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FEATURES SECTION

How to write a thesis

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The prospect of writing a thesis can be intimidating. However, there are certain formats that the writer should follow in order to make life much easier. This article covers a logical approach to presenting research findings. Also included are suggestions for a last minute checklist.

Key words: Publishing, writing a thesis, writing a dissertation

So, you think the hard part is over now that your actual research is completed, but then you realize it is only just beginning! The thesis has to be written up! However, there are many practical tips that can make writing-up as stress-free as possible.

The 'thinking' part of writing is the hardest part of any thesis.[1] Most graduate schools have their own guide to writing a thesis or dissertation, and it is important that this is obtained (and read!) prior to commencing the research. Such guides offer information on a wide spectrum of research-related issues, but more importantly, will also give other vital information, such as word limits, etc.

The recommended format for theses is similar for most institutions, with some local minor variations:

- Title page
- Abstract
- Acknowledgements
- Table of contents
- Review of the literature — concluding with a summary
- Statement of the problem, aims of the study, hypothesis
- Materials and methods (including statistical analysis)
- Results
- Discussion
- Conclusions
- Appendices
- References

Title page

The title page should include the following information:

- Title of the thesis — usually centred on the page and in upper case letters.
- Your full name and qualifications.
- The name of the institution to which the thesis is being submitted.
- The degree for which the thesis is submitted and the year of submission.

Abstract

The abstract is placed immediately following the title page and is generally short (up to a side of A4 usually). The abstract should include a brief introduction and statement of the problem, as well as a summary of the methodology, findings and conclusions. A structured abstract may be used if preferred.

Acknowledgements

It is important to acknowledge your supervisors, statistical advisers and others who have helped (e.g. colleagues who have offered support or provided data). In addition, any funding bodies should be mentioned. It is also customary to refer to those who have had to 'put up' with you during the process of writing the thesis — usually family and friends!!

Table of contents

Conventionally, there should be a table of contents, followed by a list of tables and a list of figures. The table of contents includes all the major divisions of the thesis, including subsections. The relationship between major divisions and minor subdivisions should be shown by an appropriate use of capitals and indentations.[2] The preliminary pages (Abstract, Acknowledgements and

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Contents) are numbered using roman numerals (i, ii, ii . . . .) and the remainder of the thesis is numbered using Arabic numerals (1, 2, 3 . . .). The title page is not numbered. It is sensible to start writing a table of contents as you write the thesis; however, the page numbers can only be added when you have completed the final draft. At this stage, always cross-check the page numbers between the table of contents and the main body of the text — and ask someone to double check them for you.

The list of tables or figures follow the same format, with each table/figure number in Arabic numerals, the exact title as it appears in the main text and also the page number.

Review of the literature

Beginning this section can be a daunting task, particularly if your research area is extensive. This should be one of the first things you do, and if the majority of this work is undertaken relatively early in the project, it makes later stages very much easier. The review of the literature should be as comprehensive as possible in the space available. Include only material that gives an appropriate background to your study and avoid the temptation to include everything you have ever read on the subject! Obviously, this review must be constantly updated to ensure you do not miss important additions to the literature and a final search should always be undertaken immediately prior to submission, and also just before the viva in case an important work has been published in the time between submission and examination.

Make sure you acknowledge which paper something is cited in if you did not actually read it yourself. An examiner may find it hard to believe that you managed to get a copy of a 1932 Russian orthodontic journal, let alone managed to translate it yourself!

Great care is required in the way the references are quoted in the text, especially with respect to punctuation, etc. If several papers are quoted at the same point, they should always be in chronological order.

Statement of the problem, aims and hypothesis

The literature review is followed by a statement of the problem, then the aims of the study and the hypothesis. Traditionally, null hypotheses were used because they have their basis in inferential statistics. However, it is now much more acceptable to pose a hypothesis in its positive form. When writing up the results and discussion, it is important to make sure that this hypothesis is actually answered.

Materials and method

Full details should be included in the materials and methods so that the reader could repeat the study if they wished. For this reason, details should also be provided of any equipment and materials used. These can be placed in a separate appendix if necessary (see later). It is also useful to start writing this section as you undertake your research, not only will everything be very fresh in your mind at this stage, but it will also mean you have less to do at a later stage.

This section allows readers to understand the objectives of the study and to judge whether the methods used were appropriate. The methods may actually be modified during the process of the study, in which case, the final form of the method is discussed (unless advised otherwise by your supervisor). The most serious error in this section is to omit important information required by the reader to see the logic of the study and to judge the adequacy of the method.[1]

Everything to do with the validity of the method should be included in this section, including design, instrumentation, analysis, etc. This section should also contain evidence of the reliability of the method.

There is a great deal of individual variation in the subheadings used in this section, often depending on the type of research undertaken. However, possible examples include:

- subjects;
- design;
- materials, apparatus and procedures;
- statistical analysis;
- validity and reliability of method.

Subjects

There are two particularly important aspects to be considered here, both of which determine the generality of the findings:[1]

- The number of subjects at each stage (this establishes the statistical power).
- Freedom from bias in the way the subjects are obtained/recruited. In clinical studies, we frequently fail to achieve random selection for obvious reasons and it should be acknowledged if this is so. At this stage it is also important to consider that, particularly when comparing two groups, the groups may not be balanced. If this is the case, you will need to take this into account and select an appropriate statistical analysis.

Full details of subjects should be included: number, age group, gender, where they were recruited from, inclusion and exclusion criteria, how many subjects were asked to take part and how many agreed, drop-out rate, etc. It is

also important to discuss power and sample size at this point and explain how you arrived at the estimated number of subjects/samples, etc.

Design

This section describes exactly what type of study was undertaken. For example, a prospective randomized controlled trial comparing the effect of early treatment with a functional appliance.

Materials, apparatus and procedures

This section includes all procedural elements that will allow the reader to understand what happened. It may be worth using diagrams or photographs if complex apparatus was used. Likewise, a flow chart can make a complex procedure seem much more straightforward. Some aspects may be included in an Appendix, e.g. information sheets given to patients, details of the manufacturers of apparatus or chemical reagents used.

Validity and reliability

The reliability and validity of any method should be addressed at this stage. At this point it is also appropriate to include any threats to the validity of the method (e.g. loss of subjects in a longitudinal study).

Limitations of the method should be discussed fully in the Discussion section. It is better to be honest and acknowledge any issues, rather than allowing the examiner to point them out to you. There are problems associated with all studies and examiners do realize that.

Statistical analysis

It is a failing of many research studies that statistical advice was obtained too late to be of any real use and the writing-up stage is certainly not the time to consult your statistician for the first time! They should have formed part of the research team from the outset, and this is the time for them to provide support as you undertake the necessary analyses and to offer advice regarding interpretation of data.

The statistical tests should be discussed fully, along with any criteria that were fulfilled in order to use these tests (e.g. Normality of data).

Results

The results should be presented in a clear, concise manner and avoid the temptation to present in more than one format (e.g. in both tables and graphs). It is often helpful to precede each sub-section of results with a summary paragraph, but avoid duplication. Tables and figures should be as simple as possible and the use of very complicated graphics or obscure colour combinations avoided — the examiner will not thank you! The table or figure should not repeat information covered in the main text, it should augment it. Every table and figure should have a title that is a concise explanation of what is being presented. If abbreviations are used, it is important that they are explained fully.

Tables where p-values are quoted should give the actual p-value, rather than $p<0.05$; $p<0.01$, $p<0.001$. With the widespread use of computerized statistical packages, the actual p-value can be found with relative ease.

Discussion

Researchers often find the discussion the most difficult part to write — it really is the 'thinking part' of the thesis. The examiner wants to know several things when they read this section:

- What did you find? Do you understand why you found this and can you suggest reasons why?
- Why is it important to you? Is it likely to affect current clinical practice?
- How do your findings compare with previous studies, particularly with those which have been mentioned in the review of the literature?
- Did you encounter any problems with the methodology (for example, problems with recruitment/retention of subjects that meant the study was under-powered)? Were the reliability and validity of the method acceptable?

It is also customary to follow the discussion with a small section on 'Suggestions for further study'. This allows you to make suggestions on continuation of the study or amendments to the existing methodology.

Conclusions

Finally, the salient conclusions from your work should be summarized and these frequently have more impact if they are presented in bullet format. Try to avoid repetition and making this section too long; it is supposed to represent the most important findings — not every single finding!

Appendices

In most universities, the appendices do not form part of the main word count, but avoid using them just to put data in because you run out of space! They can, however, be used for data that is not required in the main body of

the text or for questionnaires that were used, consent forms and information sheets given to patients, etc. If you have a great deal of data that is not required in the main text, but you wish the examiners to have access to it, consider using a CD or disk, and putting it in the back of the thesis.

References

When commencing the research for the thesis, ensure you enter all references on a computer-based reference manager. This minimizes the errors, although does not completely avoid them. If you do not have access to a computer-based system for any reason, keep index cards of all the references you have read so that you can go back and double check them. This avoids a great deal of work at a later stage. Always get someone else to double check your references and cross-check that all those in the text are in the references and *vice versa*. Be consistent with the style of the references, for example, either abbreviate all journal titles with correct abbreviations or write them all in full.

Publications

Include details of any papers, and the paper itself if already published, that may have been accepted from the study. This reflects well on your research, and shows that it has already been peer reviewed and judged to be of a standard that is acceptable to a national/international journal. This is particularly important for MPhil or PhD theses.

Consistency of style

Consistency of style is important (the style of tables; headings of sections, etc.). It may seem a small point, but it does make the thesis look better if you have obviously paid attention to detail.

Additional points

If you include diagrams or data from other publication, acknowledge them as such. Plagiarism is something that universities take very seriously.

With the increased use of desktop publishing, colour printing, etc., theses can be very professional. If colours are being used, choose sensible combinations and avoid making it too garish!

With the availability of spell check, there is absolutely no excuse for spelling errors. However, do make sure you choose the correct language (e.g. either US or UK English) to check against!

Word limits

Ensure you know the word limit *before* starting. University regulations can vary markedly and finding out that you have written 5000 words more than the limit, with only a week to go, will do absolutely nothing for your stress levels!!

MPhil and PhD

Larger theses are now frequently chapter based, in which case each chapter may have a review of the literature, material and methods, results and discussion. If this is the case, start the thesis with an overall introduction and end with overall conclusions that bring the whole thesis together.

Dealing with your supervisor

Try to make the supervisor/postgraduate relationship as easy as possible during your research and throughout the writing-up phase. Remember that, although your thesis is the most important thing to you, your supervisor may well be involved with several others as well!

Always keep to deadlines that are set for you and, equally, attempt to set your supervisor a deadline on returning drafts. It is also sensible to keep a copy of the supervisor's corrections, so that when they are done the supervisor is not tempted to ask for more! Most supervisors will also appreciate being given the thesis in sections as they are written, as this breaks up the workload. They will obviously want to see the entire thesis at a later stage, but most of the corrections should have been done by that stage.

Final checking

The following should prove useful as a final check list:[2]

Readability

Always ask someone else to read the thesis to check for readability, grammar, etc. This does not necessarily have to be someone who fully understands it. Indeed, family members can often be willing volunteers!

Page numbering

Check the numbering of the pages to ensure it is consecutive. Likewise, also check the numbering of tables and figures.

Margins

Check that all of the margins are in accordance with the regulations for your university (often 4 cm for the left margin to allow binding and 2.5 cm for the right margin). Also ensure that the right margin is justified throughout as it looks much neater.

Headings and subheadings

Check that all of the chapter headings and subheadings in the main text match those in the table of contents, and ensure that all of the headings and subheadings are formatted consistently throughout the thesis.

Tables

Has the data been checked for accuracy? Are sufficient details given to interpret the data? Is a consistent format used for all tables? Are units of measurement stated? Are all abbreviations explained?

Figures

Has the accuracy of the figure been checked? Is the figure self-explanatory? Is the zero position shown on the axes of graphs? Are the units of measurement clearly shown on the axes? Are all abbreviations explained?

Appendices

Is the appendix warranted? Is it referred to in the text? Are sufficient details given to make the appendix useful? Does each appendix start a new page?

Reference list

Has every work cited been included in the references? Have the rules for alphabetical and chronological ordering of references been followed? Does each *book* reference include the author(s) and/or editor(s), date of publication, title, chapter number and title, publisher and place of publication? Does each *journal* reference include author(s), date of publication, title, name of journal, volume number and inclusive page numbers?

Binding of the thesis

Have you checked the university requirements regarding number of copies; type of binding for the submitted version (e.g. do you need a hard bound or soft bound copy at initial submission?); colour of cover and the lettering on the cover?

Summary

So, you have got to the final stage and the thesis is ready to go to the binders. Getting to that point is something to be proud of — nobody will ever under-estimate the amount of effort that has been expended in the process. However, following the steps in this paper should make that effort as pain free as possible.

References

1. Van Wagenen K. *Writing a Thesis: substance and style*. Englewood Cliffs: Prentice Hall, 1991.
2. Anderson J, Poole M. *Assignment and Thesis Writing*, 3rd edn. Brisbane: Wiley, 1998.