Department of Informatics Engineering
UNIVERSITY OF COIMBRA

RESEARCH METHODS

PART I – CHAPTER 4
PAPERS, THESIS AND RESEARCH PROPOSALS

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PAPERS, THESIS AND RESEARCH PROPOSALS

PAPERS, THESIS AND RESEARCH PROPOSALS

1. Writing a research paper
2. Reviewing a research paper
3. The process of writing a PhD thesis
4. The PhD research proposal

1. Writing a research paper

The parts of a scientific paper are shown here in the order in which they are read.

This order does not correspond to the order in which they are written.

Conclusion, introduction and abstract are usually the last ones to be written, and the title can suffer last-minute radical changes

Title

Describes the essence of the paper, in a logical, rigorous, concise, and grammatically correct form.

Very often, it is made up of two parts.

Ex.:

WRITING A RESEARCH PAPER:
FROM THE PARTS TO THE WHOLE

Author(s) and affiliation

Indicates the name of the author (or authors) and the institutions to which they belong.

It normally includes the email address of the authors.

Ex.:

Linda Blair
Department of Informatics Engineering
University of Coimbra
3030-290 Coimbra, Portugal
lblair@dei.uc.pt

1. Writing a research paper

- title
- author(s) and affil.
- **abstract**
- keywords
- introduction
- body of the paper
- conclusions
- acknowledgements
- references

Abstract

It should not exceed 200 words (unless a different maximum length is stated) and should specify concisely, but not telegraphically:

1. **What the author did, that is described in the text.**
2. **How he/she did it, if it is relevant.**
3. **The main results (numerically, if possible).**
4. **The relevance and impacts of the results.**

The abstract is not an introduction to the paper, but a description of its *whole* in a concise way that highlights the relevant points.

It must be written discursively, rather than as a list of topics.

1. Writing a research paper

- title
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- references

Abstract

An abstract must get into the essence of the paper straight off, with no introductory digressions or fill-in expressions. Experienced authors even avoid trivial kick-off expressions, such as: "In this paper…".

The major aim of abstracts is to be included in lists of abstracts that are published or made available online. The readers of these lists may then, and only then, wish to have access to the full papers. For this reason, abstracts must be self-contained and self-explanatory.

No bibliographic references should be made in the abstracts. As abstracts must be self-contained, the integration of references would imply the inclusion of a list of references, which would be absurd.

1. Writing a research paper

- title
- author(s) and affil.
- **abstract**
- keywords
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Abstract

Readers often get their first impression about a paper by reading the abstract. As first impressions may define the openness of the reader toward a paper, care should be taken to make the abstracts as readable and as attractive as possible, in spite of their brevity.

In the next slide we show the example of an abstract smaller than 70 words:

1. Writing a research paper

- title
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- references

Abstract

1. What the authors did

2. How they did it

Abstract

We describe a high-speed hardware multiplier based on an algorithm that transforms the operation of multiplication into a chain of algebraic additions, squares, and binary shifts. The resulting circuit enables a 50% reduction of integrated circuit count and a 30% increase in processing speed. This solution is particularly useful for applications requiring hardware multipliers, and opens up perspectives for the development of highly integrated multiplier circuits.

3. Main results (numerically, if possible)

4. Importance and impact of the results

title
author(s) and affil.
abstract
keywords
introduction
body of the paper
conclusions
acknowledgements
references

Keywords

The author is often asked to include in the paper a list of keywords characterizing the domain or domains to which the paper belongs.

These keywords are subsequently used to let the paper be found by online search systems.

Thus, the keywords must be representative of the domain and well known to the people likely to look for the paper.

A good criteria is to chose the keywords that we would use to find on the Web a paper similar to ours.

To become familiar with the choice of keywords, authors might find it useful to have a look at *The ACM Computing Classification System* or at the *MISQ Keyword Classification Scheme*.

title
author(s) and affil.
abstract
key-words
introduction
body of the paper
conclusions
acknowledgements
references

Introduction

The introduction offers the context for the proposal presented in the paper, and should describe:

1. The nature of the problem for which the paper gives a solution,
2. The essence of the state of the art in the domain of the paper (with bibliographic references),
3. The aim of the paper and its relevance to the progress of the state of the art.
4. The methods used to solve the problem, and
5. The structure of the paper.

The introduction must be able to catch the interest of the readers from the very first sentence, into the second, the third, and so on. A dull introduction is halfway to losing the reader even before he/she starts reading the substance of the paper.

Introduction

If we lose the reader, our paper will have no impact. It will be as though we had not written it.

Writing is, to as large extent, a way of helping us structure our own thoughts. As we write the body of the paper, the text tends to gain a life of its own, and often ends up becoming much different (and much better) than originally intended.

This means that there is no point in writing the introduction before we write the body of the paper, since we do not know beforehand how the body of the paper will end up. For this reason, the introduction is often one of the last parts to be written in a paper.

Body of the paper

The body of the paper is the description, through various chapters and sections, of all the relevant points of the work that led to the paper.

The designation “body of the paper” is used here to refer to the collection of chapters and paragraphs that make up the core of the paper. Of course, when we write a paper, none of its parts will be called “body of the paper”.

title
author(s) and affil.
abstract
key-words
introduction
body of the paper
conclusions
acknowledgements
references

Conclusions

The conclusions must be stated clearly, and should cover:

1. A sum-up of what has been achieved with the work described in the paper and of its originality and relevance.
2. The advantages and limitations of the proposals.

When justified, it should also include:

1. A description of possible applications and implications of the results presented in the paper.
2. Recommendations for future work.

title
author(s) and affil.
abstract
key-words
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conclusions
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references

Conclusions

Very often, authors write the conclusions in a hurry, to get rid of the paper, especially when they are late in its completion.

This is a bad practice, because most of the impression the readers keep in their minds, after reading the paper, is built by the conclusions.

This means that the conclusions should be written with a fresh mind and should not forget that their main role is to keep a lucid and lasting favorable impression in the mind of the reader.

To summarize: the ABSTRACT convinces the reader that the paper is worth reading, the INTRODUCTION motivates the reader to read the whole paper, and the CONCLUSIONS summarize the key points and keep a lasting and favorable impression in the mind of the reader.

1. Writing a research paper

- title
- author(s) and affil.
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- key-words
- introduction
- body of the paper
- conclusions
- **acknowledgements**
- references

Acknowledgments

A research project often results from the commitment of many people beyond the authors – members of the research team and friends who contributed one way or the other – and this commitment should be acknowledged.

When the research activity leading to the paper is totally or partially financed by external institutions, their support should also be acknowledged, even when they do not explicitly request it.

Acknowledgements should also be addressed to the author's institution if the work leading to the paper benefited from institutional support (financial support, endorsement of leaves of absence).

1. Writing a research paper

- title
- author(s) and affil.
- abstract
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- **references**

References

The references correspond to the list of papers, book chapters, books, and other bibliographic elements that have been referenced throughout the paper.

Various standards for formatting references or referencing guidelines:

One of the best known is the set of formatting guidelines established by the APA (*American Psychological Association*).

In Information Science and Technologies, the guidelines of the ACM (*Association for Computing Machinery*), the *AIS (Association for Information Systems)*, and the *IEEE (Institute of Electrical and Electronics Engineers)* are the most widespread.

The referencing guidelines should be checked often, because they keep being improved.

title
author(s) and affil.
abstract
key-words
introduction
body of the paper
conclusions
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references

References

Examples (AIS):

Book:

McNurlin, B.C. and R.H. Sprague (1998) *Information Systems Management in Practice, 4th edition*, Upper Saddle River, NJ: Prentice Hall pp. 133-170.

Paper in a journal:

Lee, O. and P. Gray (1998) "Knowledge Base Clustering in KBS Maintenance", *Journal of Software Maintenance*, (10)2, pp. 395-414.

Edited book:

Coleman, D. and R. Kanna (eds.)(1995) *Groupware Technology and Applications*, Upper Saddle River, NJ: Prentice Hall PTR.

title
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References

Examples (AIS):

Chapters in edited book:

Nunamaker, J.F., R.O. Briggs, D.D. Mittleman (1995) "Electronic Meeting Systems: Ten Years of Lessons Learned" in Coleman, D. and R. Kanna (eds.)(1995) *Groupware Technology and Applications*, Upper Saddle River, NJ: Prentice Hall PTR, pp. 146-193.

Newspaper article:

Brown, J. (April 15, 1997) "Who, When, Why?" *The New York Times*, page B3.

Paper in Web page:

Burka, L. P. (1995) "A Hypertext History of Multiuser Dimensions". *MUD History*. Retrieved Dec. 5, 1998, from http://www.ccs.neu.edu/home/lpb/mud-history.html

1. Writing a research paper

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References

The referencing guidelines also establish the formats for the insertion of the calls to references throughout the text. Some examples:

In order to differentiate between the two paradigms, we will look into the ways they answer four key philosophical questions: the ontological, the epistemological, the methodological, and the ethical questions (Guba & Lincoln, 1994). The ontological question inquires about *what can be known*. The epistemological question looks into *what is knowledge*, or *what knowledge can we get*. The methodological question inquires about *how we can build that knowledge*. The ethical question, which sees ethics is very broad terms, asks *what is the worth, or value, of the knowledge* we build (Piaget, 1967, p.6). The four questions and resulting answers are summarized in Table 4-1. In this exploration, we will be drawing considerably on proposals put forward by LeMoigne (1999) and Figueiredo and Afonso (2006).

APA

1. Writing a research paper

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References

Modern action research originated in two independent research programs with the development of action based social psychology in the 1940s. Kurt Lewin [1947a; 1947b] developed a field-theory version of action research at the University of Michigan Research Center for Group Dynamics in order to study social psychology. The Tavistock Clinic (later the Tavistock Institute) independently developed an operational research version of action research [Trist, 1976]. The Tavistock Institute used action research to study psychological and social disorders among veterans of battlefields and prisoner-of-war camps. The two developments converged when Lewin joined Tavistock.

AIS

1. Writing a research paper

- title
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References

It is important to note that although our examples are architectural, there is considerable work in the HCI tradition that also bears on these issues. In particular, a considerable body of work begins with research in video-mediated communication (e.g., Fish et al. [1990]; see Finn et al. [1997] for a collection of work), which has since been generalized and is often referred to under the rubric "awareness" (e.g., Dourish and Bellotti [1992] and Gutwin et al. [1996]). Another significant strand of research is ethnographic studies of physical work places such as transportation control rooms [Harper et al. 1991; Heath and Luff 1991] and office environments [Bellotti and Bly 1996].

ACM

1. Writing a research paper

- title
- author(s) and affil.
- abstract
- key-words
- introduction
- body of the paper
- conclusions
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- **references**

References

Many universities and engineering colleges have the opinion that pedagogical activities must actively involve the students in order to motivate them to learn basics of mathematics and physics. Problem based learning and working with projects has already been implemented in engineering educations in many different universities [1],[5],[6],[8]. This paper describes one of the methods, which actively engage the students for learning mathematics.

This paper presents how we implemented the course of differential equations in the curriculum for undergraduates in the Electronics Department. The mathematics has become a part of the third semester course KRA3 [2],[3],[9],[10],[11] which includes theory, a practical project (electronic scale),

IEEE

- title
- author(s) and affil.
- abstract
- key-words
- introduction
- body of the paper
- conclusions
- acknowledgements
- **references**

References

Likewise, if you know your paper is minor, why send it to a highly selective forum? Send it where it has a reasonable chance of being accepted. If you suspect that further work will be needed before publication, do the work before submitting the paper; it may turn an unpublishable paper into a publishable one, without the delay. You can answer many of these questions by looking at an issue of the publication. You should also look at the information the journal sends to prospective authors.[8, 9]

PAPERS, THESIS AND RESEARCH PROPOSALS

2. Reviewing a research paper

REFEREEING A RESEARCH PAPER

A BLOWN UP EXAMPLE

Classify the paper on a scale between 1 (weak) a 5 (excellent) for the following aspects
(some aspects overlap partially)

Relevance. Is the paper relevant for the conference or journal? Does it solve genuine problems? Are its proposals useful for the expected readers? Or are the proposals, on the contrary, mere intellectual speculations with no perceptible use?

Significance. Does the paper improve significantly the understanding of the topic on which it concentrates? Or does it, on the contrary, merely reshuffle old formulations, with no visible change in perspective?

2. Reviewing a research paper

Originality. Does it represent a significant advancement in the field? Does it open up new, yet unexplored, threads? Or does it merely revisit old problems and old solutions, with minor improvements or no improvements at all?

Depth. Does it explore the topic in depth, or does it remain at the level of the general ideas? Does it address the applications and implications of its proposals, if appropriate, or are they left unaddressed?

Adequacy of research method. Are the chosen research methods adequate to the problems addressed? Do they agree with the methodological approaches followed in similar situations? Do they justifiably diverge from the standard methodological approaches?

Adequacy of research process. Was the research process used scientifically solid? Was it founded on credible experimental data? Was it supported by appropriate and reliable references? Does it clarify the relevance of these experimental data and references?

2. Reviewing a research paper

Adequacy of analysis. Are the analysis leading to the proposal and the analysis of its consequences credible enough?

Logic and fluency of the lines of reasoning. Are the lines of argument logic and fluent, avoiding undue repetition and the attempt to decode blurred argumentation?

Adequacy of the title, abstract, introduction and conclusions. Is the title elucidative enough? Does the abstract describe concisely the entirety of the paper? Does the introduction offer a clear vision of the context of the problem, the essence of the state of the art, the objectives of the paper and its relevance for the progress of the state of the art? Do the conclusions clarify what has been achieved and comment on implications and limitations?

Completeness and coherence. Are there any important aspects missing that should have been included? Are there any irrelevant aspects present that should have been omitted?

Adequacy of references. Do the references represent the state of the art? Are there any important references missing? Are any of the references unreliable or scientifically doubtful? Has the referencing format been followed?

2. Reviewing a research paper

In addition to the previous analysis, identify :

- **The strengths of the paper.**
- **The weaknesses of the paper.**

All authors should apply this screening process to their own papers before submission

2. Reviewing a research paper

EXAMPLE

- **Relevance 3**
- **Significance 3**
- **Originality 2**
- **Depth 4**
- **Adequacy of research method ... 4**
- **Adequacy of research process ... 4**
- **Adequacy of analysis 3**
- **Logic and fluency of reasoning ... 2**
- **Adequacy of the title, abstract, introduction and conclusions 3**
- **Completeness and coherence 3**
- **Adequacy of the references 4**
- **GLOBAL IMPRESSION 3**

Strengths:
- Bla, bla, bla
- Bla, bla, bla
- Bla, bla, bla
- Bla, bla, bla
- Bla, bla, bla

Weaknesses:
- Bla, bla, bla
- Bla, bla, bla
- Bla, bla, bla
- Bla, bla, bla
- Bla, bla, bla

2. Reviewing a research paper

BLIND REVIEWING

To avoid bias in paper refereeing, conferences and journals usually adopt a policy of of blind reviewing or anonymous reviewing – the copy of the paper sent for reviewing does not include the identification of the authors, so the reviewers do not know who wrote the paper (the references to papers written by the authors must also be omitted, to avoid any clues). As the authors do not know who does the reviewing, the process is also called double-blind reviewing.

Some useful texts on how to carry out a research paper review:

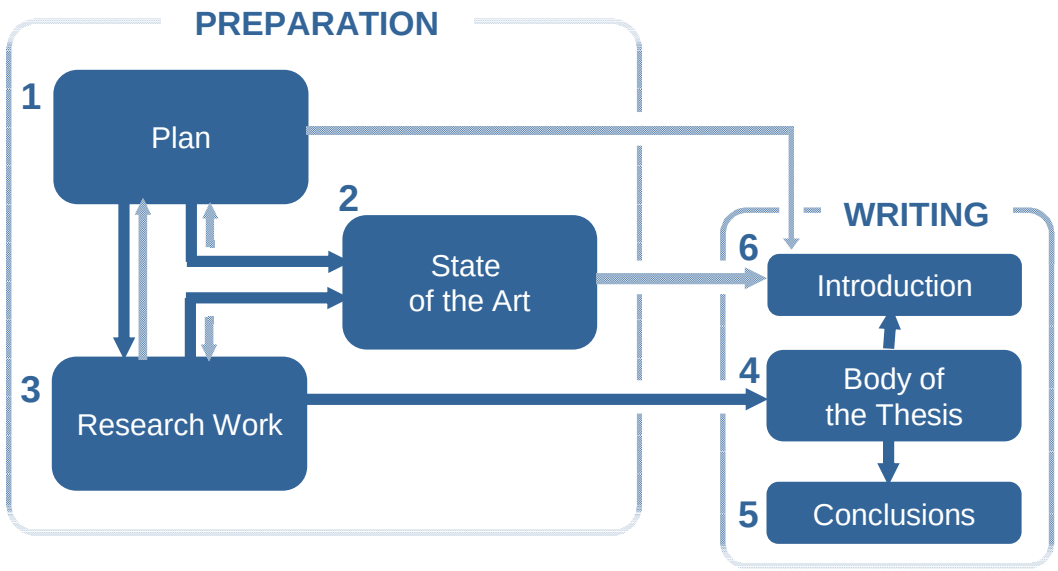
Lee, A. S. (1995), "Reviewing a Manuscript for Publication", *Journal of Operations Management*, (13)1, pp. 87-92.

Smith, A. J. (1990), "The task of the referee", *IEEE Computer*, April, pp. 65-71.

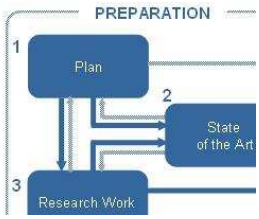
PAPERS, THESIS AND RESEARCH PROPOSALS

1. Writing a research paper
2. Reviewing a research paper
3. The process of writing a PhD thesis
4. The PhD research proposal

3. The process of writing a PhD thesis



3. The process of writing a PhD thesis

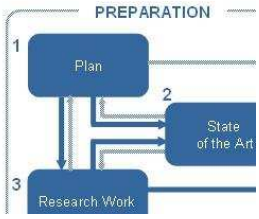


1. Plan

The Plan sometimes corresponds to what will be described later as the PhD Research Proposal.

Ideally, it characterizes briefly the knowledge domain where the research takes place and the key issues of that domain that offer opportunity for research, identifies the problem to be researched and makes clear its relevance, narrows down the problem into a plausible research question, detects representative variables, briefly assesses their validity and limitations, establishes a strategy for measuring (or evaluating) them, proposes a research design for the problem, and provides a tentative list of the steps the researcher intends to take to bring the thesis to completion.

3. The process of writing a PhD thesis



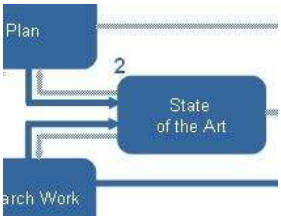
1. Plan

To facilitate de writing up of the thesis, it is useful to include in the plan a tentative table of contents of the thesis. This lets the student visualize how the work translates into a tangible text that will become the key deliverable of his/her work – the thesis .

The plan keeps changing, sometimes very radically, as the research work progresses. For this reason, it is not advisable to produce an early "Introduction" to the thesis. Indeed, a text written with the aim of becoming a lasting "Introduction" may restrict the freedom of the student to wander around in unexpected directions that often lead to the most innovative lines of exploration.

The "Introduction", which ends up incorporating much of the material produced for the plan, is usually the last part to be written in a thesis.

3. The process of writing a PhD thesis



2. State of the Art

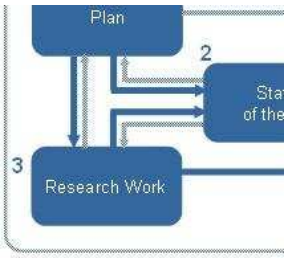
The State of the Art is a detailed description of the research work already done by other scientists in the field we intend to explore, including a good choice of references to the most representative aspects of that work.

From the very beginning, and throughout the whole research, the State of the Art is constantly improved and updated. In fact, at least some ground work on the state of the art is essential to build the first version of the plan.

The text resulting from the State of the Art will become the chapter, or chapters, that follow the "Introduction" to the thesis.

As the work on the State of the Art progresses, it is important to keep a complete list, or database, of all the references found to be of use, with all the attributes of each reference correctly collected. *EndNote* (http://www.endnote.com) is the most popular software tool used to this end, and *Zotero* (http://www.zotero.org/) is an equivalent open source (free) tool, with a much more friendly user interface.

3. The process of writing a PhD thesis



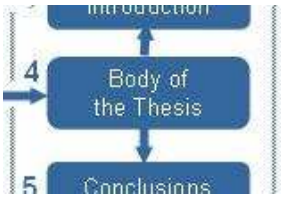
3. Research Work

The Research Work is the core of the activity leading to the thesis.

It progresses in permanent interaction with the work on the State of the Art and often dictates changes of the Plan.

As the Research Work progresses, some of its parts become stable enough to be converted into chapters of the Body of the Thesis.

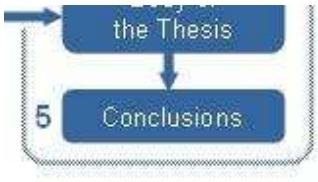
3. The process of writing a PhD thesis



4. Body of the Thesis

The Body of the Thesis is the description, in successive chapters, of all the relevant aspects of the research work, including its assumptions, reasonings and results, all of them adequately discussed and justified.

3. The process of writing a PhD thesis



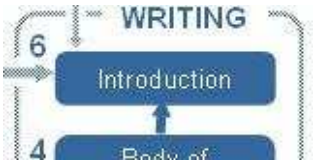
5. Conclusions

The Conclusions should include:

1. A sum-up of what has been achieved with the work described in the thesis, and of its originality and relevance.
2. A critical judgment of the advantages and limitations of the work described in the thesis and of its originality and relevance.
3. A description of possible applications and implications of the results obtained.
4. Suggestions and recommendations for future wok.

The conclusions should be made very readable and attractive to help keeping a favourable impression in the mind of the examiners when they finish reading the thesis.

3. The process of writing a PhD thesis

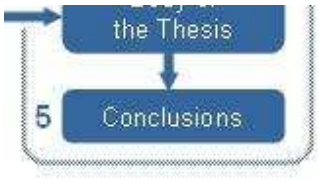


6. Introduction

The Introduction contains, at least, the following parts:

1. A brief statement of the aims of the thesis.
2. A brief description of the essence of the state of the art, which will be presented in detail in the following chapter(s).
3. An overall presentation of the research work that has been done, together with a clarification of the extent to which it represents a contribution to the improvement of that state of the art.
4. A brief description of the methods used.
5. A brief description of the structure of the thesis and of each one of its chapters.

3. The process of writing a PhD thesis



6. Introduction

Care should be taken to make the introduction readable and attractive, since the first impression the examiners get from the thesis is obtained by reading the introduction. If they get a bad impression, their analysis of the rest of the thesis is carried out under that bad impression!...

Although there is some vague similarity between what is said in the "Conclusions" and was is said in the "Introduction", the way in which that is written is completely different:

- The "Introduction" is written for people who are reading the thesis for the first time and may know little about its field and topic. Care should be taken to make the introduction readable and
- The "Conclusions" are written for people who have just read the whole thesis and are fully aware of what is involved.

3. The process of writing a PhD thesis

ANNEXES

The thesis can be completed with a number of annexes (Annex A, Annex B, Annex C, etc.) containing elements that are important to understand the research work carried out but whose extension or density would not advise their inclusion in the body of the thesis.

This includes preliminary studies, diagrams, lists, and documents produced by the author or by third parties, which may be essential to understand the work (e.g., international standards).

PAPERS, THESIS AND RESEARCH PROPOSALS

4. The PhD research proposal

In many universities, including ours, the approval of a PhD Research Proposal is a necessary requisite for the acceptance of a student as a PhD candidate. Until that approval, a student can only be said to be a candidate to be a candidate to a PhD.

A PhD proposal is written by the student, who usually departs from the definition of a topic by a provisional advisor, who also provides suggestions and recommendations. The assignment of a permanent advisor to the student only happens after the approval of the PhD proposal.

The PhD proposal has two key aims:

- **to make sure that the student has the right motivation and qualification to engage in the long and demanding effort required for a successful PhD, and**
- **to make sure that student and advisor are perfectly in tune about the topic and about the process leading to the PhD.**

The PhD Research Proposal is also a major confrontation of the candidate with himself or herself on the face of a most demanding challenge.

4. The PhD research proposal

Whatever the competence, intelligence and creativity of a candidate, his or her inability to face that confrontation – with autonomy, assertiveness and commitment – could mean that the candidate may not have the availability or the profile for such and enduring and demanding effort.

Once written and approved, the PhD proposal can work as a reference plan to guide progress toward the thesis. Some PhD students are most successful in using the PhD proposal as a sort of evolutionary prototype that keeps being improved until it becomes the thesis.

PhD proposals can be written as scientific papers and presented at the doctoral consortia of major international conferences. Doctoral consortia are usually run by prominent international scientists in the area of the conference, who give their constructive criticisms and suggestions to the presenters. The presenters, research students from all over the world, also exchange ideas, swap addresses, and make acquaintances that are often of much value to their future research.

4. The PhD research proposal

The typical structure of a PhD research proposal is shown on the right.

Many other structures are possible, with different titles and title sequences, but the aspects they end up covering are more or less the same.

Typically, the extension of a PhD research proposal varies between 40 and 80 pages.

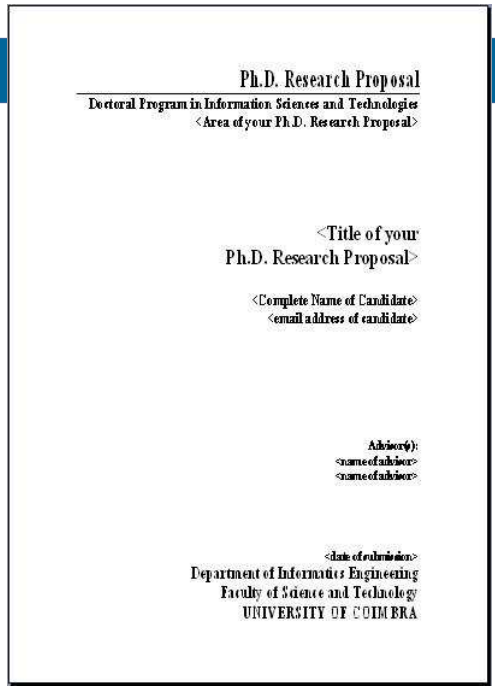
- Cover Page
- Abstract
- Keywords
- Introduction
- State of the Art
- Res. Object. & Approach
- Current Work & Results
- Work Plan & Implications
- Conclusions
- References

4. The PhD research proposal

- Cover Page
- Abstract
- Keywords
- Introduction
- State of the Art
- Res. Object. & Approach
- Current Work & Results
- Work Plan & Implic.
- Conclusions
- References

Cover Page

The cover of a research proposal typically contains the elements shown on the right.



Ph.D. Research Proposal

Doctoral Program in Information Sciences and Technologies
<Area of your Ph.D. Research Proposal>

<Title of your Ph.D. Research Proposal>

<Complete Name of Candidate>
<email address of candidate>

Advisor(s):
<name of advisor>
<name of advisor>

<date of submission>
Department of Informatics Engineering
Faculty of Science and Technology
UNIVERSITY OF COIMBRA

4. The PhD research proposal

Abstract

A brief summary of Ph.D. Research Proposal, no longer than 200 words.

It typically includes:

1. **A brief description of the field where the research occurs and of the key issues in that field that offer opportunity for new research.**
2. **A presentation of the research statement (or research question), properly related to the above description.**
3. **The proposed research approach.**
4. **The expected results and anticipated implications of such results to the advancement of the field.**

It must be written discursively, rather than as a list of topics. It is usually one of the last parts to be written, to make sure that it fully agrees with was is written on the proposal.

4. The PhD research proposal

Keywords

An alphabetically ordered list of the more appropriate words or expressions (up to twelve) that you would introduce in a search engine to find a research proposal identical to yours.

4. The PhD research proposal

Introduction

The Introduction gives an overview of the research project you propose to pursue.

It explains the background of the project, focusing briefly on the major issues of the field and clarifying why these issues are worthy of attention.

It then proceeds with the concise presentation of the research statement (or research question). The research statement should capture both the essence of the project and its delimiting boundaries.

The presentation of the research statement should be followed by a clarification of the extent to which you expect your proposal to represent an advance in the field you have described.

4. The PhD research proposal

Introduction

The introduction should endeavor, from the very beginning, to catch the reader's interest and should be written in a style that can be understood easily by any non-specialist with a general science background.

It should cite all major references pertaining to the issues described.

It should close with a brief description of the chapters that follow.

It is preferable to postpone writing the Introduction till the rest of the document is finished.

State of the Art

The State of the Art, also known as the Literature Review (or Theoretical Foundations), demonstrates that:

1. You have built a solid knowledge of the field, you are familiar with the main issues at stake, and you have critically identified and evaluated the key literature.
2. You have created an original and coherent view integrating and synthesizing the main aspects of the field, so that you can now put into perspective the new direction that you propose to explore.

The state of the art must give credit to the authors who laid the groundwork for your research.

4. The PhD research proposal

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State of the Art

In the next chapter, where your research objectives are clarified, anyone who reads the state of the art should be able to see that you are proposing to do something that has not been done before and that your research can make a significant contribution to the literature.

The state of the art is often the more extensive part of a research proposal, so it will normally develop over various sections and sub-sections, or, even, chapters.

It should be accompanied by comprehensive references, which you list at the end of the proposal. Ideally, all influential books, book chapters, papers and other texts produced in the field that are relevant for your work or related to it should be mentioned here and listed at the end of the proposal.

Research Objectives and Approach

The Research Objectives and Approach clarify the research objectives of your project, taking as a background your description of the state of the art, and describes the methodological approaches you have in mind to face the key research challenges of your project.

The clarification of the Research Objectives should build solidly on the state of the art and relate your research to the work carried out by others.

It should elucidate the extent to which your work develops from their work and the extent to which it diverges from theirs to open up new threads.

4. The PhD research proposal

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Research Objectives and Approach

In essence, the Research Objectives and Approach should make clear WHAT you plan to do to tackle your research problem, WHY you plan to do it that way, and HOW you are going to do it.

The "how to" component of the proposal is called the Research Methods, or Research Methodology. It should be detailed enough to let the reader decide whether the methods you intend to use are adequate.

It should go beyond the mere listing of research tasks, asserting why you assume that the methods you have chosen represent the best available approach for your project.

You should include a discussion of possible alternatives and explanations of why your methods and approach are expectedly the most valid.

Current Work and Results

This chapter is a concise description of the work you have carried out so far and of the progress made toward the aims of the project.

You should concentrate on the parts that contribute specifically to the goals of the proposal, avoiding detailed descriptions of digressions you may have attempted in the earlier phases of your work

If you have already obtained preliminary results, you should provide them here, in a structured manner that helps supporting the rest of the proposal.

Work Plan and Implications

Not all research proposals lend themselves easily to the creation of detailed work plans.

In some cases, namely when the work fits the broader plans of a research group that is progressing steadily, it is possible do build a detailed description of what the researcher plans to do.

In these cases, it is possible, and desirable, to establish specific milestones and timelines, and a Gantt diagram.

It should also anticipate the conferences and journals to which the work in progress is expected to be submitted along the way, and schedule it in a *Goals for Publication* section of the work plan.

Work Plan and Implications

In other cases, when the topic is exploratory or the research approach establishes that each step should build on the unanticipated results of previous steps, it may be impossible to work out a detailed plan.

Even in these cases, it is advisable to establish a section on *Goals for Publication* that gives a rough schedule of the publications to be produced.

In spite of its contingency, this list is often very useful to keep the researcher focused, motivated and under productive pressure.

Your work plan should be able to put in perspective the implications of your work and show that your approach is oriented toward results, the topic is timely and relevant, and the outcomes of the project are likely to contribute to the improvement of the field.

Conclusions

The Conclusions briefly :

1. restate the objectives of the research project,
2. recap the research approach you plan to follow, and
3. clarify:
   - what you expect to find out,
   - why it is scientifically valuable, and
   - how you expect to assess the validity of the results.

4. The PhD research proposal

References

The references list the papers, book chapters, books, and other bibliographic elements that you have referred to in the proposal.

You should list all the documents you referred to and you should not list documents you did not refer to (the "References" is not a "Bibliography")

You should adopt a referencing standard appropriate to the topic of your proposal and stick to it for all your references.

4. The PhD research proposal

ASSESSING THE RESEARCH PROPOSAL

In 2006/2007, the assessment of the PhD research proposal of the Doctoral Program in Information Science and Technologies took as a reference the following eight questions (valued from 0 to 5):

1. Is the problem to be solved clearly stated? i.e., to what extent is the PhD proposal successful in characterizing the research question and clarifying its relationship to the state of the art?

2. Is this an important problem? i.e., to what extent was the author able to demonstrate that the problem is original and its solution represents a significant advancement in knowledge relatively to the state of the art?

3. Is the student well aware of the state of the art? i.e., how successful has the student been in covering all the relavant literature and building from it a scientifically sound vision on which to ground the proposal.

4. The PhD research proposal

ASSESSING THE RESEARCH PROPOSAL

4. Did the student present ideas to be exploited that are well beyond the state of the art? This question partly overlaps question 2 but emphasises the innovative potential of the proposal.

5. The methods that are proposed to study the problem have been clearly described? i.e., to what extent was the author able to characterize, with rigor and completeness, the methods to be used?

6. Are those methods the most appropriate? i.e., is the choice of methods a good one, bearing in mind the research question and the aims of the proposal?

7. The Gantt plan of the activities is appropriate? i.e., is the scheduling of tasks for the whole thesis credible?

8. Does this proposal have potential for publications in top-level conferences (and journals)?