What is a master’s thesis?

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ELEC-E0110 Academic skills in master’s studies
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Aalto University
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What is a thesis?

- **Project where the student aims at solving a problem relevant to the field of study**
- **Based on existing scientific knowledge**
- **Conducted according to**
  - Principles of scientific research
  - Good engineering and scientific practices
  - Ethical guidelines
- **Documented in a scientific thesis report**
  - Summarizes the relevant existing knowledge on the topic area
  - Describes the own research by the student during the project

Master's thesis…

- tests and evaluates the student's maturity
- demonstrates the student's competences
- shows the student's ability to work independently and methodologically
- is a self-sufficient report in standard written form with necessary references (and potential appendices)

Learning outcomes

- **Problem-solving skills**
- **Skills in applying scientific and engineering theories and methods in the topic area**
- **Project management skills**
- **Skills in scientific and professional communication**

(School of Chemical Technology 2018)

What makes a master's thesis?

On a general level, the thesis must have

1. **Problem**
2. **Methodology**
3. **Solution**
4. **Verification/validation/testing of the results (and evaluation of your own work)**

1. Problem

- Solution for the problem is the objective of the thesis
- There must be some novelty in the problem: nobody else has solved it in the presented format (if has, the work can be claimed as plagiate)
- Problem must not be too broad – this will easily lead to a superficial work (contribution to new knowledge is not evident)
- Too narrow problem-setting is rarely met – but too narrow scope will not suffice as a master's thesis

2. Methodology – the how

- **Methodology is your systematical way from the problem to the solution**
    - Mathematical modelling or simulation of a phenomenon and reporting of the results
    - Use of a systematical method to design a system, a device or a programme
    - Statistical analysis, optimization techniques, concept modelling
    - Measuring something in a novel way – the method itself becomes the object of the study
    - Analysis based on examples (case study)
    - Comparative research (comparing phenomena based on certain criteria)
    - Qualitative research methods: surveys, interviews, …
- **The methodology section of the thesis should accomplish two tasks:**
    - Should allow readers to, if necessary, reproduce your experiment, design, or method
    - Should help readers to “anticipate” your results
- **Finding the most appropriate method to test and evaluate a product, phenomenon etc. may itself be the target of a study**

3. Solution

- **Solve the problem systematically and report the results**

3. Verification/validation/testing of the results, evaluation of your own work

- **Show that you have done good work**
- **Show that the result is ”correct”**

Thesis types

- Main principles of a thesis are general and common
- However, there are different thesis types
  - Theoretical
  - Experimental
  - Research-oriented
  - Design-oriented or development-oriented

Thesis structure

- **How you present the described substance and methods of the thesis**
  - Bring together in a scientific format the whole process:
    - Problem, theory, execution (measurements, coding, calculations etc.), presentation and analysis of results, and conclusions
  - Commonly follows the IMRAD-structure
    - Introduction Method Results And Discussion)
- **To consider in thesis writing: chapter titles, structure inside the chapters, academic language**
- **The course ELEC-E0210 Master's thesis process focuses on this topic**

MSc thesis vs. BSc thesis

- **Typical BSc thesis at Aalto**
  - Literature survey without experimental part
- **MSc thesis**
  - Experimental part is usually the key issue
  - Build a hypothesis when defining your research questions
  - Test the hypothesis or prove it with the selected methods

Thesis evaluation

The main areas of evaluation affecting the grade:

- Definition of research targets and research area
- Familiarity with the research area
- Methods and conclusions
- Contribution and overall management of the work
- Scholarly presentation and use of language
- Time used in the thesis (target time 6 months)

Source: ELEC Guideline for thesis evaluation (available in Into)

In more detail…

Definition of research scope and goals

-The research scope has been defined.
-The goals of the thesis are evident.
-The research questions and hypotheses contained in the scope of research and goals are evident from the thesis.

Command of the topic

-The student demonstrates command of the topic and understanding of the scope of research.
-The student demonstrates understanding of the relevant theoretical framework.
-The student demonstrates skills in making use of literature and other sources of information.

Methods and conclusions

-The student demonstrates ability to choose justified methods for reaching the goals.
-The student demonstrates ability to apply the chosen methods.
-The thesis contains references to scientific publications.
-The thesis presents well-founded conclusions drawn from the results.
-The results answer the research questions presented.

Contribution to knowledge and thesis structure

-The thesis is relevant to the set goal.
-The thesis is a well-organised logical whole.
-The thesis makes an original contribution to knowledge, i.e. it is produced by the student.

Presentation and language

The overall appearance of the thesis is appropriate.
The thesis contains no such grammatical or spelling errors that complicate reading.
The thesis is written in coherent, formal style. The thesis is a well-organised coherent whole.

Master’s thesis topic

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Finding a topic

- **Students are responsible for finding the topic**
  - No one will propose you to make a thesis (unless you are lucky)!
- **The topic might emerge from**
  - Business and industry
    - Research and development project carried out for a company
  - Academic community
    - Research and development project carried out for a department of the university
  - Personal interest
    - Independent topic agreed with a professor

Where to look for topics 1/2

- **Companies**
  - Announcements (career websites etc.)
  - Contact companies directly and ask
  - You can also consider ”selling” your idea for a company as a thesis topic
- **Department**
  - Usually no open calls or lists of available topics
  - Lists of topic areas per supervisor in each programme are currently being updated (EleNano example: https://wiki.aalto.fi/display/nanoradthesis/Master%27s+Programme+in+Electronics+and+Nanotechnology+-+thesis+supervisors)
  - Contact professors or researchers and ask
- **Independent topic of own interest**
  - Contact professors whose fields are of your interest

Where to look for topics 2/2

- **The actual work and writing can be done anywhere**
  - Company
  - Other university in or outside Finland
  - At home
- **Keep in mind Aalto's thesis requirements**
  - Scope of the project might vary in a wide range
  - Thesis must fulfil Aalto's requirements
    - Usually differ from e.g. the final report for the company project
  - Thesis is a public document
    - Watch out for confidentiality problems

Thesis supervision

- **Thesis must have a supervisor, in addition thesis can have 1-2 advisors**
- **Supervisor must be a full-time Aalto professor or lecturer**
  - Can be from any department as long as the topic is related to your advanced studies (major).
  - Supervisor's responsibility is to provide guidance on the scientific validity and format of the thesis and on the thesis as a whole
- **Advisor must hold at least an MSc degree**
  - Advisor can be e.g. the supervisor at the company (different from thesis supervising prof.), a doctoral student at the department or any other professor or researcher in the University or elsewhere
  - Takes care of daily guidance and support the student in the planning and execution of the experimental part of the thesis as well as in the writing process
  - Supervisor of the thesis can also be the advisor

Starting the process

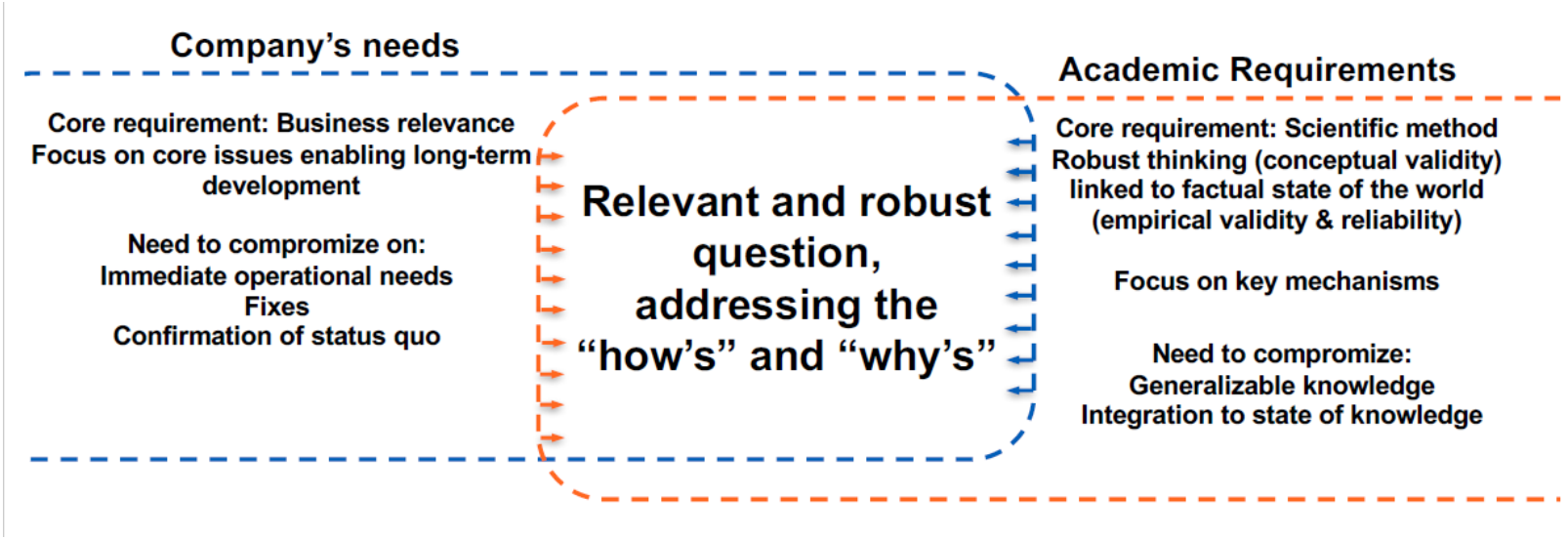
- **Thesis topic can be confirmed once 45 cr towards the degree have been completed**
- **If you do not have a thesis project but it would be time to start**
  - Approach the professors whose fields are of your interest
  - Go during visiting hours (if applicable) or agree the date by email
  - Take your transcript with you
- **If you have a thesis project (industry/department)**
  - Prepare a draft with the thesis advisor where you describe the research problem and how you are planning to solve it
  - Contact a possible supervisor early enough, and agree a meeting to present the draft

Thesis in the industry

When thesis is commissioned by a company, expectations may conflict!

- **Company is expecting a result to a specific project**
- **University is expecting a scientific research**
  - Company project often constitutes only a part of the master's thesis, e.g. the experimental part
  - Report of the project is not sufficient as a master's thesis.
- **Pay attention to merging the schedule and the content of these projects properly!**

Thesis in the industry



Source: Professor Mikko Jääskeläinen, Industrial Engineering and Management

Formal requirements in the process

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Formal requirements

- **Approval of the master's thesis topic**
  - Degree programme committee
  - Once 45 cr is completed and thesis work is starting
  - Online application, 3-4 deadlines per semester
- **Seminar presentation**
  - At the end of the thesis work
  - Agreed with the supervisor
- **Evaluation and approval of the master's thesis**
  - Degree programme committee, based on the supervisor's statement
  - Final pdf version submitted and seminar presentation given
  - Online application, 3-4 deadlines per semester

More: into.aalto.fi -> Your programme -> Planning your studies -> Completing your master's thesis

Thesis timetable

- **Default schedule to graduate in two years**

What	When
Preliminary planning / topic search	1st spring – early 2nd autumn • Meeting with mentor – preliminary plan for thesis topic area, type of thesis etc. • Plan for topic search
Topic search	2nd autumn • From industry: start early enough • If no topic towards the end of the year -> contact professor(s) -> **topic agreed by Jan 2022**
Thesis work on-going	2nd Spring • Full-time thesis work • Attending ELEC-E0210
Finalizing thesis (formalities)	Late 2nd Spring/Summer • Seminar presentation agreed and held before July • Submission of completed thesis (May/July 2022) • Remember to consider the summer holidays of supervisors/advisors

Practical support – ELEC-E0210 Master's thesis process

- **This course is compulsory to students who have started their MSc studies in 2018 or later. Other students can also attend.**
- **The purpose of the course is to support students at the initial stages of the master's thesis by focusing on thesis planning and scheduling as well by providing guidelines for the thesis structure and for the writing process.**
    - Structure and language support (English and Finnish) is executed in co-operation with the Language Centre.
- **Course has continuous registration during the academic year (periods I-V) – students can register once they have agreed on the topic with the supervisor and are ready to start.**
    - Completing the course takes 12-18 weeks.
- **During the course students do homework assignments directly connected to their thesis. Thus to attend and pass the course, you must have a topic (formal approval is not required).**
- **Course consists of group meetings, feedback sessions, assignment submission and online exercises.**