,
- 3 methodology must be verifiable and results replicable,
- 4 complete and sound understanding of the research topic that gives answer to a research question,
- 5 a precise definition of the focus and scope of the thesis,
- 6 a clear thesis structure and outline,
- 7 a clear citation style,
- 8 a complete bibliography.

## 2 Information on the procedure

Topics for study projects or final theses are regularly offered by working research teams and advertised on the board of the institute and/or on the website: <http://isww.iwg.kit.edu/291.php>

Once the student has chosen an acceptable topic and found an appropriate supervisor, the “task description” and a timeframe for the thesis work is defined<sup>1</sup>. In some cases, the student has a period for preparatory research prior to the beginning of the thesis work. In that case, the thesis assignment is defined after that period is completed.

### Study Projects

At the beginning of the "Study Project“, the corresponding examination paper with admission by the study program service Bau-Geo-Umwelt has to be submitted to the supervisor.

[http://www.wasser.kit.edu/downloads/Pruef\\_ZulAnmeld\\_StudyProject\\_engl.pdf](http://www.wasser.kit.edu/downloads/Pruef_ZulAnmeld_StudyProject_engl.pdf)

### Bachelor’s and Master’s theses (final theses)

Registration for Bachelor’s and Master’s theses is done online via the CAMPUS system. Registration and admission must take place **before the beginning of the thesis** (start date).

<https://campus.studium.kit.edu/>

### Important!

**Experimental work in the laboratory may only be started after the student has received instructions in laboratory safety.**

Working on the thesis includes in addition to the final manuscript a final colloquium, which is due within one month after submission of the final document. This applies to Master thesis, Study Projects and Bachelor thesis.

In arrangement with the direct supervisor, a „Kick Off“ presentation (about 10 min) can be set, usually no later than 2 weeks after starting date. This presentation should give the student the possibility to structure the topic and define milestones at an **early stage**, which is essential to complete a thesis successfully. Additionally, suggestions and general remarks from non-directly involved colleagues will help the student to refine the research proposal.

Submission of the final thesis is usually in digital form by handing in a pdf-document. This document should be sent to the examiner as well as the secretary for documenting the final submission.

Late submissions imply that the thesis will automatically be graded as „unsatisfactory“ (5.0). If the student considers that he/she is not able to submit by the deadline, it is recommended to inform the supervisor as soon as possible. If necessary, an application for an extension of the deadline must be submitted to the examination board.

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<sup>1</sup> Starting date, submission deadline as well as complete duration of a final thesis is defined in the examination regulations of a study program

A date for the final colloquium is arranged at the day of the final submission at the latest. This final presentation is mandatory and constitutes your thesis defense. It consists of a 20-minute presentation followed by 10-minute question and answer session.

### **3 Some notes on editing**

#### **3.1 Thesis structure**

The final thesis contains a title page containing the following information:

- 1 Type of thesis (study project, bachelor, master thesis),
- 2 Title of the thesis,
- 3 Candidate's names, registration number and study program,
- 4 Supervisors' names,
- 5 Submission date and place.

This is followed by an abstract in German and English, a written statement on the independence of the work and a declaration of consent for the rights of the final thesis. The following statement should be used:

„I truthfully declare that I have produced the work independently, that I have given complete and exact details of all tools used and that I have identified everything that has been taken from the work of others, either unchanged or with modifications. I truthfully declare that I have observed the KIT Statutes for Safeguarding Good Scientific Practice in the currently valid version.

Furthermore, I agree that my final thesis is placed in the library of the Institute of Water and Environment, Water Quality Management and may be replicated for research and teaching purposes.“

(Place, date and signature)

The declaration is followed by the table of contents, lists of figures, tables and abbreviations and subsequently the main body of text. The structure of the thesis is complete with the bibliography and optional appendices (annex).

The subdivision level in the table of contents is to be done following the Wittgenstein's decimal system (see table of contents of this guideline). Any other classification may be used only after consultation with the supervisor.

Should the manuscript include tables, diagrams, photos etc. in color, these should be easily recognizable and readable in a copy of the original document.

## 3.2 Outline

The outline gives the first impression about the structure of the thesis and a general overview of the content. The outline should be clear, succinct and concise.

The structure of the main text differs depending on the topic and the type of thesis. Normally, theses can be differentiated into experimental work (“wet” or numerical/theoretical) and literature research studies.

The outline for an experimental work is shown as an *example* as follows:

- Indices (Table of contents, overview of figures and tables)
- Introduction
- Background (Literature review)
- Materials and methods
- Results and discussion
- Summary, conclusions and recommendations
- Bibliography (List of references)
- Appendices

A general structure for literature studies or non-experimental work cannot be specified. In this case, the structure depends specially on the topic and the content of the work.

The subdivision level in the outline should not exceed the fourth level.

### 3.2.1 Introduction

A short chapter that includes the problem statement, the scientific objectives as well as the research questions and motivation. It leads the reader from the known to the unknown and gives a preview of the thesis.

### 3.2.2 Theoretical background

In this section, a critical review of the theoretical and/or empirical literature is provided. This contributes to a deeper understanding of the topic and points toward the answer of the problem of the study. Only content which is relevant for the subsequent chapters is introduced and explained here.

### 3.2.3 Materials and methods

This part includes a general description of the methods and research design. Detailed information about data collection and data analysis should be presented in a comprehensive and transparent manner.

### 3.2.4 Results and discussion

This chapter addresses the results of the data analysis and implications of the findings. It outlines as well the tests of the research questions/hypothesis. Tables and figures should be used to illustrate and summarize all numeric information. Original data is included in the appendix chapter.

The discussion section adds scientific value to the student’s work. The purpose is to evaluate the meaning of the findings in relation to the theoretical body of knowledge and in some cases to existing research studies or empirical literature. Are the results in accordance with accepted theory? How do you explain unexpected or inconsistent results? What are the limitations of the

methodology chosen? These among other questions should be addressed when discussing the results.

### **3.2.5 Summary, conclusions and recommendations**

The summary gives an overview of the study, describe the significance of the results and present the new knowledge that has been gained. In this chapter, areas for future research are proposed. The thesis ends with a brief conclusion that provides closure.

## **3.3 Written documentation**

### **3.3.1 General information**

Study projects and final theses can be written in German, alternatively in English. Writing the thesis in another language requires prior consultation with the supervisor.

When writing a final thesis, attention should be paid to three important characteristics of scientific writing, which are precision, clarity and brevity. This refers not only to the overall structure of the work but also to the individual chapters by describing the content, procedures and conclusions.

Clear thoughts and careful writing indicate there are no gaps in the flow of logic and allow the new findings to be replicated in other fields of knowledge.

Considering the above mentioned, it is important to limit the extent of the thesis. Keep it short and simple! The final thesis should have a size of around 50 to 60 pages (not including appendix), a study project about 30 pages.

### **3.3.2 Formal aspects**

Thesis evaluation rely mainly upon the content rather than the form of the thesis. However, a proper layout makes the thesis visually attractive and easy to read, here some recommendations:

- Line spacing not too small so that the text is easy to read. (multiple line spacing 1.3),
- Font and font size: Arial, 11 pt,
- Thesis reports could be printed and submitted using recycling paper,
- Margins not too small (> 2 to 2,5 cm).

A suitable template is provided by the supervisor.

### **3.3.3 Diagrams, graphs and tables**

Coordinates in diagrams and/or graphs are correctly labeled (indication of variables and units). Captions are given to all diagrams, graphs and tables containing a number<sup>2</sup> and where appropriate the source must be specified. Table captions are placed above the table, whereas figure and diagrams captions are placed below. One example of a figure caption is shown here:

Fig. 2.8: Trickling filters with nozzles (Imhoff, 1993)

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<sup>2</sup> commonly as chapternumber.figurenumber (see example) or chapternumber-figurenumber

Figures and tables are numbered<sup>3</sup> consecutively. In addition to the table of contents, a list of figures and tables must also be included.

Figures should be clearly recognizable, otherwise they should be avoided. Figures provide benefit compared to ordinary text but its meaning behind should be not omitted in text. References to every figure, diagram and table should be present in the text<sup>4</sup>.

### 3.3.4 Bibliography, references

Correct citation is one of the fundamentals of scientific writing. The five basic rules of citation are (c.f. among others Hirsch-Weber and Scherer, 2016):

- The citation has a defined citation style.
- The citation is made directly after mentioned in text.
- The citation should be accurate.
- The citation should be appropriate.
- The source of the citation should be fully documented.

Generally, a distinction is made between a “quotation” and paraphrases. The quotation uses the same exact wording as the original source with quotation marks at the beginning and at the end. It follows an immediate reference in text or a footnote with the appropriate information at the bottom of the page.

More frequently, there are citations that describe correlations or contain results and conclusions. These are referenced in text using the author’s name and year of publication, i.e. Mustermann (19XX) or (Mustermann, 19XX).

**All** referred sources, maps, statistics and other documents used in the study are included in the bibliography with complete and accurate bibliographic information. It is placed at the end of the thesis and must be free of faults to allow the reader to track down the source used.

The bibliography or list of references is sorted in alphabetical order by the author’s last names. Two or more entries by the same author(s) are listed in chronological order with the earliest first. Sources with the same author and from the same year are distinguished by a lower-case letter after the year (a,b,c, etc.). By multiple authors, all author names are included in the reference starting with the author’s last name that was mentioned first. If the author is not available, include the name of the organization (in capital letters) or editor that published the source. If an author has published books together with other authors in addition to his individual work, the latter should be listed first.

Citations may look different, depending on what is being cited and which style was used to create them. Any citation style contains common standard elements including author(s) names, title, date of publication, page numbers and volume and issue numbers.

Most importantly is to choose a citation style and be consistent with it throughout the document, e.g. by **monographs**:

Imhoff, K. (1993): Taschenbuch der Stadtentwässerung, 28. Auflage, München, Wien: Oldenbourg

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<sup>3</sup> in popular word processing systems as an automated feature

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or for **journal articles:**

Kolbe, D. (1996): Kosten für Abwasser in den neuen Bundesländern, Korrespondenz Abwasser, Heft 1, 43. Jahrgang, S. 41 - 43

or for **contributions from publication series:**

Jakobs, J. (1998): Quantifizierung der Wirkung von Kanalnetzbewirtschaftungsmaßnahmen, Schriftenreihe des ISWW, Universität Karlsruhe, Bd. 84

It is important for **books/publication series with contributions by multiple authors** to include the book's title as well as the article's title:

Metzger, J. (2006): Endokrine Spurenstoffe im Abwasser: Vorkommen, Verhalten und Eliminationsmöglichkeiten. In: Hahn, H.H., Hoffmann, E., Blank, A. (2006): Abwasserproblemstoffe – Erfahrungen mit neuen Produkten und Technologien. Schriftenreihe des Institut für Wasser und Gewässerentwicklung, Bereich Siedlungswasserwirtschaft und Wassergütwirtschaft, Universität Karlsruhe, Bd. 123, S. 1-8

The list of references must include all references cited in the text of your paper. The only exceptions to this rule are personal communications and classical works.

There is now different citation software freely available on the internet that assist the writer in tracking sources used and building in-text citations and bibliographies. Further citation software is available for free to KIT students (<https://www.scc.kit.edu/dienste/4800.php>).

### **Electronic sources: online items of web addresses**

Scholarly sources (peer-reviewed, verified) or print sources, which have been published, are to date the only accepted in scientific writing. The problem of citing websites is that websites change, and the address that was used will not always be active when the reader tries to view a source. There is no standard format for citing an online source, but these following hints might be useful:

- Provide an original printout in the annex chapter (as for newspaper articles).
- Contact the author by email and inquire if there is a print source available.
- Save the online source (e.g. pdf format) in a flash drive.
- Indicate in the bibliography that it is an online source.

If an online source is listed, it must include the full URL for the page, the date it was accessed and a full account of the person that sponsors the site. The general form of a citation from an Internet source is:

Author's name. (Date of Access [dd.mm.yyyy], optional time): Title. Subtitle - Online-Information. URL (complete).

Online sources in which is not possible to identify the author or the publisher should not be provided since these are not reliable and verifiable sources. Electronic sources with a DOI (Digital Object Identifier) can be listed in the references including only the DOI, without indicating the URL.

## 4 Supervision

As part of a master thesis process, the student is supervised by a scientific researcher of the institute. The supervisor provides feedback at different stages throughout the process of preparing a master thesis. His/her role is limited to guide the learning process, since the student must **carry out the work independently**.

In case of study projects and bachelor thesis, the supervisor's role covers more "training" since these are generally the first major and independent work in the course of study.

## 5 Thesis evaluation

The following evaluation criteria are important for the supervisors when assessing a student's work:

- Clarity of ideas, flow of logic in the structure (comprehensible for fellow students with some expertise in the field),
- Rationale for the conceptual experimental design/theoretical framework,
- Literature review („Extent“ of the bibliography, student's understanding of the topic, critical review and justification of hypothesis),
- Compactness and brevity of theoretical/methodological framework – selectivity (e.g. the theory of a n+1-thesis on flocculation should be presented for the nth-times in an appropriate length),
- Student's ability to develop new methods, solve problems (e.g. modified methods in chemical analysis, modified experimental setup, adapted computer software, etc.),
- Results interpretation (plausibility, practical relevance),
- (constructive) criticism of one's own work,
- Discussion and comparison of the new findings with existing research studies and empirical literature,
- Style: quality of graphs, tables and layout (clear arrangement etc.),
- Completeness and consistency of the bibliography

## 6 Bibliography

Hirsch-Weber, Andreas; Scherer, Stefan (2016): Wissenschaftliches Schreiben und Abschlussarbeit in Natur- und Ingenieurwissenschaften. Grundlagen - Praxisbeispiele - Übungen. 1. Aufl. Stuttgart: UTB GmbH; Ulmer (UTB, 4450).