

Completing a Minor Thesis

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Challenges

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Understanding
research

Getting started

Phases of research

Success in research

Most of the deadlines must be self-imposed.

Many of the activities are novel or unfamiliar.

Some of the activities are intimidating.

It may be a 'minor' thesis, but it still might be the largest single task you have ever undertaken.

Identify a topic and research question that match your strengths.

Be organized – careful planning, filing, and backing-up. Keep a notebook.

Actively reflect on your behaviour and working practices; be honest with yourself about limitations and bad habits.

Build an effective routine, with sufficient time commitment right from the start.

Develop a productive, open relationship with your supervisors.

Create a good working environment.

Research is about questions

A good question:

- ▶ Solves a genuine problem, with a genuine challenge. (Avoid work on methods where there is no motivating problem or task, or on solutions to non-problems.)
- ▶ Relates to real data, of a realistic volume. Synthetic data allows exploration, but is unlikely to confirm predicted behaviour on real data.
- ▶ Can plausibly be answered in the negative.
- ▶ Can plausibly be answered in the scope of your project.
- ▶ Suggests something useful to measure.
- ▶ Should have a clear answer.
- ▶ Has results of interest even if the gains are small.

Finding the question

Work with your supervisor on a question; make sure it meets your needs, as well as your supervisor's.

Match the topic to your strengths – though you may not know what they are yet! A single research area can offer many different kinds of topic. Consider web search:

Statistical. Identify properties of web pages that are useful in determining whether they are good answers.

Mathematical. Prove that the efficiency of index construction has reached a lower bound in terms of asymptotic cost.

Analytical. Quantify bottlenecks in query processing, relate them to machine and network properties.

Algorithmic. Develop and demonstrate the benefit of a new index structure.

Representational. Develop a formal language for capturing properties of image, video, audio, etc., to be used in search.

Behavioural. Quantify the effect of varying the search interface.

Social. Link changes in search technology to changes in public opinion on key topics.

Framing the question

Expect development of a precise statement of the question to take time.

- ▶ It is common to have to revisit the question after some substantial work has been done.
- ▶ Development of a question is a good basis for early supervision meetings
- ▶ Consider alternatives, and their strengths and shortcomings.
- ▶ This may be how you discover whether your supervisor makes sense for you as a (senior) research partner.

Consider whether:

- ▶ Answering the question involves access to data and if so, whether the necessary data can be obtained or created.
- ▶ The volume and diversity of the research literature is likely to be manageable.
- ▶ There is a feasible methodology for pursuing an investigation.

Dimensions in research

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Success in research

observation	vs.	innovation
exploratory	vs.	exhaustive
study	vs.	case study
qualitative	vs.	quantitative
simulation	vs.	field trial
primary sources	vs.	secondary sources
theoretical	vs.	applied
mathematical	vs.	empirical
principled	vs.	pragmatic

What research isn't

'I am planning to build a new ...'

'I am going to find out about ...'

'I am going to show that A is better than B ...'

'I think that Q is a good tool for ...'

'I am going to collect data on ...'

'I have an interesting algorithm ...'

'I want to use method X ...'

Timelines for a minor thesis

Enrolled over multiple semesters? (50 or 75 points.)

- ▶ The focus of the final semester will be writing the thesis – and yes, it will take the whole of the semester.
- ▶ Expect to spend the period between semesters getting clean drafts of experimental results and data analyses.

You are probably working on a sole-investigator project, in close collaboration with a supervisor.

- ▶ Right at the start, work with your supervisor to get a detailed timetable, covering completion dates for components of the thesis, and for stages such as experimental work.
- ▶ Commit your supervisor to being available to you at critical times. Negotiate, if necessary.

Timelines for a minor thesis

Enrolled over one semester? (25, 37.5, or 50 points.)

You may be in a sole-investigator project, or may be one of several students working on the same activity.

- ▶ Right at the start, work with your supervisor to get a detailed timetable, covering completion dates for components of the thesis, and for stages such as experimental work.
- ▶ Plan to write every week. *Every week.*
- ▶ Twelve or thirteen weeks means a tight timeline for every component. A thesis *cannot* be completed by cramming in the last week or two. Even though there may be no formal progressive deadlines, you must work as though you are out of time, right from the start.

Writing as research

Use your writing to define your work. Get into the habit of:

- ▶ Having action lists of plans and open tasks.
- ▶ Creating abstracts and summaries of research questions.
- ▶ Noting down uncertainties, issues, guesses, and speculation.
- ▶ Formally describing methods, innovations, hypotheses, and experiments.
- ▶ Listing and summarizing literature.

Making progress is equivalent to having writing outcomes.

Phase One

Extend your skills with word-processing and data-analysis software; chat to senior students about approaches to working; e.g., learn programming & scripting languages and computing environments.

Become familiar with standard approaches to experimentation and data-gathering.

Establish a routine, and write down milestones.

- ▶ Meet regularly (weekly!) with your supervisor.
- ▶ Clarify your mutual contributions and responsibilities.
- ▶ Set weekly targets, and monitor your progress. Discuss bottlenecks with your supervisor as soon as they arise.
- ▶ Have action lists of plans and open tasks.
- ▶ Work on a balanced mix of activities: reading, writing, doing.

Phase One ...

Read papers comparatively – form opinions as to which work is more persuasive, and why.

Write about papers. Your final thesis will cite 20–50 papers – the papers in your literature review should be read, discussed, and written up in the first half of your enrolment time. (In parallel with setting the question, data-gathering, coding, ...)

Learn the skills of doing a robust investigation or analysis in a context in which it will be obvious when you get it wrong.

In a minor thesis, the shape of the outcome should be clear early on. The work should be of interest even if ultimately it is incomplete.

A critical success factor is the habit of regular writing.

Be persistent

Take the time to do things well.

Failure and dead-ends are a routine part of research – what matters is how they are used in the research program overall.

Actively seek out alternative resources, tools, approaches, thinking, etc.
When something isn't working – neither give up too soon, or persist for too long.

If in doubt – be skeptical, ask questions.

Phase Two

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Success in research

This phase requires absolute commitment and focus.

Expect to largely give up your outside interests and social life.

Give your timetable to your supervisor, and pin a copy on the wall near your desk.

Software, data, and tools are secondary to the thesis.

If you are creating software, don't get distracted by making it all-singing all-dancing, putting it on sourceforge, etc. It just has to get you the data you need to complete the tables and figures that demonstrate the validity of your conclusions.

Phase Two ...

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Success in research

You need to get into a rhythm of writing, and it differs from person to person. Find your own rhythm, and defend it against intrusion.

Set daily targets, and monitor your progress. Discuss bottlenecks with your supervisor as soon as they arise. Don't tolerate anything that delays you.

Make designing graphs and figures a 'reward' for writing two pages of text. Keep the bibliography up to date at all times.

Success factors

A desire for discipline, stringency, quality, and standards.

A good supervisor, or supervision team; a good relationship between student and supervisor.

A good research question that matches your strengths.

Products that look plausible – the outcome of work done to a high standard.

Organization – careful filing, naming, archiving, and backing-up.

Actively reflecting on habits and working practices, and seeking to improve them; being honest with yourself about limitations.

A healthy, diverse balance of activities.

Recognising and managing anxiety and other mental health issues.

Failure factors

Refusal to start writing, procrastination; inappropriate prioritisation of other tasks.

Obsessive engagement with irrelevant activities (computer games, socialising, work).

Failure to recognise that writing is a struggle and *takes a long time*.

Concealment from supervisors: of progress issues, lab issues, health issues, life issues.

Inadequate reading of or search for literature.

Failure to finish work properly, stopping when the 'fun stuff' is done, not writing up regularly.

What supervisors (should) usually provide

Guidance, suggestions on research direction.

Timely, detailed feedback on writing (English expression, technical arguments, critical analysis).

A broad perspective on the topic.

Motivation, encouragement, discipline, and rigour.

Familiarity with University procedures.

Pastoral care and advice, within limits.

What supervisors usually expect

Student commitment and dedication.

Enthusiasm, ownership.

Self-management, independence, responsible working habits.

Writing, staying ahead of the curve.

Honesty and openness, frank communication.

Keeping of and preparation for appointments.