

Best Practices for Writing Your Master's Thesis

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Goals for today:

- Offer some strategies for preparing to write your master's thesis;
- Briefly discuss the basic components of a master's thesis;
- Explain common writing problems and how to prevent them;
- Offer some suggestions about time management;
- Take any questions you might have about the writing process.

The best thesis
is a finished thesis.

Why is it so hard to write a thesis?

- Writing a thesis is a completely new experience.
- Writing a thesis marks a major transition in your professional life and thus can cause significant stress.
- Writing a thesis is a very large, independent project.

Also...many graduate students have never actually read a thesis. Check out <http://scholarsmine.mst.edu>; talk to your advisor, other faculty members, and colleagues in your department to find good examples.

About your thesis advisor...

1. If you are given the opportunity to select your thesis advisor or advisory committee, do it wisely. Don't focus only on content experts. **Make sure you have selected committee members who are supportive of you** and are willing to assist you in successfully completing your research.
2. **Your thesis/dissertation advisor is your ally.** Your thesis advisor wants you to succeed, so be sure to think of this person as something of a “teammate.” Spend time talking with your advisor so that he or she really understands your goals. Don't be afraid to talk with your advisor; it is part of this person's job to help you, and most faculty members take this responsibility very seriously.
3. **Your thesis advisor cannot read your mind.** If you have questions or concerns about your project, or if you are struggling for any reason at all, you cannot expect your advisor to know this automatically. One of **your** primary responsibilities is to keep the lines of communication open, so don't wait for your advisor to come to you. Talk to your advisor when things are going well **and when things are not.**

Master's theses have many parts:

Abstract

Introduction

Literature Review

Methodology

Results

Discussion

References

Appendices

Abstract

An abstract is a short paragraph that summarizes your entire project. It is NOT just the first paragraph of your introduction.

Most abstracts contain four common elements:

Problem. Describe the major topic or problem addressed in the document.

Method. Describe the specific approach or method used to address the problem.

Results. Describe one or two of the most important results.

Conclusion. Describe the conclusion drawn from the result(s).

It's often helpful to write your abstract last, when you already know how your research has turned out.

Introduction

- State the subject of your document as clearly as possible.
- Define the problem you are addressing, your approach to the problem, and why this problem is important.
- Define the scope of your research. Include descriptions of who or what your research applies to, what its goals are, and why this research is necessary or useful.
- Provide necessary and relevant background information. Because the introduction leads your reader into your document, try to begin with a general statement about the topic before moving on to specific issues.

Literature Review

Q: What's the point of a literature review?

A: A literature review demonstrates that the work you're doing contributes to a much larger effort that has begun among your professional colleagues. A literature review shows the reader what **relevant** work has already been conducted on your chosen topic, and how your work fits in to this established body of work.

Literature Review

Literature Reviews are **not** merely summaries of existing research.

Although you do need to summarize relevant research, you must also:

- **evaluate** the existing research;
- **explain** the relationships between different research projects;
- **demonstrate** how this body of research relates to your own individual work.

Example of a bad literature review:

Many researchers have shown interest in the field of coastal erosion and the resulting beach profiles. They have carried out numerous laboratory experiments and field observations to explore this field. Their findings and suggestions are reviewed here.

JACHOWSKI (1964) developed a model investigation conducted on the interlocking precast concrete block seawall. After surveying damages caused by the severe storm on the coast of the USA, a new and especially shaped concrete block was developed for use in shore protection. This block was designed to be used in a revetment type seawall that would be both durable and economical as well as reduce wave run-up and overtopping, and scour at its base or toe. It was proved that effective shore protection could be designed utilizing these units.

HOM-MA and HORIKAWA (1964) studied wave forces acting on the seawall which was located inside the surf zone. On the basis of the experimental results conducted to measure waves forces against a vertical wall, the authors proposed an empirical formula of wave pressure distribution on a seawall. The computed results obtained by using the above formula were compared well with the field data of wave pressure on a vertical wall.

SELEZOV and ZHELEZNYAK (1965) conducted experiments on scour of sea bottom in front of harbor seawalls, basing on the theoretical investigation of solitary wave interaction with a vertical wall using a Boussinesque type equation. It showed that the numerical results were in reasonable agreement with laboratory experimental data.

and so on.

WHY was this a bad literature review?

- Summarizes previous research but does not use the literature to explain more about the writer's own research problem.
- Not critical: does not emphasize which theories or findings are important, which are inconclusive, what the shortcomings are, etc.
- Does not show the relationship between different research projects already carried out.
- The writer organized this literature review chronologically, based on the **researchers** themselves. By organizing the review around the researchers and not around the research (e.g. around key concepts) the writer emphasizes the people and not their work.

How do you write a good literature review?

Read with a purpose. You need to *summarize* the work you read, but you must also decide which ideas or information are important to your research (so you can emphasize them), and which are less important (so you can cover them briefly or leave them out altogether).

You should also look for the major concepts, conclusions, theories, and arguments that underlie the work, and look for ***similarities*** and ***differences*** with closely related work. This is difficult when you first start reading, but will become easier the more you read in your area.

How do you write a good literature review?

Write with a purpose. Your goal is to evaluate and show relationships between the work already done and your own research project.

(Is Researcher Y's theory more convincing than Researcher X's? Did Researcher X build on the work of Researcher Y?)

To achieve this goal, you must carefully plan how you are going to organize your review.

Example of a better literature review

Roll, Y., M.J. Rosenblatt and D. Kadosh. “*On the optimal container size in automated warehouses*”, Proceedings of the Ninth ICPR.

Automated storage and retrieval systems (AS/RS) are being introduced into the industry and warehousing at an increasing rate. Forecasts indicate that this trend will continue for the foreseeable future (see [1]). Research in the area of AS/RS has followed several avenues. Early work by Hausman, Schwarz and Graves [6, 7] was concerned with storage assignment and interleaving policies, based on turnover rates of the various items. Elsayed [3] and Elsayed and Stern [4] compared algorithms for handling orders in AR/RS. Additional work by Karasawa et al. [9], Azadivar [2] and Parry et al. [11] dealt with the design of an AS/RS and the determination of its throughput by simulation and optimization techniques.

Several researchers addressed the problem of the optimal handling unit (pallet or container) size, to be used in material handling and warehousing systems. Steudell [13], Tanchoco and Agee[14], Tanchoco et al. [15] and Grasso and Tanchoco [5] studied various aspects of this subject. The last two references incorporate the size of the pallet, or unit load, in evaluation of the optimal lot sizes for multi-inventory systems with limited storage space. In a report on a specific case, Normandin [10] has demonstrated that using the 'best-size' container can result in considerable savings. A simulation model combining container size and warehouse capacity considerations, in an AS/RS environment, was developed by Kadosh [8]. The general results, reflecting the stochastic nature of the flow of goods, are similar to those reported by Rosenblatt and Roll [12]. Nevertheless, container size was found to affect strongly overall warehousing costs.

In this paper, we present an analytical framework for approximating the optimal size of a warehouse container. The approximation is based on series of generalizations and specific assumptions. However, these are valid for a wide range of real life situations. The underlying assumptions of the model are presented in the following section.

Why is this example better than the first one?

The writer did several things to make this literature review more effective than the earlier example:

- The writer grouped similar information: "Steudell [13], Tanchoco and Agee[14], Tanchoco et al. [15] and Grasso and Tanchoco [5] studied various aspects of this subject."
- The writer showed the relationship between the work of different researchers, including similarities/differences: "The general results, reflecting the stochastic nature of the flow of goods, *are similar to* those reported by Rosenblatt and Roll [12]."
- The writer indicated the position of the work in the research area history: "*Early* work by Hausman, Schwarz and Graves [6, 7] . . . "
- The writer moved from a *general* discussion of the research in AS/RS to the more *specific* area (optimal container size) that the writer intends to research.

Methodology

The goal of this section is to explain two important things about your project:

What you did

How you did it

You should also justify your choices, explaining why your plan was appropriate for this project.

Results

- Include summaries of your findings and what is significant about them. Do not include every single data point in your text (that's what figures and appendices are for).
- Organize your information based on its importance to your study and to your audience.
- Often, the Results section will include extensive graphs, figures, and tables of data. Only include what is relevant to your audience.
- Refer to every figure that you include **before** the figure actually appears in the document.
- Caption your figures carefully. Make sure your captions make sense and describe what the figure really illustrates.

Discussion

Relate your findings to the general problem you're working on and any specific objectives posed in your introduction.

- What have you learned? Summarize clearly what your results do and do not demonstrate.
- What kinds of questions might other researchers study in order to expand our knowledge about this topic?

Note: This section combines references to your own work (described in the past tense) with general conclusions about the state of this field (described in the present tense). You will also speculate about the work still to be done (future tense).

References

Figure out what **citation style** you're going to use in your thesis. If you're not sure what citation style to use, you can check the national websites for your discipline's major organization (IEEE, ASCE, ASME, ASEM, STC, AIP, AMS, etc.) to see what citation style they require in their major publications.

Or...better yet...**ASK YOUR ADVISOR.**

Include a References page at the end of your document. Your References page includes all the citations for the research you included in your report.

Appropriately format all entries according to the citation style used by professionals in your discipline.

Appendices

In one or more appendices, include materials that are not essential parts of your thesis but that provide useful information to readers seeking more detail.

Typical materials included in appendices include:

- Detailed explanations too technical or involved to be included in the main text
- Additional diagrams
- Additional tables summarizing data
- Long lists
- Experimental protocols or survey questions
- Computations directly relevant to discussions in the main body

Common Writing Problems

Common Problem: Abbreviations

When you use an abbreviation, even if it's a very common one in your field, spell out the entire term or phrase the first time you use it, and place the abbreviation in parentheses. From this point on, use the abbreviation and only the abbreviation in your text. Don't switch back and forth.

Common Problem: Starting Sentences Incorrectly

Do not start sentences with:

numerals

variables

abbreviations that require a period at the end (except for titles, such as Dr.)

Common Problem: Incorrect labeling of graphics

Figure captions go **BELOW** the figure.

Table titles go **ABOVE** the table.

Common Problem: Ambiguous Language

It's very easy for writers to lapse into ambiguous prose that can confuse the reader.

Strategy: Check your document for sentences that start like this:

It is (or was)...

This is...

That is...

This is...

These are...

Whenever you see a sentence like this, figure out what you're really talking about, and then replace ambiguous pronouns with more specific nouns.

Common Problem: Ambiguous Terminology

Each technical term used in a thesis must be defined either by a reference to a previously published definition (for standard terms with their usual meaning) or by a precise, unambiguous definition that appears when the term is first used (for a new term or a standard term used in an unusual way).

Each term should be used in one and only one way throughout the thesis.

Common Problem: Verb Tense

Work that hasn't been done yet.....future tense

Actions, observations, and procedures

that have already taken placepast tense

Things that are always or generally true.....present tense

You will use future, past, and present tense in your thesis.

But... when you refer to figures, tables, or graphs, you should use the present tense.

Example:

Figure 6 charts the relationship between x and y .

Table 4 demonstrates the rate of change of z .

Passive vs. Active Voice

Although scientific writing has a long history of using passive voice, many professional journals in science and engineering now encourage, or at least accept, active constructions.

You should follow the conventions of your discipline and the advice of your advisor. But do not think that one way is automatically correct and one way is automatically wrong. You should use passive and active constructions deliberately, to help your reader to understand better what it is that you're writing about.

What is Passive Voice?

Passive voice is a grammatical construction in which the object of an action becomes the subject of the sentence.

form of "to be" + past participle* = passive voice

Examples:

Tadpole survival is limited by increased water salinity.

Green roofs have been increasingly enlisted to alleviate urban environmental problems.

* Grammar Review: the past participle is a verb form often, but not always, ending in “-ed.” Some exceptions are words like “paid” and “driven.”

Active vs. Passive Voice

Each of the following sentences is grammatically correct, but they are not exactly equivalent. Each emphasizes a different subject.

The operating system starts the device. (active)

The device is started by the operating system. (passive)

The most important thing is that **the subject of your sentence is what the subject is really about.** Allow the decision about your subject—what you're really talking about—to guide your decisions about active vs. passive voice.

Active vs. Passive Voice

Passive voice can be tedious to read if you use it too much. Try to use active constructions that include such verbs as *supported, indicated, suggested, corresponded, challenged, yielded, or demonstrated.*

Instead of: *A number of results are indicated by these data.*

Try: *These data **indicate** a number of results.*

or *Further analysis **yielded**... (or **suggested**, or **showed**...)*

Terms and Phrases to Avoid

I will describe... The first person has no place in a formal thesis. Recast your sentence into the third person: “Section 10 describes...”

This thesis will talk about... A thesis can’t talk.

You will read about... The second person (“you”) is inappropriate in your thesis—it is too colloquial.

More Terms and Phrases to Avoid

Different vs. Various

Use *different* when you mean that something is unlike something else.

Use *various* when you mean “more than one.”

Phrases indicating ambiguous quantity or quality

Phrases such as: *in terms of*, *lots of*, *kind of*, *type of*, *something like*, *a number of*, and *just about* are usually too imprecise to be useful.

TOO BUSY TO WORK: Strategies for Time Management

Even when you are dedicated to your thesis and have no problems with your topic, advisor, or committee, you can have trouble getting it written.

Simple exhaustion, financial stresses, and family responsibilities can seem to conspire to keep you from doing the work that you need to do.

While you can't avoid many of these stressors, you can change the way that you deal with these external concerns and minimize their impact on your psyche and productivity.

Plan Your Long-Range Goals

Chart out your long-range goals working backward from commencement.

- When do you need to turn in the dissertation to the Office of Graduate Studies?
- To do that, when would you need to defend?
- To do that, when would you need to get your document to the committee?
- To do that, by when would you need to get X chapter(s) written?

Get specific—don't use “this semester” as a deadline—use actual dates.

Plan Each Day and Stick to the Schedule

Find a calendar, chart or other scheduling device that you like. Some advice books offer elaborate scheduling mechanisms that require you to keep calendars of the entire year, of each month, of each week, and of each day (broken down by hour). This might be overdoing it, but find some sort of daily, weekly or monthly planner that makes sense to you and use it. Refer to it each morning to get a sense of what you plan to do each day.

Block out the 30 minutes, one hour, three hours, or whatever length of time you plan to work on your thesis. Identify a scheduling strategy that works for you. Some people like to schedule their daily thesis work in terms of hours and minutes worked, and others in terms of “problems solved” or “pages written.” Figure out which works best for you.

Learn to say “NO”

Don't accept every invitation to give a guest lecture, present at a graduate student forum, or attend a conference. Similarly, try not to agree to drive every needy friend to the airport, watch every neighbor's cat while the neighbors are away, and meet everyone you know at Panera's at their convenience. If you find you can work steadily on your thesis while doing some of these activities, by all means do them—but don't be “guilt tripped” into doing favors you don't have time to do.

Work on Your Thesis for Five Minutes a Day

Surely you can find five minutes in between classes, after you brush your teeth, or while you wait for dinner to cook, right? Sometimes the biggest hurdle to time management isn't finding big blocks of time in which to work—it's simply starting to work in the available time. Once you work for five minutes, you may find that another five minutes wouldn't be so bad. Getting in the habit of working on the dissertation every day, even for a short period of time, can be an important time management strategy.

Things to Write When You Don't Want to Write

Make a list of all the little things you need to do for a given section of the thesis, no matter how small. Write down everything that you need to do to get it out the door. Then when you don't feel like tackling something big, you can do something else, like work on your acknowledgments, photocopy an article, or check your citations. You don't have to do everything on the list during the time you've allotted for thesis work, but tell yourself that you DO have to do SOMETHING. You'll be surprised that the habit of getting something done on the thesis, no matter how small, can be addicting.

Key to Success

There is a key to success: practice. Attending presentations like this one will help you, I hope, but nobody ever learned to write well by attending a presentation. Instead, you need to practice, practice, practice. Every day.

Portions of this presentation were adapted from the following sites:

<http://www.cs.purdue.edu/homes/dec/essay.dissertation.html>

http://www.ece.uiuc.edu/current/grad/overview/ECE%20Style%20Guide_Jan2006.pdf

<http://www.learnerassociates.net/dissthes/index.htm>

<http://www.unc.edu/depts/wcweb/handouts/dissertation.html>

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Additional information about all aspects of technical writing and communication can be found at the S&T Writing Center, 113 Campus Support Facility,
<http://writingcenter.mst.edu>.