



## Writing a Quality Thesis/Dissertation for MS or PhD Degree – A Note for Researchers, MS and PhD Students

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### Abstract

Thesis or dissertation is a research report concerns a problem or series of problems in the area of applied or basic research. Abstract should contain all elements of the thesis in an extreme shorter form. Need to try to accommodate the description of the works including introduction, design and methodology within 2-3 sentences. Key findings of the experiments should be written in very brief. After findings, key words are written. The key words have to be different from the words in the title and to be arranged alphabetically. Introduction covers (i) identification of scientific problem stated in brief, (ii) critical analysis of relevant background information of the study to justify the problem using past research reports, (iii) identification of scientific information gap based on background analysis, (iv) formulation of the hypothesis, *i.e* making researcher's best guess at the answer to the problem, and (v) formulation of specific objective(s) of the work. Review of literature has two reasons. One is to explain the results, need to collect only the relevant information and the other is to find out the gap or unexplored area for the study, that the designed work is either original or some works done still gaps are remained and/or different workers on the line to find contrast results. In materials and methods, the materials including treatments used in the study are recorded. Listed parameters are also mentioned. New technique(s) should be described in detail, other wise mention name only if necessary giving a brief note. Mention the layout/design of the experiments and analysis procedure. In results and discussion, we describe results chronologically and conclude logically. Presentation of the same result both in table and graph is prohibited. Summary and conclusion include introduction (importance) about the works, methodology, design/layout, etc. in very brief. In conclusion key message should be provided.

**Key words:** Preparation, Procedure, Scientific report

## Introduction

### Thesis

A thesis consists of an argument or a series of arguments combined with the description and discussion of research you have undertaken. In the case of a PhD, and to a lesser extent, a Masters (research) thesis, the research is expected to "make a significant contribution to the chosen field" (Phillips and Pugh, 1994). Minor theses (e.g., for coursework Masters programmes or Honours theses) may also contribute to the knowledge in the field, though the main requirement is that they provide evidence of an understanding of the field.

### Writing

Thesis writing is not an easy task. However, research guide/supervisor gives simple and practical advice on the problems of getting started, getting organized, dividing the huge task into less formidable pieces and working on those pieces. However, once started it will seem less threatening. The examiners evaluate the thesis. They are the experts in the general field of your thesis but, on the exact topic of your thesis, you are the world expert - keep this in mind: you should write to make the topic clear to readers using your own language. Copying or stealing sentences of other

authors' work or writing is strictly prohibited and in such cases, thesis supervisor or thesis evaluator may reject your thesis or paper containing valuable information.

### An outline

First make up a thesis outline: several pages containing chapter headings, sub-headings, some figures, tables and some other notes and comments. There is a thesis structure and it is given below:

### Thesis structure

The list of contents and chapter headings below is appropriate for some theses. 'Results and Discussion' are usually combined but in some theses, they may be separated. Think about the plan of chapters and decide what is best to report the work. Then make a list, in point form, of what will go in which chapter. Once a complete list of things to be reported or explained, under each chapter heading prepared, thesis writing becomes an easy job. In an experimental thesis, the 'Materials and Methods' chapter is often the easiest to write – just write down what you did; carefully, formally and in a logical order.

In making the outline, all the figures should be assembled in order that will be used and explained.

Once you have an outline, discuss it with your adviser. This step is important: s/he will have useful suggestions, but it also serves notice that s/he can expect a steady flow of chapter drafts that will make high priority demands on his/her time. If you have a co-adviser, discuss the outline with him/her as well, and present all chapters to both advisers for comments.

### **Organization**

You should also have a physical filing system: a collection of folders with chapter numbers on them. This will make you feel good about getting started and also help clean up your desk. Your files will contain not just the plots of results and pages of calculations, but all sorts of old notes, references, calibration curves, suppliers' addresses, specifications, speculations, letters from colleagues etc., which will suddenly strike you as relevant to one chapter or other. Stick them in that folder. Then put all the folders in a box or a filing cabinet. As you write bits and pieces of text, place the hard copy, the figures etc in these folders as well. Touch them and feel their thickness from time to time – ah, the thesis is taking shape.

If any of your data exist only on paper, copy them and keep the copy in a different location. Consider making a copy of your lab book. This has another purpose beyond security: usually the lab book stays in the lab, but you may want a copy for your own future use. Further, scientific ethics require you to keep lab books and original data for at least ten years, and a copy is more likely to be found if two copies exist.

While you are being organised, you should deal with any university paperwork. Examiners have to be nominated and they have to agree to serve. Various forms are required by your department and by the university administration.

### **Supervisor's opinion**

Your adviser will expect to read each chapter in draft form. S/he (adviser) will then return it to you with suggestions and comments. *Do not be upset if a chapter---especially the first one you write--- returns covered in red ink (or its electronic equivalent).* Your adviser will want your thesis to be as good as possible, because his/her reputation as well as yours is affected. Scientific writing is a difficult art, and it takes a while to learn. As a consequence, there will be many ways in which your first draft can be improved. So, take a positive attitude to all the scribbles with which your adviser decorates your text: each

comment tells you a way in which you can make your thesis better.

As you write your thesis, your scientific writing is almost certain to improve. Even for native speakers of English who write very well in other styles, one notices an enormous improvement in the first drafts from the first to the last chapter written. The process of writing the thesis is like a course in scientific writing, and in that sense each chapter is like an assignment in which you are taught, but not assessed. Remember, only the final draft is assessed: the more comments your adviser adds to first or second draft, the better.

Before you submit a draft to your adviser, run a spell check so that s/he does not waste time on those. If you have any characteristic grammatical failings, check for them.

### **The length**

Once your thesis has been assessed, the only further readers are likely to be people who are seriously doing research in just that area. Good referencing also tells the reader which parts of the thesis are descriptions of previous knowledge and which parts are your additions to that knowledge.

### **Writing style**

Short, simple phrases and words are often better than long ones. It is not the place of elegance or efficient communication. In certain cases you may need a complicated sentence because the idea is complicated. Some lengthy technical words will also be necessary in many theses, particularly in fields like biochemistry, biology, environmental science, etc. Do not sacrifice accuracy for the sake of brevity. Sometimes it is easier to present information and arguments as a series of numbered points, rather than as one or more long and awkward paragraphs. A list of points is usually easier to write but in thesis writing, this format is not creditable.

One important stylistic choice is between the active voice and passive voice. The active voice is simpler, and it makes clear what you did and what was done by others. The passive voice makes it easier to write ungrammatical or awkward sentences. If you use the passive voice, be especially wary of using participles. The active voice is desirable because it is clearer, more logical and makes attribution simple. The only arguments for avoiding the active voice in a thesis are (i) many theses are written in the passive voice, and (ii) some very polite people find the use of "I" immodest. Use the first person singular, not plural,

when reporting work that you did yourself: the editorial 'we' may suggest that you had help beyond that listed in your acknowledgments.

### ***Presentation***

There is no need for a thesis to be a masterpiece of desk-top publishing. Your time can be more productively spent improving the content than the appearance.

In many cases, a reasonably neat diagram can be drawn by hand faster than with a graphics package, and you can scan it, we should mention that photographs look pretty but take up a lot of memory, still it is preferred. About figures and photographs- in the digital version of thesis, do not save ordinary photographs or other illustrations as bitmaps, because these take up a lot of memory and are therefore very slow to transfer. Nearly all graphics packages allow saving in compressed format as .jpg (for photos) or .gif (for diagrams) files.

## **Components of a Thesis**

### ***Functions and characteristics***

Theses come in various sizes. The components of many theses are similar although their functions and requirements may differ according to the degree they are presented for. The components and their functions and characteristics are set out below. Note that not all theses must contain all components. Consult with your supervisor and the regulations governing your degree to identify which components you need. Notable exceptions from the following format are theses that do not have an empirical element, and historical studies. The ways in which data are related to the literature can vary enormously, so that there may be no clearly defined differentiation of function amongst your chapters regarding literature and data presentation.

### ***Title***

The title announces the problem. In a sequential combination of the keywords, a title is a meaningful expression that adequately describes the content of a scientific paper. Thus, title of a paper is not merely a sentence with the usual arrangement of subject, object and/ or verb. Title of a paper is a label of the content. Thesis writing must have proper and informative titles. It must be self explanatory.

### ***Cover/ Title page***

Title page may vary among institutions but there main purpose is to identify topic, writer, institution, degree and date/ academic session.

For an example: Title/author's Examination Roll No., Registration No./ Session/Semester (for MS) /Thesis submitted to the Department of Environmental Science, Bangladesh Agricultural University, Mymensingh in partial fulfillment of the requirements for the degree of Doctor of Philosophy/ Master of Science in Environmental Science/.../date. In addition, another page for approval of the style and content of thesis by Supervisor, Co-supervisor and Chairman of the Examination Committee & Head of the Department (consult with old thesis for setup) is needed.

### ***Declaration***

Many universities require some declaration while others not. If so check whether there is a standard format and the wording required by your institution and do accordingly. Normally it is required to state that (i) this submission is his own work and it contains no material written by another person and (ii) the material presented has not been used for any other degree award, and that all sources are acknowledged, etc.

### ***Acknowledgments***

Most thesis authors put in a page of thanks to those who have helped them in matters scientific/ intellectually, and also indirectly by providing such essentials as food, education, financial help, advice, friendship etc. It is not wise to include a name that has no contribution. The supervisor generally receives the first vote of thanks.

### ***Abstract***

Of all the theses, this part will be most widely published and most read because it would be published in Dissertation Abstracts International. It is best written towards the end.

A good abstract explains in one line why the paper is important. It then goes on to give a very short summary of your major results. The final sentences explain the major implications of your work. A good abstract must be self-contained, a distillation of the thesis, a concise description of the problem(s) addressed, methods employed for solving it/them, results and conclusions. All are in concise, readable,

and quantitative without any citation. Answers to the questions what, why and how research was conducted and why does it matter should be found in the abstract. The length should be less than one paragraph having approximately within 150-400 words.

**Contents**

This will contain list of all headings and subheadings with page numbers.

**Table 1.** Contents of a thesis in the Department of Environmental Science

CHAPTER	TITLE	PAGE #
	<b>Acknowledgments</b>	
	<b>Abstract</b>	
	<b>Contents</b>	
	<b>List of Tables</b>	
	<b>List of Figures</b>	
<b>1</b>	<b>Introduction subheads ...?</b>	
<b>2</b>	<b>Review of Literature subheads ...?</b>	
<b>3</b>	<b>Materials and Methods subheads ...?</b>	
<b>4</b>	<b>Results and Discussion subheads ...?</b>	
<b>5</b>	<b>Summary and Conclusions</b>	
<b>6</b>	<b>Recommendations/ Suggestions</b>	
	<b>References</b>	
	<b>Appendices</b>	

**List of tables**

List page numbers of all tables: The list should include a short title for each table but not the whole caption.

**List of figures**

List page numbers of all figures: The list should include a short title for each figure but not the whole caption.

**Introduction**

Introduction is the first event of communication acts as a bridge between the writers and readers providing background information from general to specific, known to unknown. Fill up the information gap

between the readers' and writers and helps the readers to grasp quick understanding the message contained in the article. Statement of the problems with importance and justification with concluding remarks (final argument). Finally, formulate correct and specific objective (hypothesis) of the study. According to Ernst, Chief Editor, Journal of Experimental and Environmental Botany (2001) mentioned in his editorial note that introduction covers (i) identification of scientific problem stated in brief, (ii) critically analysis of relevant background information of the study to justify the problem using past research reports, (iii) identification of scientific information gap based on background analysis, (iv) formulation of the hypothesis, *i.e* making researcher's best guess at the answer to the problem, and (v) formulation of specific objective(s) of the work. There should be a relation in the message given in the 'Title' with objective(s).

Especially in the introduction, do not overestimate the reader's familiarity with your topic. You are writing for researchers in the general area, but not all of them need to be specialists in your particular topic. The introduction should be interesting. If you bore the reader here, then you are unlikely to revive his/her interest in the remaining sections.

### ***Review of literature***

Only the relevant literature should be reviewed. The main objectives of this chapter is to (i) prove the reader/examiner that the researcher is familiar with issues and debates in the field that needed to explain and discuss to solve the problem(s), (ii) demonstrate the reader that there is an area in this field to which researcher can contribute (thus, the review must be critically analytical), (iii) identify from where does the problem come? What is already known about this problem? What other methods have been tried to solve it? However the main purposes of review of literature are 1) to explain the results: collect only the relevant information to explain the results. And to find out the gap or unexplored area for your study: show that your work is either original or some works are done still gaps are remained or different workers on the line find contrast results .

This is the section where other's finding are used. Here the verb tense becomes most important in conveying subtle meanings, where you must beware of unwarranted repetition. This is where plagiarism becomes an issue. Researcher should write a summary (anything from a couple of sentences to a couple of pages, depending on the relevance adding key words and comments about its importance, relevance to its quality).

How many papers? How relevant do they have to be? It is a matter of judgment. For PhD thesis hundred is reasonable, but it will depend on the field. Now the thesis writer is the world expert on the (narrow) topic of the thesis: it must be demonstrated.

## **Materials and Methods**

### ***Methods***

Methodology provides the framework for getting answers to the questions "What did you do using what and how did you do to pose in the purpose of the work". Here, you have to illustrate the materials and the methods you used in your work. Therefore it is an easy part of the paper to write. However, you must make sure that you have described everything in enough detail. It should include all the detail that will

make it possible for any reader to repeat the work easily without asking for more detail to the author. In this section no interpretation is needed but presentation of a rationale for the methodological approach is essential. Descriptions and justifications of the methods of research and analysis are vital points. If the research is survey type descriptions of the processes for selection of site, participants, sampling, data gathering and analysis are the critical points.

Researcher has to justify his/her preference of one method or technique over others available by stating the assumptions made. This will provide the examiners during examination and finally the readers when the report is published to understand clearly. The most important thing is to impart just enough detail to allow other scientists to judge the validity and accuracy of results, soundness and pertinence of interpretation of that results. Any researcher can repeat the experiment to get the same results. Mentioned parameters included in your study. Follow a logical order in describing the methods (First pot experiments then field). New technique(s) should be described in detail, other wise mentioned name only if necessary give brief description (not the list of solutions, glassware's, etc.).

### ***The materials***

Descriptions of used animals, plants, microorganisms, chemicals, materials, equipment, machinery, study populations, human cells, plant tissues, geographical locations etc. should be provided. Clear identification of new equipment and description of chemical compounds, with specification of concentration and fertilizers doses are essential, so the workers will be able to obtain the exactly the same materials or use the same concentration of active ingredients.

### ***Name of materials***

Internationally recognized name/nomenclature for materials, and standard unit preferably metric units should be used. If any local name is used, Latin or Scientific Name, at least English common name is must for international readers.

### ***Sources of the materials and equipment***

In case of common materials it can be said that the animals/plants/seeds used in present study were grown/ reared/ raised/ sown or procured/ obtained/ provided/ purchased/ bought/ acquired from the field laboratory of the Department of Environmental Science, Bangladesh Agricultural University.

### ***Place of the experiment***

Author should mention about the location of the experiment place or of the sampling or survey sites.

### ***Duration and time of experiment***

Timing for conducting research and duration of the experiment are very important because the weather and other environmental parameters vary with the season. Therefore, clear description in a concise form is essential.

### ***Treatments***

In field, plot and laboratory experiments describe in detail with all the parameters including treatments, replications, etc. is a must for this section.

### ***Maps, figures, photographs***

In survey type experiment, map of study area is essential because geographical locations have a prominent effect on the outcome of the experiment. The maps must be very clear, bold patterns, must show longitudes and latitudes, a scale and a side locator.

### ***Statistical analysis***

In survey, sampling techniques, collection of data, and in field experiments design of experiment and statistical techniques that are used for data analysis and other purposes should be mentioned. Most common tests are well known and do not need much description. If any uncommon technique used then it need to be explained thoroughly.

It should be remembered that Materials and Methods is a vital part of a thesis writing and needs careful consideration. Citations in this section should be limited to data sources and references of where to find more complete descriptions of procedures. Do not include any unnecessary descriptions or results. Mention the layout/design of the experiments and analysis procedure.

## **Results and Discussion**

It seems a sensible decision to combine the results and discussion in a single chapter in theses. The division of Results and Discussion material into chapters is usually best done according to subject matter.

### ***Results presentation***

To present the results break up the results into logical segments by using subheadings and key results should be stated in clear sentences at the beginning of paragraphs mentioning the table/figure number where results can be seen.

Statistics helps in presenting complex data in a suitable tabular, diagrammatic and graphic form for an easy and clear comprehension and facilitates comparison, forecasting, formulating and test hypothesis. Statistics also helps to improve the quality of data with the design of experiments and survey sampling. It provides tools for prediction and forecasting using data and statistical models. Before result presentation appropriate statistical analysis should be done to simplify and analyse data to information, from information to facts, and finally, from facts to knowledge.

The graphs are finished and scored, researchers present the information on graph, the observations/conclusions they drew from the graphs. In plotting data it should bear in mind that bar diagram is normally used for simple comparisons, linear graph is used for trend analysis and/or progressive growth while pie chart is used for contribution/share representation. The trend such as increase in production with increasing amount of raw materials, relationship and measure of strength are expressed by correlation and regression graphs and finally by the regression and correlation coefficient. Analysis of variance is used to compare the differences in means and finally means separation test is most widely used to compare treatment means simultaneously.

Presentation of some result in table and graph should be avoided (i.e. present in one form)

### ***Results discussion***

In most cases results need discussion. What do they mean? How do they fit into the existing body of knowledge? Are they consistent with current theories? Do they give new insights? Do they suggest new theories or mechanisms? etc.

However, discussion provides findings, drawing out main achievements and explaining results, makes links between objectives and findings, formulates suggestions and recommendations. Describe chronologically and conclude with yield integrating the effects of yield contributing characters.

The student would qualify his/her results by mentioning any limitations and shortcomings of his/her experiments.

### ***Results interpretation***

After discussion, the researcher should make necessary explanation and interpretation of his/her results, primarily to justify the statement made in the lead sentences. While doing this, the writer should be careful to avoid unnecessary repetition of data presented in results. Interpret results in terms of background laid out in the introduction to show the relationship of the present results to the original question. Statistical statements mentioning the level of significance of those observations best accomplish this. He/she should also explain the probable reason(s) of variations. Say for an example: mere counting the number of tillers, grains or measuring height of the plants or length of the panicles is not sufficient for researchers, it is the base for the scientists to explain the results how and why it differ from one another. Researchers need to explain possible reasons of differences and also to relate findings of other works ( use of the review of the literature here).

### ***Results comparison***

The student should make necessary comparisons of his/her results with relevant results of others. Clearly mention the agreement or disagreement with previous works. Because it is not just mere comparison, rather this is an effort to show how his/her results fit in the current state of the knowledge. He/she should mention if his/her results have anything new or original. If the results of the researcher are not in agreement with previous observation of others, he/she should consider why. In that case, what are the likely causes, what is the implication of the present results for other unanswered questions in sciences specially in ecology and/ environmental policy, etc. should also be mentioned. Controversial issues should be discussed fairly and politely. This section should be rich with references to similar work and background needed to interpret results.

\*Remember Results discussion in a critical part of a thesis. It should be written very carefully and if allowed try to accommodate two independent chapters for these purpose

## **Summary and Conclusions**

A summary of conclusions is usually longer than the abstract. Introduction (importance) about the works, methodology, design/layout, etc. should be presented in very brief

Present all arguments and findings together, summarizes major findings with implications and limitations, suggests directions for future research. Mention the strongest and most important statement that you can make from your observations. Leaves the reader with a strong sense that the work you set out to do has been completed with the fulfillment of the objectives set for research, and that it was worthwhile.

## **References**

### ***Literature cited***

The Literature Cited section gives an alphabetical listing of the references that you actually cited in the body of your paper. Do not label this section "Bibliography". A bibliography contains references that you may have read but have not specifically cited in the text.

Many professional publications often have their own system style, which introduces specific variations within these general conventions. There are two main methods of referencing articles in journal and book publications. These are known as the Harvard (author-date) and Vancouver (number-author) reference systems. However, there are many other styles too. But there are only two styles used with all subjects are: (a) Chicago style, e.g. Wilcox, Rhonda V. 1991. Shifting roles and synthetic women in Star trek: The next generation. *Studies in Popular Culture* 13 (2): 53-65. and (b) Turabian style, e.g. Wilcox, Rhonda V. 1991. Shifting roles and synthetic women in Star trek: The next generation. *Studies in Popular Culture* 13 (June):53-65.

### ***Appendices***

If there is material that should be in the thesis but which would break up the flow or bore the reader unbearably, include it as an appendix.

***Suggestions to the students***

***Look at other theses in the field***

Hundreds of theses are available in Bangladesh Agricultural University Library and also in the Departments concern. Look at ones in your field to get ideas about the main features and for other information.

***Size***

A suggestion on the size of thesis is given below:

- Abstract --- 1 page
- Introduction including objectives of the study --- 2 pages
- Review of Literature - maximum 10% of the total thesis
- Methodology - 3-5% (as it required) of the total thesis
- Main Results - 60-70% of the total thesis
- Conclusion --- 2 pages

***Paper size***

Standard (8.5" x 11")

***Font***

Times New Roman (if not otherwise instructed)

***Font sizes for***

- Title :12pt. Bold
- Author(s) :11pt. Normal
- Sub-title :11pt. Normal
- Abstract Body :9pt. Normal
- Others :11pt. Normal

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***Reference***

Phillips, E. M and Pugh, D. S. 1994. How to get a PhD : a handbook for students and their supervisors. Open University Press, Buckingham, England.