CHAPTER 9

THESIS WRITING

Thesis or dissertation is a pre-requisite for the award of a postgraduate degree in many institutions of higher learning. It is the outcome of research work conducted in accordance with an approved synopsis or protocol and presented in a format accepted by the institution. It is divided into several chapters: Abstract, Introduction, Review of Literature, Materials and Methods, Results, Discussion Summary, Conclusions, Recommendations, Literature Cited and Acknowledgement. Normally a certificate from the supervisor or supervisory committee accompanies the thesis.

9.1 INTRODUCTION

Thesis or dissertation is a long piece of writing, a scientific essay, or a detailed discourse on a subject especially submitted for a higher degree in a university. The term 'thesis' is normally used for Master's degree and 'dissertation' for the doctorate level of work. It is a pre-requisite for the award of a postgraduate degree in most academic institutions. Thesis is a major milestone in a student's career and marks the end of academic life for that programme. Having qualified the thesis defence means the candidate has been through a process of maturation, discipline and scholarship. In thesis work, students are being taught a few things at the same time. They learn:

- techniques of planning and conducting research
- skills of writing and presenting written report and
- oral presentation skills to defend their work.

Thesis is an important form of academic writing and serves as a permanent record. It is written for a narrow audience, a committee of experts in the field who have the need and interest to read it

carefully. The major purpose of a thesis is to convince the committee that the student has attained maturity in his discipline, knows the field and is capable of undertaking independent research.

A thesis is supposed to present candidate's original research. A proper thesis should have the same structure as a scientific paper (Chapter 8). It should exhibit the same form of disciplined writing that would be required in a journal publication. The thesis may describe more than one topic and it may present more than one approach to some topics. The thesis may present all or most of the data obtained in the research; even sometimes raw data is attached as an appendix. The thesis is longer and more involved than a scientific paper.

It must be remembered that the thesis bears student's name as the author. Hence, early reputation and perhaps job prospects may depend on the quality of the thesis and of related publications that may appear in scientific journals. A well-written, coherent thesis will definitely lead to a good start.

9.2 PRE-REQUISITES FOR A THESIS

Research in professional disciplines is very expensive, both in terms of money and time. The institution invests huge sums on providing equipment, chemicals and infrastructure, while students spend time and money on research work and preparation of thesis. Hence, the work has to be planned before hand. The first pre-requisite for a meaningful research is to select a suitable title that should have some impact. This is then followed by preparation of a comprehensive proposal, protocol or synopsis (Chapter 7). This proposal contains significance and objectives of the project as well as methodology. This whole exercise is done in the light of existing studies on this or similar topics. The synopsis must be followed during the research – quite often new avenues have to be investigated. Usually work proposed in the synopsis must be completed. Additional work done is encouraged but that below specified in the synopsis is usually not permitted. Before starting to write, ensure that proposed research methodology has been followed.

9.3 SIZE OF THE THESIS

Normally no upper or lower limits are prescribed for the number of pages in a thesis. Some institutions may impose restrictions on minimum number of pages acceptable. A normal M.Sc. or M.Phil.

thesis could be presented in less than 100 pages, while a doctoral dissertation involves more work, hence more pages. The value of thesis depends on its quality and not the volume. Hence, the thesis must be a presentable document. Few pages of well-written and well-presented thesis are definitely superior to a junk of few hundred pages.

9.4 STARTING TO WRITE

A thesis is a technical document that must have a simple, natural and indirect style. The expressions in writing must be very clear and unambiguous. The writer should be placed in the background, by writing in the third person unless a personal opinion is being stated. The use of "I", "we", and others is discouraged and should be avoided. Past tense is preferred in some sections, while in others present tense would be more appropriate. Quite often there is poor cross referencing to figures, tables and references that hinders understanding of the document. While citing references in the text, spellings of the authors and year of publication must be cross-checked for correctness.

The writing of thesis starts as soon as the research title is finalized. At this stage, Synopsis or Protocol has to be prepared. This means the library will be visited, Internet will be searched and assistance from databases will be taken to collect relevant literature. It would be wise to start writing portions of the thesis as soon as any part of the work is completed. If sufficient literature has been collected, one may start writing parts of the Review or even Introduction section. When a particular set of experiments has been completed, it is good to write immediately while still fresh in the mind. If every writing aspect is left until the end, there may not be sufficient time available to do a proper writing job. Even the supervisor or the typist might be too busy to attend to you.

When you are ready to start writing, move section-by-section until you find a section where some input can be made. Make the input and continue moving through the entire chapter - writing and adding to those sections for which there is some input. This will help to visualize the end product of the efforts from very early stages. In this manner each time you work, you will be building the entire thesis. At some point you will be able to spread out in front of you all sections that have been written. These can now be sequenced in the best order to see what is missing and should be added.

Table of Contents is invaluable to the writer. A provisional Table of Contents for each chapter of the thesis must be prepared to help improve the manuscript and keep you on track. Thanks to the miracle of the computer technology, one can easily copy and paste anything anywhere and as such headings from the writing can be transferred to the Table of Contents. Ensure that Table of Contents is clear and will make good sense to the reader. It would be easy to see areas that may need some more attention.

To avoid piling up hand-written drafts while writing proceeds, feed the material in the computer. You may own a personal computer, or visit an Internet club or hire a person to type for you. If you own a personal computer then writing job would be easy. Open new folders with different names, such as Introduction, Review, Materials and so on. This will prevent mixing of the files. A paid operator may become expensive, hence it is better to learn how to use a computer.

In the early stages of write up, the only troublesome thing would be to find that you need too much paper, since as soon as a print is taken, you will need to make changes in it. It would be better if files are maintained for different chapters and each print is properly labelled, i.e., write date and version of the draft on it. This will prevent mixing up of various drafts. In this manner the write up can be finished well in time.

Time soon reaches to write the last chapter, which is in fact, Chapter One, Introduction. This has been written in bits and pieces. It needs to be rewritten. Re-read Chapter One carefully with the insight you now have from the completed thesis. This chapter should help the reader move in the direction of last Chapter, Discussion. All important concepts that will be necessary for understanding Discussion should be presented in Chapter One.

If the above suggestions are followed, then it would not be difficult to complete the writing process well ahead of time. Some hints follow on each section of the thesis.

9.5 COMPONENTS OF A THESIS

Essentially a thesis has the same components as a research paper, except that some chapters are not combined and are written more elaborately. It follows the IMRAD formula consisting of an Introduction, Materials and Methods, and Results and Discussion. Review of Literature is separated from the Introduction and is written more comprehensively.

Generally a thesis should be written in the style of a review paper. Its purpose is to review the work that led to the award of the degree. Therefore, it might often be desirable to go back into history of the subject. This might enable you to compile a really valuable review of literature in the field that can be published in a journal and become a milestone for scientists working in the area. Each section may be designed along the lines of a research paper, IMRAD. Overall the sections should fit together and not remain solitary. The original data, whether previously published or not, should be incorporated and buttressed by all necessary experimental details

9.5.1 Introduction

A thesis addresses a problem or an issue important to the audience and presents sound arguments clearly and coherently. It must show that the topic represents an original contribution of knowledge. This means that the topic must be described and its significance to science, country, economy or elsewhere must be provided. Hence, special attention must be paid to Introduction in the thesis. It must answer a few questions:

- What is the problem?
- How and why that problem was selected?
- What has been done so far?
- How was it tackled?

If this chapter is well written, then the rest will flow easily and logically. Moreover, usually the first impressions are important; therefore, this chapter must offer interest for the readers.

For a skilful introduction, the ability to choose relevant facts from the scientific literature is important. These facts should be paraphrased, and reassembled into ones own logical sequence citing the sources to support each statement. If something practical can be tied up, the introduction becomes more valuable. This may have biological, medical, academic or commercial significance that will give relevance to the study.

9.5.2 Review of Literature

A Review of Literature is meant to review the recent work in defined subject area. It is designed to summarize, analyze, evaluate, or synthesize information that has already been published. It must demonstrate familiarity with all the current knowledge related to the topic. The review of literature must be extensive. It must begin at a

very general level and narrow down to the very specific issue being investigated.

9.5.3 Materials and Methods

This chapter must contain details of all materials, equipment and methods used. It is important to define makes and models, and sometimes provide serial numbers of all equipment used. This information is usually contained on a shield on the equipment. Many institutions require that the methods must be elaborated and not just referred. These should be standard methods and acceptable to the research community. For writing Materials and Methods in the thesis, simply change future tense in the Synopsis to past tense. If the Synopsis has been followed as written, then this gives Materials and Methods section of the thesis. In case some methods were changed or modified, then these have to be written fresh, in the past tense.

9.5.4 Results and Discussion

This could be written as a single chapter or split into two with results in one and discussion in the other. Whatever the pattern followed, results of the research are described in the results portion. The results should be presented in details to convince the reader that ample work was done and that nothing was left out. The presentation style of results in a thesis differs from that of a journal article. While brevity is advocated in a journal article, in the thesis results should be presented in details. Tables and graphs should be liberally used.

After the results have been described, these need to be discussed and concluded. Most students and scientists find it tough to discuss the results. Quite often results are compared with findings of others – the results agree or disagree with earlier conclusions. Although this is useful, it does not reflect "discussion". The discussion must answer "how" and "why" and has to be related to the Introduction. In the Introduction the problem was narrowed down to the significance of the work. In the Discussion, this needs to be broadened again. Here the significance of the work can be reemphasized. This is done partly by relating the findings to the problem statement given in the Introduction and partly by describing the implications of the work for future research. The shortcomings in the research work should be liberally elaborated so that those who follow can remove them.

9.5.5 Figures, Tables, Maps and Equations

Figures and tables should be interspersed in the text to assist the reader and to support a statement. When presenting information in the form of a graph or table ensure that these are introduced in the text. Then, following the insertion these must be discussed. Tables should be used when calculations are of a repetitive nature. A visual form like a figure or a graph is more beneficial. All figures or tables should be placed in the text as close as possible, but immediately after where reference to one is made. Avoid splitting tables over two pages. If the table is large, it may be better to place it in an appendix. In case there are a whole series of very similar tables try to use similar words in describing each. If each introduction and discussion of similar tables uses very similar wording then the reader can easily spot the differences in each table. Table captions labelled as Table 1 or 2, should be centred top of the table

Numerical results are more easily interpreted when presented in graphic form, interspersed with the text that discusses them. Graphs are also particularly useful in comparing measurements with hypothetical or theoretical predictions. In such cases, only graphs should be included in the body of the text, while data may be placed in an appendix. The captions should be descriptive. Figure captions, labelled as Fig 1 or 2, should be centred underneath the figure.

Photographs and photomicrographs are sometimes needed to illustrate equipment or tests that are unusual or difficult to describe in words. These can be scanned with the help of a scanner and inserted where required. Where maps are needed, these must have a scale and a north point. The captions for these should be written underneath and labelled as Plate 1, 2 and so on. This will distinguish them from graphic illustrations.

Equations and formulae should be numbered consecutively as they appear, with Arabic numerals in parentheses ( ) on the right margin. Each equation should begin on a new line and should be centred in the text. When there are a series of consecutive equations, the equal signs (=) should be vertically aligned.

9.5.6 References

Primarily there are two styles of writing References – the citation-sequence (C-S) and name-year (N-Y) systems. Others are off-shoots or modifications of these systems. Since there may be variations in different institutions, it is advisable to check with the respective

authorities in your institution. While most universities follow the N-Y system, the College of Physicians and Surgeons Pakistan adopts the C-S system (CPSP 2004). However, in both cases, following information is obligatory:

a. Name or names of author(s), editor(s) or translator(s).
b. Year of publication.
c. Title of the article or book or proceedings.
d. Volume, issue number and inclusive pages for journal article.
e. Publisher's name and location for books and proceedings.
f. Date and location of proceedings.
g. Accession date and path names for data from the electronic sources .

It is wise to collect complete information on each reference right in the beginning. This should be fed in the computer in the style of the institution, when each reference is treated. These can be sorted out in alphabetical order or arranged in sequence at the finalization stage according to requirements of the degree-awarding institution.

9.5.7 Conclusions and Suggestions

This is a key section that is written after the whole thesis has been completed. The results must not be repeated nor should a summary be given. The conclusion is not a summary but an important message to leave with the reader. Only conclusions drawn from the research findings should be provided. It should draw a variety of insights that will help link this research to others and answer "so what"? Moreover, it should give an opportunity to better understand what has been done and what is to be done. This section should offer key ideas that can be drawn from the study to apply to other areas of concern.

9.5.8 Appendix

Appendices contain detailed supporting information which is relevant to the investigation. Material such as experimental details, or raw experimental data and detailed mathematical derivations are usually included as appendices. It is not uncommon for the appendices to be bigger than the rest of the report

9.5.9 ACKNOWLEDGEMENT

This is usually inserted in the beginning of a thesis. It is customary and courteous to acknowledge any academic or financial assistance received during the course of studies. Acknowledgments should be restricted to persons or organisations that provide significant or substantial assistance. It is not unusual to see a sea of names of irrelevant persons who have "helped" in the thesis.

9.6 STATISTICAL ANALYSIS

Quite often raw data cannot be interpreted nor can be tabulated in meaningful tables. Hence, it requires to be analyzed statistically. Different statistical packages are available that can be used for data analysis. In case you are not much conversant with statistical analysis, services of a statistician can be hired.

9.7 THE ENDING ASSIGNMENT

After a thesis has been bound and placed in the library shelf, there are very few people who would be interested in it. The work reported in a thesis would be waste of resources unless publishable portions appear in some journals. Certainly there will be parts of the research work that can take the form of a research paper or a review article. Even popular articles can be prepared in some cases. These articles should be written and submitted before leaving the institution. Share the outcome of your research with others. It will be difficult to do this after leaving the institution, hence capitalize on all the investment that has been made in the research and reap some additional benefits. This will give you credit in finding a job and in future endeavours.

9.8 COMPOSING AND FORMATTING

There are no generally accepted rules for composing and formatting a thesis. The correct way to format a thesis varies widely from institution to institution and even from professor to professor within the same department of the same establishment. However, every institution has prescribed some standard format for the theses. It would be worthwhile to examine some theses submitted by previous graduates of the department and the institution. Observe their use of headings, overall style, typeface and organization. The one that appeals may be used as a model for the preparation of your own thesis. In this way you will have an idea at the beginning of your writing what your finished effort will look like.

The thesis has a specific format that is guided by the degree-awarding institution. It must have a covering page that should contain title of the thesis, author's name, registration number and name of the institution. The first few pages should be:

Page 1	Praise to Almighty Allah	Optional	
Page 2	Dedication	Optional	
Page 3	Title page	Compulsory	Sample 1
Page 4	Certificate from the supervisory Committee	Compulsory	Sample 2
Page 5	Acknowledgement	Optional	
Page 6	Table of contents	Compulsory	
Page 7	List of Tables	Optional – better to have it	
Page 8	List of Figures	Optional – better to have it	

9.8.1 Page Layout

Availability of the computer and printers has eased the job of a typist. In order to have uniformity in all theses submitted to an Institution, it is recommended that there should be uniformity in style. It is suggested that:

1. **Paper** – 100g Letter or A4 paper be used.
2. **Margins** – 4 cm margin on the left and 2.5 cm margin on other three sides be provided.
3. **Line spacing** – It is suggested that line spacing should be 1.5.
4. **Page number** – Insert page number at the bottom of the page in the centre. Use same font as the text, or one point lower.
5. **Captions for tables, figures and others** – Use one font lower than the text for captions for all tables, figures, plates, maps and others.
6. **Fonts** -Typing should be done in a uniform font. Times Roman or Arial, size 12 can be used for the text.
7. **References** and **index** should be typed in a font smaller than the text by one point

8. **Headings** - Following font sizes are recommended for headings and subheadings: One blank line should be left before a new subsection.

   a. Chapter heading – Font 24, bold, all caps
   b. First subheading – Font 12, bold, all caps
   c. Second subheading – Font 12, bold, small caps
   d. Third level subheading – Font 12, bold, running
   e. Subsequent headings – Should be listed as a, b, c, and so on and placed in bold face, running.

9.8.2 Typing Conventions

Numerous typographical mistakes are made, usually due to the negligence of the author. These annoy the readers and may give negative impact in evaluation. The thesis bears the name of the student, hence it becomes his/her responsibility to ensure that these mistakes are avoided. Some hints in this regard are: -

- Always leave one space after every punctuation mark - comma, question mark, exclamation mark, semicolon, colon and a period (full-stop).
- Leave no space between a punctuation mark and the preceding word.
- Place period (full-stop) and comma inside quotation marks.
- Place colon and semicolon outside the quotation marks.
- Do not start a new paragraph on a page where there is space for less than three lines
- Leave one blank line before a new paragraph.
- There is no need to indent. If the start of the paragraph is to be indented, then indent at about 1.25 cm or 0.5 inch.
- Start a new section preferably on a new page, especially when less than 10 lines from the bottom of a page are available.
- Do not split tables and references on two pages.

9.8.3 Binding

Thesis is a permanent document. The final copy must be hard-bound. The title of the thesis, student's name, registration number, department and the institution must be printed on the cover. It is suggested that each faculty in a university should prescribe a separate colour for the cover.