

# Writing a Research Proposal

## A guide for Science and Engineering students

A Research Proposal has several inter-related purposes: Writing an effective research proposal also trains you in a valuable skill required to operate effectively in both

1. Your proposed topic should address a significant problem and, therefore, advance the state of knowledge in that field.
2. You have identified an appropriate methodology and underlying theory to address the problem, including data collection methods and equipment, if required.
3. Your methods of data analysis are outlined and appropriate to your data set so that you can draw useful conclusions from your work.
4. You have an organised plan for your work, including a timeframe.

academia and industry after you graduate. You are presenting a reasonable thesis idea or hypothesis, the significance of which you have demonstrated by relating it to relevant literature in the field of enquiry. You are also proposing a methodology to investigate the problem with clear steps leading to a reasonable conclusion.

The main criterion for the award of a PhD is that your thesis constitutes an original contribution to knowledge in a particular field. Remember that you may eventually refine or even abandon your initial topic as your research progresses, but the proposal demonstrates that you are aware of the process of enquiry and experimentation that leads to a thesis outcome.

Finally, the research questions, significance and methodology that you write in your Research Proposal will help you refine your Themis ethics research application.

### The structure of a thesis proposal

The structure and size of your Research Proposal will vary depending the requirements of your Faculty or School so the initial step is to find out departmental guidelines and requirements. Nevertheless, there are certain elements that any Research Proposal requires and these should be presented in the following order.

**Title or Cover Page:** identifies the research project title, the student researcher, the institution, department, and the project mentors or supervisors.

The title should be brief and descriptive and may use a colon (:) to separate the topic from the focus (e.g. *Stormwater Harvesting: managing the hazards of surface water pollution by run-off*).

**Table of Contents:** lists the sections of the Research Proposal (headings and indented sub-headings) and the corresponding page numbers.

**Abstract:** outlines the essence of the research project in around 150–200 words. It describes the purpose and motivation for the study, and a statement of the problem,

the data collection methodology and analysis, and the significant results and implications of the research.

**Introduction:** provides background information for the research (i.e. the problem being addressed) and is typically structured from general information to narrow or focused ideas; whereupon your research question/s or hypotheses are presented.

The Introduction should be about 10% of your proposal. Imagine you are writing for a general science reader rather than an expert audience.

The Introduction includes a *brief* review of relevant literature or knowledge in the field, so that you are able to present the gap in the existing knowledge and, therefore, the significance and originality – the purpose and aims – of your research.

Finally, articulate the scope of your research; or what you will *not* be doing, so as to limit your task.

**Research Question/s:** what is the primary question you are trying to solve? It may be a hypothesis/hypotheses or research question/s and is usually a few sentences (in statement and/or question form) that articulate the essence of your project and its scope. E.g. *Land use and terrestrial carbon storage in western Victoria from 1890-2020: A historical reconstruction and simulation study.*

**Research Design or Methodology:** includes a description and rationale for the methods of data collection and analysis, and the materials used when solving the problem. When and how will you know, for example, that sufficient experimentation has been done, and sufficient and valid data analysed, to support or invalidate the original hypothesis?

This section includes the dataset/s, calculations, equipment, calibration graphs, and procedures to be used, lists project limitations and outlines how ethical considerations of the research have been considered.

Typically, it uses subheadings (i.e. Subjects, Instrumentation, Data Collection, Methods of Analysis etc.) and is written with a future aspect, e.g. *The research will initially examine water treatment processes in...*

**Preliminary Results:** details any results that you may already have as a result of previous Honours or Masters research work, perhaps also from a pilot study. It is important to relate these results to the critical framework of your intended PhD research.

**Timetable / Plan:** lists the stages of the research project in timeline, spreadsheet or tabular format, and the deadlines for completion of these stages or tasks. You should include any challenges to completion that you anticipate facing.

**Thesis Outline or Structure:** outlines the proposed chapters of the thesis and the content of each chapter in several lines or a paragraph, including a Table of Contents.

## Academic Skills

**Significance and Implications of the Study:** relates the intended or expected outcomes of your research to the original aims expressed in the Introduction so that the significance of the study and the contribution to knowledge is apparent.

**List of References:** lists **all** the resources cited in your resource proposal using a referencing format appropriate to your faculty or discipline. Do **not** list resources that are not referred to in your proposal. This is a good time to begin using a bibliographic tool such as EndNote to track all the references for your study.

See <http://www.lib.unimelb.edu.au/endnote/> for further information about EndNote.

## Writing the Research Proposal

**How to write:** Remember that you do not need to write your Research Proposal in the order in which it will be read. In fact, you might begin the writing process with a concept map drawn up on large-size paper in landscape orientation.

Give your concept map a title at the top of the paper and then write appropriate headings for the different sections of the Research Proposal (e.g. Introduction, Methodology, Conclusion) and draw boxes around these headings so they look like pages of a book.

Now, add anything you think you will need in these boxes (e.g. figures, graphs, references, topic sentences) and use colours to highlight different kinds of content. Because this is a creative brainstorming session don't restrict your ideas and don't be concerned with neatness. The idea is to gain an impression of the whole proposal and to draft your chapter outline.

The next step is writing the rough draft. Start with the Methodology section and remember to provide enough information for the experiments and data collection to be replicated by someone else, but nothing more. Then, ask yourself, what is *different* about your proposed method? What kind of research are you proposing? This will give you your sub-headings.

- **Experimental** – equipment, materials, method
- **Modeling** – assumptions, mathematical tools, method
- **Computational** – inputs, computational tools, method.

Next, write up the implications and significance of your research in bullet-point form. Then, write your Introduction, remembering that the conclusions you draw from your research (i.e. the significance and implications) are related to the aims and objectives of the research which you state in the introduction.

Finally, distil everything you have written down to its essence and write the Abstract for your proposal.

## Tips and common problems

- Use well-labelled figures and self-made drawings (i.e. sketches) to illustrate key aspects of your proposal, to reduce overall text length, and to clarify your own thinking. Each figure or drawing should have a title and informative caption. Most engineers and scientists are visual learners, so your pictures *are* indeed worth 1000 words.
- Edit and revise your writing thoroughly; poor grammar and inappropriate style detract from your message and compromise your credibility as a researcher. Use spell check and grammar check applications.
- Make an appointment with **Academic Skills**; and read your proposal out aloud; errors often get picked up this way.

- Use transition language (e.g. '*In other words*', '*In contrast*') to signal to the reader what is happening in your text.
- Avoid language that is overly hesitant or tentative (e.g. '*It seems that...*', '*It is hoped that ...*').
- Break up large blocks of text into smaller sections using sub-headings and bullet-points.
- Anticipate possible problems with, or limitations of, the research. Address such issues directly for your own benefit as much as for the benefit of the proposal.
- Don't confuse the rationale for the research with the research question/s: don't confuse the big questions that rationalise the research with the smaller and more precise research questions.
- Ensure that the proposal is easy for readers to skim read. Never assume the reader has read the previous section. Use headings and restate key ideas throughout.
- Obtain copies of other research proposals in your field and study the ways they, a) devise titles; b) structure their proposal; and c) use technical language. You might ask your supervisor for previous examples, or simply Google for examples.
- Check that your objectives are expressed in terms of measurable, quantifiable outcomes and not just methods or activities.
- Check that your referencing style is appropriate to your faculty or discipline and consistently used. The University of Melbourne library website <http://www.lib.unimelb.edu.au/cite/> is an excellent authority for referencing styles as well as past RHD theses.
- The university library **LibGuides** site is also a fantastic resource for discipline-specific materials. Go to <http://unimelb.libguides.com/index.php>
- Finally, draw up a check-list from the relevant application form and make sure that your research proposal fulfils all criteria.

## Further Resources

The following resources contain advice on writing and evaluating Research Proposals in various areas of Science and Engineering.

These North American university sites provide advice on the stages and strategies of academic and industrial research proposal writing:

<http://facstaff.gpc.edu/~ebrown/infobr3.htm>

<http://www.ecf.utoronto.ca/~writing/handbook-proposals.html>

The following document from the University of Cambridge Engineering department outlines strategies for writing effectively in the sciences:

<http://www-mech.eng.cam.ac.uk/mmd/ashby-paper-V6.pdf>

This site provides an example of a research proposal for research into the role of research proposals in undergraduate biochemical and biological engineering courses:

<http://aiche.confex.com/aiche/2005/techprogram/P27927.HTM>

## Academic Skills

# Project Proposal

## Project Proposal Guidelines

Depending on the faculty advisor a formal document may or may not be required, but it is strongly recommended that you write a proposal as part of your professional education and to help you end up with good project results.

Also note it is possible that the proposal may have to be modified during the term or year to adapt to intermediate results. This is not a bad thing but is often necessary and desirable - compared to proceeding with a plan that is not working.

## Goals of Project Proposal

Convince the faculty advisor and/or client that the project is both worthwhile and feasible and that the proposed approach is the best possible.

State the goals of the project and what the faculty/client can expect to see accomplished.

Specify a time limit and budget for completion of the project.

Identify milestones by which the faculty/client can monitor the progress of the project.

Clarify the relationship between the faculty/client and the project team; in particular, state what data and services the faculty/client is expected to provide.

Establish and delineate a professional approach to the project to gain experience with proposal skills that will be needed in professional life.

## Suggested Outline

**Executive Summary:** 1-2 paragraph statement of project goals and deliverables emphasizing the benefits to the university/department/faculty/client, outline of methodology, and statement of time and budget required.

**Introduction:** Statement of problem context (background) and problem essentials (foreground).

**Project Statement:** Expanded statement of goals. Clarify the deliverables of the project.

**Methodology:** Description of approach to be taken. Organize in subsections. Motivation for the approach and the advantages and disadvantages of the approach. As necessary, provide definitions and a brief technical outline. Note skills to be learned by students.

**Resource Requirements:** Identify software, hardware, facilities, space, funding and data required for project completion. Identify what data you will collect, and what data and services the university/client will provide.

**Schedule:** Set up a method for the client to monitor the project through measurable accomplishments, milestones, and a meeting schedule with the client. Include a timeline or list of dates and deliverables.

**Budget:** This section is not required for many M.Eng. projects but is an essential part of any other proposal. Outline monetary requirements for the project along with a schedule for expenditure.

**Contacts:** It may prove useful to identify all parties involved with their contact information

[see less in this section](#)

## DESIGN YOUR PROGRAM

### Project Proposal

### Energy and Sustainability

### Astronautics

### Micro and Nanoscale Engineering

# Tips on How to Write a Project Proposal

## Use typical sales techniques to create a better proposal.

- Know your client
- Know their needs and address them
- Use positive language
- Promise only what you can deliver
- Understand the difference between needs and wants

## Consider the possible negative outcomes of your proposal so that you may avoid them.

- Rejected
- Accepted but you didn't want it
- Oversold; the client expected more than was intended
- Under-resourced; possibly the result of the project being over-scoped

## How a project will be judged and graded

The Master of Engineering project will receive a letter grade as other courses, but it is not just another course. It is the centerpiece of the Master of Engineering program. It requires sustained effort and time comparable to that of your most difficult courses, over a longer period of time. The work effort is close to activities in the workplace. The project report must meet the high academic standards applicable to a thesis while communicating effectively to non-specialist clients. While the faculty advisor and any client are valuable resources, the individual student or student team, not the advisor or the client, is responsible for overcoming obstacles and moving the project steadily forward.

The grade is entirely the responsibility of the faculty advisor, who is the official instructor of the course for the team being advised. Here are some criteria that faculty advisors usually take into account in establishing individual project grades:

### Creativity and judgment

- Accurately discern and define the essential and true elements of the real-world problem, develop a practical solution strategy, and follow through to a useful product.
- Searching out, learning and making appropriate use of available theory and tools, seeking additional expertise and data as needed.
- Figuring out how to deal with a difficult, complex and unstructured real-world problem with incomplete data, for which the solution may not be straightforward or 'cookbook'

### Communication

- Establishing clear two-way ongoing written and oral communication with the client and the advisor about progress, status, and issues, up to and including the final presentation
- Producing clear, well-organized and accurate project documents.

### Leadership and Teamwork

- Taking initiative, resolving conflicts, and maintaining participation
- Professionalism
- Making and updating the project plan and meeting the resulting commitments about deadlines, milestones and budgets
- Justifying recommendations by conclusions and findings
- Adhering to high ethical standards

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## Quick Links

