Chapter 8

THESIS

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Contents

1. What is MEE/PhD Thesis?
2. Structure of Thesis: Conventional, Journal paper compilation
3. When to start writing?
4. Format and styles
5. Submission and examination and correction

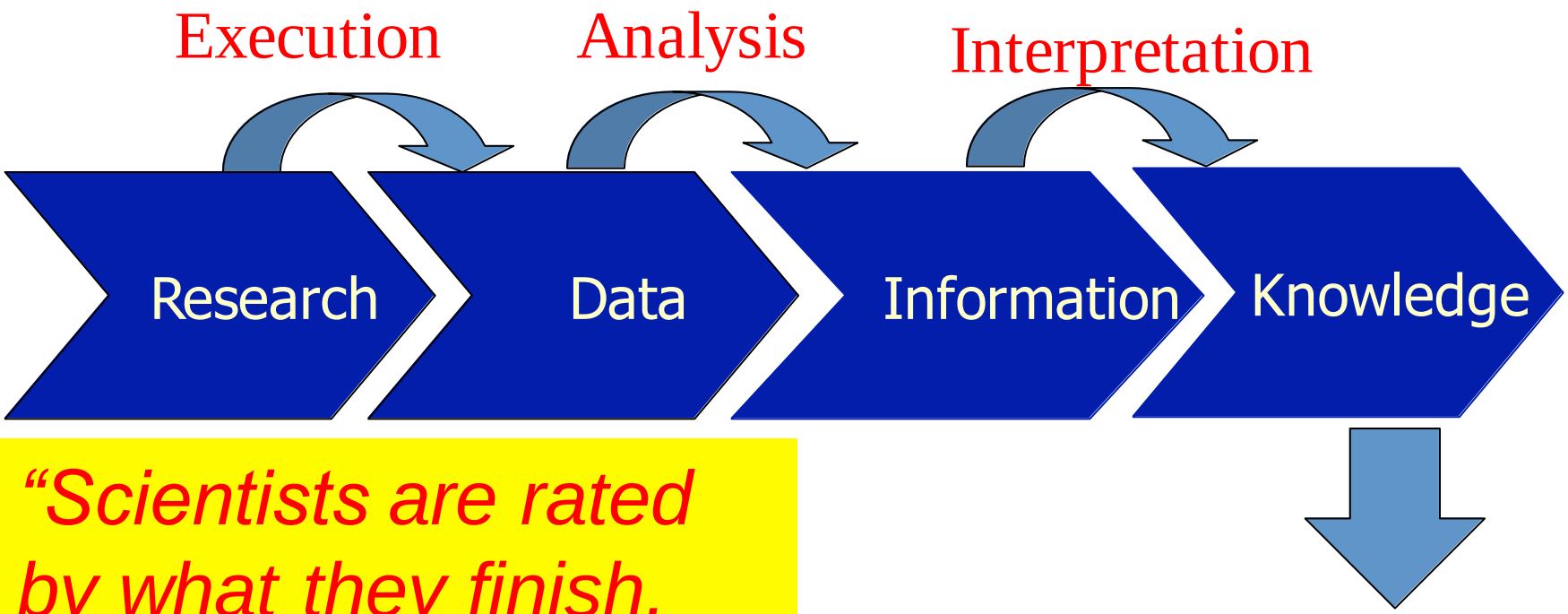
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Why Do We Write Thesis?

- Obviously, to determine if your work is good enough for a MEE/PhD degree
- Partial fulfillment of the degree
- To legitimize the research
- To share knowledge
  - Sharing opinions and experiences with peers
  - To receive expert feedback
  - Independent verification of methods and results.

Steps of obtaining research output for Thesis



"Scientists are rated by what they finish, not by what they attempt"

To be disseminated by PUBLICATATION (THESIS)

What is a Thesis

- A complete “Scientific Story Book”.
- The objective is to convince reader to accept certain ideas/hypothesis, which are then being researched and verified extensively
- Contain sufficient detail, making it possible for others to repeat the work.

Two Types of Thesis

- Unrestricted
  - Non-confidential.
  - Anyone can have access from University library
- Restricted
  - Information is confidential
  - Protected by University
  - Project funded by companies, or special Govt. Dept.
  - Permission granted for specific users
- Thesis is copyrighted under the University.
  - Legally, it belongs to the University.
  - The thesis will be indexed somewhere

Thesis Examination

- With viva-voce
  - Candidate is given a “face-to-face” chance to explain any issues in the thesis.
  - Advantages to candidate
  - Practiced in UTM for PhD; in some cases for MEE

- Without viva-voce
  - No opportunity to explain
  - Everything depend son the content of the thesis
  - Thesis must be written with minimum ambiguity.

NEED OF A THESIS/RESEARCH REPORT

- Writing a research report is very challenging task for the researcher. A good research report requires sufficient experience and insight about the research activities. A research report is needed due to the following reasons:

1. The research must be reported in full and its results should be subjected to a criticism and verification.

2. It is needed for providing a clear picture of research method, sample and techniques used in conducting the research work.

3. The research report is meant for popularizing the new contributions in the discipline.

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GENERAL FORMAT OF RESEARCH REPORT

A written format of a research work is known as thesis or research report. All such works may differ considerably in scope of treatment and details of presentation. Even then all types of research reports are expected to follow a general uniform, common pattern of format, style and structure. A research report or thesis is an organized format of research work done. It is viewed in three major categories:

A. Preliminaries,

B. Textual Body, and

C. References.

GENERAL FORMAT OF RESEARCH REPORT

Each category has been outlined further as follows:

A. Preliminary Section

1. Title page
2. Preface or acknowledgements
3. Table of content
4. List of tables (if any)
5. List of figures (if any).

GENERAL FORMAT OF RESEARCH REPORT

B. Main Body of Report or Textual Body

1. Introduction
    a. Statement of the problem
    b. Objectives of the study
    c. Hypotheses to be tested
    d. Significance of the problem/motivation
    e. Assumptions and delimitations.
    f. Definitions of Important terms used.

GENERAL FORMAT OF RESEARCH REPORT

2. Review of related literature.

3. Design of the study

- Method and procedure used
- Tools of research or sources of data
- Techniques of data collection
- Description of techniques used.

4. Analysis and presentation of data

- Analysis of data
- Tables and interpretation
- Figures and interpretation.

GENERAL FORMAT OF RESEARCH REPORT

5. Conclusions

   a. Discussion of results
   b. Main Findings and inferences
   c. Implication of the findings and limitations
   d. Suggestions for further studies.

6. Reference Section

1. Bibliography
2. Appendices (if any)
3. Index or glossary (if any).

Thesis Structure

- Approximately 5-8 Chapters.
  - Title
  - Abstract (Summary)
  - Introduction
  - Literature Review (sometimes call background)
  - Detailed description of the proposed idea
  - Verification of the idea (can be more than one chapter)
  - Conclusion
  - References
- There must be hypotheses to be proven in the thesis
- The thesis must be coherence, i.e. must be able to link one chapter to another.

Title

Abstract

Standard Preliminary Pages

Introduction

- Research Background
- Problem statement/Motivation/Hypothesis
- Objectives
- Scope of work
- Research Contributions
- Research Significance, Thesis Outline

Literature Review

- Theoretical Background
- *Review on previous work/ 'Helicopter view'*
- Review on methods
- Critical analyses of previous work -> Identify gap/possible enhancement/new method/identify novelty

Methodology

- Overall Method/Flowchart
- Simulation/Modeling/Hardware Implementation
- Experimental set-up / Samples
- Measurements/Performance bench marking/Comparison

Results and Discussions

- Results and Analyses
- Discussion

Conclusions

References

Appendices

Title

- Extremely important
- Looks trivial, but not so.
- It is a “summary” and “essence” of your work in the thesis.
- No more than 15 words (UTM)
- Should be “encompassing” as well as “descriptive”.
- Perhaps the last thing to write.

Abstract (Summary)

- First impression
  - It decides whether the thesis pertains to the readers interests and needs.
  - A powerful representation of your research work.
  - In approximately one page, you need to summarize your work.
  - All important elements of the thesis must be included

- Single paragraph
- Self-contained (independent)
- Without abbreviations, footnotes, or references.
- Should not contain mathematical equations, diagram or tabular material.
- Three or four different keywords or phrases, as this will help readers to find it.
- Reads well and is grammatically correct.

Important Elements of Abstract

1. State the ***primary objective*** of the thesis.
2. Highlight the merits (or ***contribution***).
3. Give a conceptual ***idea*** on the method
4. Describe the research design and ***procedures/processes*** employed (is it simulation, experimental, survey etc.)
5. Give the ***main outcomes or results***, and the ***conclusions*** that might be drawn.
6. Include any ***implications*** for further research or application/practice, if any.

The Introduction Chapter

- Very important. It sets the “tone” and “direction” of the thesis.
- Contains several sub-sections
  - Overview
  - Problem statement (hypothesis)
  - Objective
  - Scopes
  - Outline

Introduction: Overview

- Bringing the reader into the context of your research
- Acknowledging other work
- Linking your work with others so that it does not seem “isolated”
- Highlighting the “gaps” exist in previous work. A prelude to state the problem staement

Introduction: Problem Statement (Hypothesis)

- Show exactly what the gaps are and the need for it to be resolved
- The problem must be of certain interest and value.
- Example:
  - "The system is slow. Need to improve the speed…"
  - "The existing algorithms do not cover a wide range…"

- Arguably, the most crucial part in Thesis.
- Ask these questions:
  - What exactly are you doing?
  - Has anyone done the same thing?
- However, you can always redefine the gap by looking at the problem in different angels/perspectives
  - Improved speed, lower cost, simpler implementation, etc.

Introduction: Objective

- State clearly what are the aim, target, mission etc. of your work.
- They can be a several, but not too many
- These are the “promises” you made. They need to be addressed, implemented or proven.
- Write in simple and understandable sentences
  - “to study …”
  - “to design…”
  - “to develop…”

Introduction: Scope

- The "**boundaries**" of the wok you undertaken
- Need to define them so that the readers know what to and what not to be expected from the thesis.
- **Note:** You are not expected to solve the entire universe problem. Be sincere and practical in defining your scope. Don't claim too much.
- Example:
  - "This research only covers simulation and analytical work. No experimental work is carried out..,"
  - "The measurement only covers up to 100 MHz range…"

Introduction: Thesis Outline

- Probably the easiest to write
- Purpose: to navigate the readers on the content of the thesis.
- Try to highlight salient features of each Chapter or Section.

Literature Review

- Compilation of related work on the same topic/area
  - Serves as background knowledge to the research
  - To prove that there is a niche (gap) in previous knowledge that need to be addressed
    - Insufficient work
    - Improvement needed
    - New ideas

- Act as a “bridge” to introduce your own proposed solution to the problem statements
- To connect your work to previous research. Thus, showing that your work is not isolated.
- Use concept of logical funnel
  - More general aspects are told first
  - Followed by narrower details
  - End with the possible solution to the problem



- The “idea”
- This is the backbone of your thesis
- What is your contribution to knowledge?
- The details of the method must be told:
  - What are the principles behind it.
  - Why is it different from others?
  - Any analytical, simulation work to support the idea?

Verification of your ideas

- Show that the idea should or can work by providing some evidence.
- Depending on the nature of the problems, the verification can be in one or more that several forms
  - Simulation, Mathematics (analytical), Survey, Experiments
- Must be corroborated with other work
- Show it is working/viable
- Make comparisons by using known (standard) performance indices, if possible.

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Interpretation and Report Writing

After collecting and analyzing the data, the researcher has to accomplish the task of drawing inferences followed by report writing. This has to be done very carefully, otherwise misleading conclusions may be drawn and the whole purpose of doing research may go wasted.

Interpretation and Report Writing

Title		*Abstract*		*Introduction*		*Report*
25 words	→	250 words	→	2500 words	→	25000 words
3 lines		1 paragraph		5 pages		50 pages

•*Welman, C. , Mitchell, B. & Kruger, F. (2005), Research Methodology, 3rd Edition, Cape Town, Oxford University Press

Report Writing

While determining the length of the report one should keep in view the fact that it should be long enough to cover the subject but short enough to maintain interest.

Abstract terminology and technical jargon should be avoided in a research report. The report should be able to convey the matter as simply as possible. This, in other words, means that report should be written in an objective style in simple language, avoiding expressions such as “it seems,” “there may be”, “perhaps” and the like.

Report Writing

Readers are often interested in acquiring a quick knowledge of the main findings and as such the report must provide a ready availability of the findings. For this purpose, charts, graphs and the statistical tables may be used for the various results in the main report in addition to the summary of important findings.

Layout

The layout of the report should be well thought out and must be appropriate and in accordance with the objective of the research problem.

The reports should be free from grammatical mistakes and must be prepared strictly in accordance with the techniques of composition of report-writing such as the use of quotations, footnotes, documentation, proper punctuation and use of abbreviations in footnotes and the like.

Layout

Report must be attractive in appearance, neat and clean.

Calculated confidence limits must be mentioned and the various constraints experienced in conducting the research study may also be stated in the report.

Objective of the study, the nature of the problem, the methods employed and the analysis techniques adopted must all be clearly stated in the beginning of the report in the form of introduction.

In spite of all that has been stated above, one should always keep in view the fact report-writing is an art which is learnt by practice and experience, rather than by mere doctrination. You acquire it by doing it again and again.

Conclude your work

- Back to your original hypothesis, i.e. what you have promised in the Introduction.
- Are the objectives met? Partially met?
- Is is successful? If not, justify.
- Propose future work

Citing Others: References

- Reference list should be exhaustive
- All important work CANNOT be missed
- Examinees are very particular about quality of the papers you cite
- Try to cite more “revered’ journals, such as IEEE Trans.
- “Flagship” Conference in respective filed is also OK
- Avoid citing from “unknown” journal or conferences
- Be careful with specific formatting.

HYPOTHESIS and ABSTRACT

HYPOTHESIS

1. It is a tentative supposition or provisional guess which seems to explain the situation under observation.
2. A tentative generalization, the validity of which remains to be tested. In its most elementary stage the hypothesis may be any hunch, guess, imaginative idea which becomes the basis for further investigation.
3. It is a shrewd guess or inference that is formulated and provisionally adopted to explain observed facts or conditions and to guide in further investigation.

HYPOTHESIS

4. Guides the thinking process. Science employs hypothesis in guiding the thinking process. When our experience tells us that a given phenomenon follows regularly upon the appearance of certain other phenomena, we conclude that the former is connected with the latter by some sort of relationship and we form an hypothesis concerning this relationship.
5. A proposition is to be put to test to determine its validity. A hypothesis states what we are looking for. A hypothesis looks forward. It is a proposition which can be put to a test to determine its validity. It may prove to be correct or incorrect.
6. An expectation about events based on generalization. A hypothesis then could be defined as an expectation about events based on generalization of the assumed relationship between variables.

HYPOTHESIS

7. A tentative statement of the relationship between two or more variables. A hypothesis is a tentative statement of the relationship between two or more variables. Hypotheses are always in declarative sentence form and they relate, either generally or specifically variable and variables.
8. A theory when it is stated as a testable proposition. A theory when stated as a testable proposition formally and clearly and subjected to empirical or experimental verification is known as a hypothesis.

HYPOTHESIS

9. A statement temporarily accepted as true. A hypothesis is a statement temporarily accepted as true in the light of what is, at the time, known about a phenomena, and it is employed as a basis for action in the search for new truth, when the hypothesis is fully established, it may take the form of facts, principles and theories.
10. A testable proposition or assumption. Hypothesis is an assumption or proposition whose testability is to be tested on the basis of the computability of its implications with empirical evidence with previous knowledge.

Abstract

An abstract is essentially a brief summary of the whole report. It gives an overview of the research study including the conclusions.

The main purpose of an abstract is to give the reader a general idea of the content of the report. The abstract will help a reader decide whether to read the whole text in detail. An additional purpose is to inspire interest in your report.

An abstract is found at the beginning of reports immediately after the title page. *Abstracts may also appear separately and be held in databases of abstracts*.

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When to Start Writing

- When the Supervisor said so!
- Results are comptitive enough.
- The hypotheses or problems have been solved.

Shall I Write Paper or Thesis first?

- It depends, but **time** is the main factor
- If significant results obtained early, it might be good to write one or two papers prior to thesis writing.
- It is not a waste because most of the material can be re-used in thesis
- In fact its advantageous because valuable comments form the reviewer can be used for improvement.

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Make a Frame Work of Thesis

- Discuss and agree with supervisor on the framework of the whole thesis.
- It's a comprehensive and detailed table of content that includes:
  - The storyline of thesis, chapter and sections
  - Estimated number of pages
  - What diagrams, tables, aquations, results to put in.
  - Put ideas in point form.
  - Avoid writing complete sentences
- Give serious thought on designing the frame work. Try to stick to it.

Writing Strategy

- Recommendation: write chapter by chapter.
- Get comments for every chapter from supervisor
- Review and revise, revise, revise
- Write Results Section first. You can see if the results are adequate.
- Intro and Abstract last. Most difficult

How long (duration) is the writing?

- Quick calculation: one chapter per month. So, six month minimum.
- One month for polishing
- If you have published several papers beforehand, that will speed up significantly.
- Don’t underestimate diagrams. It takes a lot of time.
- Plan drawing in advance. If possible, keep folder for diagrams over the whole PhD program.

Proof Reading

- Very crucial. Don't take it lightly.
- Don't expect supervisor to do it.
- If thesis has too many mistakes, can be a turn-off to examiner.
  - It shows that candidate is careless
  - Results in negative perception
- Common Mistakes
  - Sentence structures
  - Grammar
  - Punctuations

Technicality of Writing

- No ”short cut”. Candidate has to learn the hard, traditional way.
- Build the arguments.
  - Every sentence must be supported by facts
  - You are accountable for every sentence.
  - Do not repeat unnecessarily
  - Variation of words: USE THESAURUS!

- Stress level can increase dramatically during writing.
- Supervisor may not be cooperative if you give him “shoddy” chapter, with the hope of he will be forced to involve in the writing.
- You must be fair to your supervisor. This is YOUR PhD, not his.
- EXPERIENCE ON UTM CANDIDATE:
- 8-10 Months (without paper prior to writing)

Tips

- Try to be discipline on PhD work.
- Write bit by bit throughout the PhD
  - Keep records and folders
  - Draw diagrams when need arise (even in sketch form)
- Read good papers to see how the authors argue and discuss points.

- Starting a section with a diagram/table
- Reference is in the list, but not cited
- Although the work is good, but (??) it does not…

Plagiarism

- Don’t ever apempt too copy any sentence from anywhere without proper referencing.
- **Similarity Check** soqware is available (e.g. TURNITIN). It can easily tell if you have copied any sentence.
- Be honest. Write yourself. Not worth plagiarizing. The price to pay is too heavy.

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Conclusions/Outcome Check

Explain the content of a thesis