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Tallinn University
School of Natural Sciences and Health

**Guideline of the procedure of writing and defending Bachelor and
Master's theses for all natural sciences specialities**

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1. Scope

The guide specifies the procedure of writing and defending Bachelor and Master's theses for all natural sciences specialities of the School of Natural Sciences and Health. The general principles of Bachelor and Master's theses have been established in the study regulations (TLU homepage>Studies>Student gateway>Study regulations).

The guide applies to all theses of 3+2 study programme natural sciences specialities in the School of Natural Sciences and Health; if the study programme has specific features, which are different from the guide, you should follow the latter. In the formatting of all written works, the ethics of scientific work need to be followed, see <http://www.eetika.ee/et/teaduseetika/teadustoo>

2. The nature of the thesis

A thesis is a student's individual piece of work completed under the guidance of a supervisor, the objective and study outcomes of which are prescribed by a respective study programme (see the Study Information System)

A thesis can be either empirical or theoretical research, but also applied (development) work. Empirical research relies on material gathered by the author or acquired from databases. Theoretical work is based on literary sources. A thesis must have a clearly worded objective and research questions or hypotheses which shall be answered or checked by using a scientific approach, which results in grounded conclusions. Referred overviews, which are limited by the reproduction of existing knowledge, are not accepted as theses.

Applied research involves solving a practical task (e.g. compilation of a waste management plan or handbook of an environmental management system, establishing experimental work guidelines etc.).

The volume of a Bachelor's thesis is, depending on the study programme and the version of study programme, 6 to 12 ECTS credits. *The length of the main part of an exploratory Bachelor's thesis is 30–50 pages (20–40 pages in physics). The volume of the Master's thesis is 24 or 30 ECTS credits. The length of the main part of an exploratory Master's thesis is 50–80 pages, 16 or 18 ECTS credits and 40–60 pages in teacher education. The pages are counted from the title page up until the end of the references. The main part of the thesis can be followed by up to 20 pages of appendices. It is suggested to put substantial appendices on an additional digital data medium for the print version of the thesis.*

3. Choosing the topic

The student chooses their thesis topic according to their study programme and their specialisation desire. The topic is usually the result of independent thinking of the student, but one can also choose from the topics offered by the lecturers or researchers of Tallinn University. In choosing the topic, one is guided by the studied problem, which is why choosing the topic goes hand in hand with delving into the problem through literature. The preliminary topic might be specified during the research. When choosing the topic, the aims of the study programme and study results need to be considered, the achievement of which has to be supported by the thesis. For additional guidelines for finding the right topic, see Aarma (2008, pp. 51–60) and Hirsjärvi et al. (2010, pp. 60–82).

Topics that have been written on in Estonian universities in the past three years or which are being written on in TU (topic is registered) need to be avoided. It is allowed exceptionally with the consent of the supervisor and relevant reasoning. A relevant reason would involve different research questions, different study methods etc., and it has to be presented in the introduction of the thesis. Information about the defended theses can be received from the homepage of the School of Natural Sciences and Health, while information about the theses being written can be received from the study counsellor and specialists of the study programme.

4. Supervision

Bachelor's thesis can be supervised by a lecturer, researcher, or PhD candidate, who has at least a Master's level degree or an equal level of education.

The supervisor of a Master's thesis has to 1) have a PhD or equal qualification; 2) have a Master's level degree or equal qualification and at least five years' experience of research and development in the area of the Master's thesis; 3) be an acknowledged expert in their profession, who has at least a Master's level degree or equal level of education.

The student has to be active in their choice of a supervisor. Firstly, the student has to look for a supervisor candidate from the lecturers, researchers and PhD candidates of TU, whose study area would best meet the topic. The search for the supervisor candidate begins from the academic orientation of the natural sciences and sustainable development or natural courses and technology didactics of the School of Natural Sciences and Health, and in the case of reasoned necessity, the search is extended to other academic orientations or units. In the case of choosing a topic from the topics offered by an academic employee of TU, the person who offered the topic should be approached for supervision. If the student wishes to write their thesis on a topic chosen by them, they have to approach a lecturer whose study area best meets the topic. The BA thesis usually has one supervisor. If it is justified by the special nature of the topic, the research can have a co-supervisor with the consent of the study programme administrator.

In the case of there being no suitable supervisor in TU, the supervisor of the thesis or co-supervisor can be from outside of TU. If the supervisor is from outside of TU, there should usually be a co-supervisor (so-called academic supervisor) from the employees of the academic orientation of natural sciences and sustainable development or natural sciences and technological didactics. The study programme administrator shall approve the choice of the supervisor and then the consent of the candidate for supervision needs to be applied for.

The tasks of the student when compiling the thesis are:

- 1) to compile the research action plan, to find and work through relevant literature, to compile the results of the research into an appropriate thesis;
- 2) to submit the parts of the thesis to the supervisor to be read and commented upon according to the agreed action plan;
- 3) to submit the thesis that meets all criteria by the deadline and rules set by the academic unit.

The tasks of the supervisor are:

- 1) to assist the student in choosing the topic, formulating the research problem, selecting methods, selecting relevant literature and other sources, and help in providing scientific credibility;

- 2) to co-ordinate the research action plan, counsel, supervise, and consult with the student during the process of conducting research in all its phases;
- 3) to verify that the student's research meets the requirements set with respect to the content and form, and confirm by signature that the thesis complies with the requirements and is allowed to proceed to defence.

The role of the supervisor is guiding and advisory. In co-operation with the supervisor, the student words their preliminary title, aim and research questions, on the basis of which the topic shall be registered. The supervisor and student shall agree on the timetable for compilation of the thesis. The student can only start their research after the supervisor has approved the research methods. The student has to notify the supervisor about the course of the work according to the agreed timetable. The student is obliged to notify the supervisor about emerging difficulties and possible changes in the aim of the work, research questions, and methods. The supervisor shall follow the compliance of the work with substantial and formal requirements: draws attention to mistakes and deficiencies in the work, primarily in the implementation of the methods, argumentations, structure, terminology usage, and formatting. The supervisor is not a co-author nor the thesis editor, correcting language and style mistakes is not their task. The student is solely responsible for the correctness of the data and conclusions presented in the thesis and the required formatting.

The final version of the thesis needs to be submitted to the supervisor by the agreed deadline, but no later than five working days before the thesis submission deadline. The supervisor has to have time to look through the thesis before the submission deadline for the defence and decide whether to allow it for defence, which is confirmed by signature on the thesis. In justified cases (e.g. being abroad), the supervisor can sign the thesis digitally.

5. Confirming the thesis topic and supervisor

The director of the institute shall confirm the thesis topic and the supervisor by their order. The student has to fill in an up to standard registration sheet for the confirmation of the topic and supervisor, which is (digitally) signed by the student and the supervisor. The form can be received from the homepage of the School of Natural Sciences and Health or from the study specialist. The registration sheet is submitted to the study programme administrator for co-ordination. The thesis registration sheet needs to be submitted to the study programme administrator at the latest one week before the thesis approval deadline set in the academic calendar.

After confirming the supervisor, the supervisor can be changed by a justified application of the supervisor or the student. The application is submitted to the study manager of the institute.

6. Main structure of the thesis

The thesis has the following parts:

1. title page,
2. confirmation of authorship on the back of the title page,
3. abstract,
4. table of contents,
5. abbreviations (if necessary),
6. introduction,

7. main part,
8. summary,
9. summary in a foreign language,
10. list of works (sources) cited,
11. appendices (if necessary).

The outline of the main part of the thesis depends on the nature of the thesis. Empirical research usually consists of the following parts:

1. theoretical background and overview of prior studies,
2. material and methods,
3. results,
4. discussion.

The structure of theoretical and applied research can differ from the above, e.g. separately titled methods as a structural element, results or discussion can be absent.

Outlining of parts (chapters) into subsections has to take place in a way which ensures comprehensive, logical, and cohesive presentation. The smallest amount into which a part or a subsection can be outlined is two. Titles have to reflect the contents of the (sub)section as shortly and accurately as possible. Titles are usually not presented as questions nor are they abbreviated.

Sometimes, for a better overview, it might be useful to present the conclusions under the results as a separate section or combine the results and discussion if it simplifies the comparison of the results with the results of other researchers.

The list of terms and abbreviations is appropriate if the thesis includes a number of area-specific terms and little known abbreviations. The definition of contents of terms and abbreviations presented need to be adhered to throughout the entire thesis.

Short introductions may be at the beginning of chapters, summaries and an introduction to the next section at the end, which help to see the cohesiveness of the thesis and avoid parts which are not in compliance with the aim of the thesis.

6.1. Title page and confirmation of authorship

The upper edge of the title page has the name of the facility. The end of the first third of the page has the full title of the thesis. A suitable size for the title is 20–24 points.

Right above the title shall be the author's name and underneath the title is the thesis type: BA or MA thesis. At the right edge of the paper, at the end of the second third of the paper, shall be the name of the supervisor. The place and year shall be printed on the bottom edge. The back of the title page shall include the confirmation of the authorship and the signatures of the supervisor and the study programme administrator, which allow it for defence. In justified cases (e.g. being abroad, etc.), the supervisor may sign the thesis digitally only. The form of the title page and confirmation of authorship are in appendices 1 and 2.

6.2. Abstract

The length of the abstract is 100–250 words, which reflects the aim of the thesis and results concisely. The abstract has to be clear and give a sufficient overview of the thesis without having to read the other parts. The abstract shall not include new information, which is not in

the thesis, shall not raise new problems or have references. The beginning of the abstract shall include the thesis title and the name of the author and at the end, on a separate row, there are 5–10 keywords, which best characterise the thesis contents. For additional information, read Hirsjärvi et al. (2010, pp. 232–234).

6.3. Introduction

The introduction gives the reasons for the topic choice and shows what the thesis is dealing with exactly. This briefly describes the wider problematics to which the presented topic belongs and the aim of the thesis by showing how the thesis deals with the problem by posing research questions or hypotheses, which are the focus of the thesis. It is important to remember that they are co-ordinated. Their more detailed treatment is presented in the theory chapter. The introduction does not present the research results. The introduction may present the specific limitations of the scope of the thesis and describe the structure of the thesis. In the case of research, which is based on literature (theoretical), the introduction might explain the principles of the choice of literature.

The author of the thesis chooses whether to thank the supervisors and other people who have substantially helped in the completion of the thesis in the introduction, summary, or in a separate paragraph after the summary. The length of the introduction is 1–2 pages.

Read more about the introduction in Aarma (2008, pp. 89–90) and Hirsjärvi et al. (2010, pp. 235–237).

6.4. Theoretical background and overview of prior studies

This creates a framework for the thesis and shows the place of the questions dealt with in the thesis in the knowledge system so far. The theoretical part is limited to items related to the researched topic. The explanations of conceptions and terms are relevant here. The presented theoretical background has to demonstrate that the student has thorough knowledge about the topic, understands its meaning and knows the important research conducted in the area. In an exploratory thesis, this section should demonstrate the research object and substance, i.e. which part of the object is dealt with.

In an applied thesis, this section should include an overview of other conducted studies (e.g. plans), relevant legislations, and standards related to the topic.

The theoretical part relies on literature and all the referred to statements have to be referenced correctly.

6.5. Material and methods

The methods have to give a sufficient explanation about how the answers to the research questions are found. This includes the choice of data used in the thesis, planning the measurements, measurement techniques or databases, critical evaluation of the reliability of the data and the data processing techniques.

This chapter presents

- in the case of a field study, data about the location of the research area with the relevant description of the conditions of areas;
- in the case of an exploratory thesis, principles of planning the experiment and the

- description of conducting the experiment;
- in the case of a database-based thesis, their origin, location, structure, usability, and other necessary descriptions;
- in the case of questionnaires, the principles of how they are conducted and the choice of used methods in the compilation of the questionnaire, participants, questionnaire method, analysed text etc. (questionnaires, answers, text examples may be presented in appendices);
- in the case of measurements and analysis: what exactly was measured and how, who performed the lab analysis and how;
- description of data processing methods; if necessary, the reason for their selection, in the case of data processing kits, the name and number of the version;
- in the case of an applied thesis, an explanation of which method was used in solving the applied task.

If possible, there needs to be a choice between different research methods and a relevant reason shall be given. If using a method that has been developed and is widely used by other authors, a short description and reference to respective sources is sufficient. If the author has invented the method themselves or has modified the existing methods, this needs to be clearly expressed and described in detail.

If the data has been collected and analysed collectively, all the participants need to be named and the contribution of the author defending the thesis shall be determined.

Material and methods have to be presented in such detail that the reader could repeat the research presented in the thesis if they wish.

In the case of a literature-based thesis (theoretical), a separate material and methods section may not serve any purpose.

6.6. Results

The observation results or measurement data and data processing results are presented. If the initial data is substantial, they need to be presented in the appendices and the results of their processing should be in the results section. If the thesis has an independent discussion section, the results are in a statement, fact-presenting style and without discussion, without connection to other studies and without evaluation (except for the evaluation of their reliability). For more compendious presentation of the results, tables, drawings, schemes, photos and number drawings (e.g. graphs and maps) are used.

6.7. Discussion

The discussion shows whether the answers to the questions raised in the introduction are reached and how. The discussion has to show that the student can differentiate facts, grounded positions, and evaluations. The discussion relies on the data received by the author (see chapter 6.6) and their interlinking, as well as the connection with the positions of other authors and theories or conceptions. The ways of thinking characteristic of a scientific approach are used here: comparison, analysis, synthesis, generalisation, which help to reach grounded conclusions. The (collaborative) results of the discussion may, besides answers to research questions, be other conclusions, including new justified research questions and hypotheses, the further research of which could be worthwhile.

If the results and discussion have been presented as a joint chapter, the presentation of result-based facts is followed by associating them with the model or conception offered by the author and the results of other researchers.

6.8. Summary

The summary includes results about the entire thesis. It presents the main conclusions (positions) in the same order as in the results section. Then a general evaluation is given to the achievement of the set goal, to the fulfilment of set tasks, verification or falsification of the hypotheses (if they have been established). The conclusion could also include proposals on how the research of the studied problem could continue – this is relevant especially in those cases when the problems dealt with in the Bachelor's thesis are planned to be transferred to the Master's thesis. The suggestions or proposals could be presented as points (theses).

The summary does not produce new data, conclusions, which have not been presented in the text before, nor does it establish new problems. It also does not include references to the text (e.g. "as stated in chapter 3") or to the literature.

6.9. Summary in a foreign language

Gives a brief overview of the whole thesis: title, aim, research questions or hypotheses, used methods, results. The summary in a foreign language starts from a new page and includes the thesis title in a foreign language and the author's name.

If the entire thesis is in a foreign language, the summary needs to be written in Estonian.

6.10. List of references

All of the written sources referred to in the text have to be present in the list of works cited and vice versa – all of the works in the list of works cited have to be referred to in the text (see chapter 8).

6.11. Appendices

The appendices include materials, which are only interesting for those who wish to familiarise themselves with the problem more thoroughly, and the absence of which does not harm the integrity of the work (initial data, tables, maps, photos, software, graphs). Appendices also include large and bulky tables and drawings, which would split the thesis contents in the text too much. The appendices are numbered (Appendix 1, Appendix 2 etc.) and titled (the title requirements are the same as for tables). Each appendix has to have a reference in the text. The appendices are numbered in the order of their reference. For example: *The initial data received by using the named methods is presented in appendix 1.*

It is recommended to segregate the appendices from the rest of the thesis with a separate sheet, with "Appendices" written in the right-hand corner. The suggested font size is 18 pt.

7. Defence and assessment of the thesis

In order to defend the thesis, it needs to be submitted in two copies with a signature of the author and the supervisor to the respective study programme study specialist two weeks before the date of defence. One copy has to be in adhesive binding and the other one can be in coil binding. A PDF file of the thesis with the author and the supervisor's digital signature

needs to be submitted to the study specialist by the same time. In justified cases (being abroad etc.), the supervisor may sign the thesis digitally only. Late works may not be allowed for defence. The author has the right to take the thesis back on the day before the defence at the latest; a thesis that has been taken back can later be submitted again.

If the reviewer is suggested by the supervisor, the study programme administrator needs to approve it; in other cases, the study programme administrator shall find the reviewer. The qualification requirements for the reviewer are the same as for the supervisor. The reviewer has the right to receive the thesis at least seven days before the defence. The reviewer sends their written review to the study specialist of the study programme three working days before the defence at the latest. The review contains a general evaluation with regard to the formatting and contents as well as general questions about the thesis contents (there is no need to submit the academic discussion questions in writing). The review manual is in appendix 3. The author of the thesis gets to familiarise themselves with the review on the working day before the defence at the latest. The fact that defence of the thesis has been allowed is confirmed by the study programme administrator by signing the title page.

The thesis is defended publicly. The defence can be closed if it is justified. In order to change the defence to a closed one, or to limit the spread of the thesis, the student has to submit a written application according to the procedure set in the rules of the study regulations.

An author of a Bachelor's thesis shall receive up to 10 minutes, a master's candidate up to 15 minutes, to present the main points and results of their thesis. Then the thesis supervisor will present their opinion. After that, the reviewer will get to speak, give their opinion about the thesis and start, preferably in a question-answer form, an academic discussion with the author of the thesis. The presence of the reviewer is generally required during the BA thesis defence; in exceptional cases, there could be a written opinion of the reviewer. After the discussion, all the listeners shall have the right to ask questions and the author of the thesis shall conclude the defence with brief final remarks.

When evaluating the thesis, the committee shall follow the criteria given in Annex 4, also the criteria in Annex 5 for teacher education study programmes and shall consider the following:

- Achievement of the set goal,
- Knowledge of the topic,
- Formatting of the thesis results,
- the student's performance at the defence (presentation, discussion).

The committee shall announce the defence result on the same day immediately after formatting the protocols.

The review manual of the natural sciences theses of TU School of Natural sciences and Health

This manual is a reference material for the reviewers of natural sciences Bachelor's and Master's theses.

Upon reviewing, please note the following:

The aim of the thesis and its attainability

- Is the problem and aim of the thesis clearly worded, the relevancy of the topic justified and the content in compliance with the title of the thesis?
- Are the necessary research questions, research tasks or hypotheses (depending on the thesis focus) clearly worded for achieving the aim?
- Are the conclusions in compliance with the raised research questions (with the tasks and hypotheses)?
- Have the applied (development) research results been tested in practice?

Knowing the topic

- Are the theoretical background of the topic and the research of other authors dealt with adequately?
- Is the selected research method valid, clearly described and expertly used?
- Are the results presented clearly and unambiguously?
- Are the discussion, conclusions and suggestions (depending on the thesis focus) sufficiently grounded (factual basis, logicality of the reasoning, compatibility with other research, etc.)?

Formatting

- Is the thesis structure logical and its presentation rational (e.g. order of the parts, connectedness, volumes, using drawings and tables)?
- Is the thesis compliant with the requirements described in the thesis guidelines (including formatting, referencing, linguistic correctness)?

General evaluation

- Do the thesis results show the author's contribution in a way that corresponds to the content and volume of the BA/MA thesis (*1 ECTS credit = 26 hours of work*)?
- Does the thesis include other positive characteristics, questionable matters, or deficiencies that should be brought to attention?

Finally, give the thesis a summarising evaluation on the basis of the above-mentioned points, but do not offer a suggested mark. The review should not reflect the thesis structure (e.g. number of chapters, drawings, etc.).

The review should include questions to the defender that need to be answered during the defence.

The recommended length of the review written in free form is up to two pages.

In addition to the signature, please add the reviewer's academic degree, job title, place of work and the date on the review.