

# **Guidance for Developing Graduate Research Proposals and Completing A Graduate Project/Thesis/Dissertation**

Bruce Thomson, Ph.D., P.E.

[bthomson@unm.edu](mailto:bthomson@unm.edu)

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Water Resources Program  
MSC05-3110  
1 University of New Mexico  
Albuquerque, NM 87131

Department of Civil Engineering  
MSC01-1070  
1 University of New Mexico  
Albuquerque, NM 87131



The University of New Mexico

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Bruce Thomson  
Water Resources Program & Civil Engineering  
University of New Mexico  
(bthomson@unm.edu)

## **Introduction**

Identifying a research topic, performing the appropriate research and writing a project/thesis/dissertation is one of the most under estimated requirements associated with a graduate degree. This requirement demonstrates the student's ability to independently formulate a research question, develop an appropriate scope of work, generate information to address the question, communicate the ideas and conclusions in a written document and defend the work before a committee of experts.

There are nearly as many ways of conducting graduate research as there are university faculty. Nevertheless, experience has allowed identification of some common attributes that can provide guidance to students in developing their own research proposals, then performing the work needed to complete the project.

## **Identifying a Topic**

Identifying a topic for one's project/thesis/dissertation research is, in my experience, the single most difficult task in all of graduate school. The difficulty lies in selecting a topic that satisfies many different criteria. For example the project must be interesting and meaningful to the student and his/her advisor, and there must be adequate resources available to perform the work. The resources that are needed include intellectual resources (i.e. expertise from one's advisors), financial resources, laboratory/library/computing resources, and time; the project must be something that can be accomplished within the time constraints available to the student. Under the best circumstances the graduate student is working as a Research Assistant (RA) for a professor on a funded research project, the professor becomes the student's advisor and the project, or some component of it, forms the basis of the student's project/thesis/dissertation. These few lucky students often enjoy the additional advantage that the professor has already written a research proposal. In this case the structure and ideas from the proposal can be incorporated into the student's own research program.

Before selecting a topic the student should understand the attributes of a good research proposal. These include:

- The proposed project has a clear and concise title.
- The proposed project has a clearly stated hypothesis or clearly articulated research question.
- The proposed project has a clear statement of objectives. The statement of objectives is important because once they have been achieved, the research for the project is finished.

- Resources should be available to assist in conducting the project. These include time, library resources, laboratory or field access, and most importantly, one or more faculty members knowledgeable in the topic and willing to work with you.

There are two approaches one can take to identify a research project referred to here as the Traditional Approach and the Inverse Approach. Clearly there is some overlap between the two, but it is useful to describe them as it can lead a student to new ideas for developing their proposal.

### **Traditional Approach to Identifying a Project**

The traditional method for identifying a research project is for the student to develop a research hypothesis or question in their field of interest after extensive reading, analysis, careful thinking and discussion with their advisor. A clear statement of this hypothesis or question then leads to a research program that is designed specifically to answer that question. The student performs the scope of work, collects the data, analyses it to answer the hypothesis or question then writes it up to complete the project/thesis/dissertation. Thus, the traditional approach to identifying a research project follows the following steps:

- Develop a research hypothesis/question
- Develop a plan of study to address the hypothesis/question
- Follow the research plan to generate data or information
- Analyze the data or information to test the hypothesis or answer the question
- Write and defend the project/thesis/dissertation

It is called the traditional approach because historically most graduate students were full time students and had the luxury of using some variation of this method. The really lucky students are those supported by research projects where the professor has already formulated a research hypothesis or question in the grant proposal and the student simply joins the project and is given guidance on what needs to be done.

### **Inverse Approach to Identifying a Project**

Most part time or unsupported grad students cannot use the traditional approach for selecting a research project because they don't have the time or financial resources needed to address an academic topic. Nevertheless, many of these students work professionally and often have access to large amounts of interesting information that, with proper analysis, can tell an interesting story. In the inverse approach the research project follows these steps:

- Consider and conduct a preliminary analysis of information or data to determine if it is of suitable quality and sufficient quantity to answer a well formulated research question.
- Using the data, develop a research hypothesis/question that can be answered by the data.
- Develop a plan of study to address the hypothesis/question.
- Analyze the data. Generate more data/information if needed.
- Write and defend the project/thesis/dissertation..

The inverse strategy is frequently used by part time students who have employment in a field closely related to their area of study. Most employers are very willing to support this kind of research because it provides information or analysis that can benefit their firm or agency, as well as providing additional training and credentials to their employee.

Regardless of the strategy one uses in identifying a research project, the student should expect to work closely with their advisor; the enthusiastic and willing participation of the advisor is essential to the success of the project. It is equally important that the student recognize that identifying a research project is very challenging. It will almost certainly require multiple iterations in which an idea is proposed, some preliminary information is gathered on the topic and a scope of work is developed, then the ideas are discussed with the advisor. It is not uncommon for students to take 6 months or longer to develop a proposal for a Masters project or thesis.

### **Bad Research Statements**

One of the most common problems encountered with student research proposals begins when the student states “I want to look at ....” While this might be appropriate for a career goal it offers no guidance towards developing a scope of work that will lead to completion of a project/thesis/dissertation. “Looking at” a topic might be as simple as reading a couple of papers, or as complex as devoting the next five years of one’s life to become a world class expert. A much better proposal might start with “I believe that the following will occur if....,” This constitutes a hypothesis that can be tested, at least in principle. Properly phrased it will lead to articulation of a set of objectives. The student will then devise a way of generating data or information to achieve those objectives, thereby testing the hypothesis. A clear ending point is achieved when the hypothesis has been successfully tested. Then the student graduates, has a big celebration party, and everybody lives happily ever after.

| <b>Bad Research Proposal Statements</b>                            | <b>Better Research Proposal Statements</b>  |
|--|---|
| I want to look at methods of removing arsenic from water           | I believe that better removal of arsenic from water can be achieved through adsorption onto amorphous ferric hydroxide    |
| How does bosque restoration affect ground water?                   | Will bosque restoration cause reduced measurable evapotranspiration losses from shallow ground water?                     |
| Evaluate the effectiveness of various water conservation measures. | The following water conservation measures can successfully be implemented to achieve at least XX% reduction in water use. |

## The Research Proposal

As the student develops a research topic in conjunction with her advisor, she/he needs to begin thinking about preparing a research proposal. Graduate research proposals are formal documents and should be written as though they were to be submitted to a funding agency. There are two objectives to be accomplished in the research proposal:

- Clearly identify the problem or issue to be addressed and convince the graduate committee that it is a topic worthy of investigation. Provide a clear statement of objectives that will be accomplished in the research.
- Develop a research plan that will accomplish these objectives and present it in sufficient detail that the graduate committee has confidence in the project's success.

The research proposal is written as a formal document; all statements of fact are referenced, tables and figures have captions, and the language is careful, concise, and to the point. The body of the research proposal should not exceed 15 pages. The organization of a research proposal is usually very simple. It should have the following components:

Title Page

Abstract (1 page)

Introduction

- General description of the problem under consideration
- Clear statement of the research question or hypothesis to be addressed
- Clear statement of the research objectives
- General summary of the methods that will be used to achieve the objectives

Background or Literature Review

- Provide a thorough review of relevant information that has been done on the topic. This should include a summary and analysis of published literature and reports. If the topic involves a field study, maps, diagrams and photos should be included. This chapter will draw heavily on previous work by others and other sources of data and should be extensively referenced.
- It is suggested that references be cited as Last Name (date). For example (Smith, 1995; Jones and Allen, 2002; Sanchez et al., 2005). Remember, you're citing the paper not the individuals. List the references in alphabetical order at the end of the paper.
- This section will almost certainly form the basis of the second chapter of the project/thesis/dissertation, and therefore should have the same organization as expected in the final document.

Research Methods

- Describe how the research will be conducted. Identify methods of collecting data. Provide diagrams of experimental equipment to be built. Identify analytical methods to be use (give references). Provide maps showing locations of field sampling stations. Develop the theory of modeling studies. Identify sources of information.
- Provide a research schedule with specific tasks and specific milestones that can be used to track the progress of the project.

Expected Results and Methods of Analyses

- Describe the data or information expected to be generated by the research. Identify its form (statistical data from questionnaires, tables of data from instruments, papers from library & internet searches, computer model results, etc.).
- Describe how the data will be processed, summarized, or analyzed. Identify statistical methods to process the data. Describe how literature, interviews, or other non-quantitative information will be assimilated and interpreted.

#### References

- References should be presented using the same formatting style as will be used in the final project/thesis/dissertation.

Students should expect to put a lot of work into their research proposal. Keep in mind that the proposal constitutes the first draft of the project/thesis/dissertation. In this respect, the research proposal establishes the organization for the final document. Indeed, if done well, nearly every bit of material contained in the proposal will be used in the final project/thesis/dissertation. Thus, extra effort devoted to producing a high quality research proposal will be recovered in the form of a more efficient and productive research process, and ultimately, a better final document.

## **The Graduate Committee**

Throughout this document emphasis has been placed on the need for close collaboration between the student and their advisor. It is important to remember that the student's graduate committee is also an integral part of the process and should be utilized as a resource to assist in all phases of the research project. Most university faculty members choose this career because of a desire to help students learn. Assisting with a productive and successful research project is one of the more rewarding parts of the job because not only do you have the opportunity to play a role in the professional development of a bright young person, but there is the additional satisfaction associated with the intellectual rewards of contributing new knowledge to one's profession. Conversely, one of the most difficult situations a faculty member can be in is to be added to a student's graduate committee after most of the work has been completed, only to find the project is weak. In such cases, the committee member's role is limited to that of gate keeper – a person who is forced to make the very difficult decision as to whether a weak piece of work is nevertheless good enough to allow the student to graduate.

### **Choosing the Committee**

Committees for masters students at UNM require a minimum of three members, two of which must be regular or research faculty. The third member must have qualifications appropriate for the student's area of study. Ph.D. committees must have four members, three must be regular or research faculty, and one of these must be from a different graduate unit than the student's major department (i.e. a different department at UNM or a different university). All committees must be approved by OGS. Specific guidance on the composition of graduate committees is given in the UNM catalog.

Generally, students pick a committee based on faculty they know and/or people they work with. The characteristics of an ideal committee member are: 1) they are knowledgeable in the field of interest, 2) they are available and willing to serve on the committee, and most importantly, 3) the student has confidence that they will provide constructive assistance during the course of the project. Part-time students who have selected a topic related to work are encouraged to select a supervisor or other senior member of the organization for their committee. Senior staff from work are beneficial because they have frequent contact with the student, usually have good knowledge of the subject, understand the constraints the student faces, and can provide immediate suggestions when questions arise. Furthermore, because the student's project is work-related, a supervisor can sometimes make resources available to assist in completing the project.

### **Working with the Committee**

Students are strongly encouraged to take full advantage of the expertise, knowledge, and experience of their entire graduate committee by involving them in the research project from the beginning. At the same time, this involvement must be balanced against the challenges of obtaining meaningful input from very busy people. In other words, most committee members do not want to have weekly reports on the student's progress. But neither is it appropriate for the

student to simply show up one day after months or years without contact, plop a document on the desk and say, “here’s my project/thesis/dissertation, let me know what you think.”

It is suggested that during the research project the student arrange two formal meetings of their full committee. The occasion of these meetings and their objectives are:

- 30% Completion Meeting – Obtain Committee Buy-In. This meeting should be held when the student has completed roughly one third of the proposed research. The objective of this meeting is to obtain the committee’s agreement that the research project is well framed, the methods are appropriate, and the project has a high chance of success. The student will formally present their research proposal to the committee, describe the project objectives, the scope of work and the research methods.
- 70% Completion Meeting – Identify Fatal Flaws. This meeting occurs after the student has collected most of the information needed for the project. The objective is for the committee to consider this information and the student’s preliminary conclusions and determine whether the work has been done with sufficient care and the results have been interpreted by proper methods to support these conclusions. It is important to have this meeting while the research is still in progress so that if new data is needed, or new experiments must be conducted, it can be accomplished with minimal additional work.

In addition to these formal committee meetings, it is important to continue regular meetings with the student’s advisor. It is suggested that biweekly progress reports is an appropriate frequency if there is not regular personal contact. Similarly, monthly reports to the rest of the committee are helpful. These reports need not be overly detailed and in many cases can be one page bulleted lists of Accomplishments and Planned Activities. The purpose is to maintain regular contact and avoid surprises.

## **Conducting Research and Writing the Project/Thesis/Dissertation**

It is difficult to provide generic guidance to students conducting research projects because each project, each advisor, and each discipline is so different. Thus, a strategy that works well for lab oriented engineering research is likely of limited value for a project investigating cultural characteristics. Listed below are some ideas that may appropriate for some projects.

### **Prepare a Schedule and Regularly Revisit It**

A detailed scope of work and research schedule should be part of the research proposal. Periodically go back to this schedule and consider your scope of work and the progress made towards completing it. Revise as appropriate.

### **Keep a Project Notebook**

Science and engineering students are strongly encouraged to keep a project notebook, a recommendation that has value to students in other fields as well. Project notebooks should be bound (not 3 ring binders) and the pages numbered. Entries should be made in ink. Errors are crossed out by a single line through the erroneous material. The notebook thus becomes a combination of diary and repository of information collected in the field or laboratory. While data files might be stored on a computer, the procedures used to collect the data, any hand written notes or information, and the name of the data file should be written in the notebook.

### **Backups**

Back up your work and data by storing it on a flash drive or CD. Back it up frequently. All of it.

### **Writing**

Writing a project/thesis/dissertation is always much more time consuming than students estimate. The rule of Pi should be used in predicting how long it takes to write the final document: Estimate the time required, then multiply by Pi.

The project/thesis/dissertation is a formal academic document and should be written as such. It is generally written in the third person impersonal tense and should be clear and succinct. Adjectives should be used sparingly and superlatives are almost never used. In my experience the style editor in MS Word has apoplexy when analyzing most well written projects/theses/dissertations.

Most academic documents including papers/projects/theses/dissertations as well as technical reports should be written in the past tense to the extent reasonable. The document describes work that has been done. While it sometimes makes sense to write in the present tense, six months, a year or a decade later it won't make any sense at all (unless you're still working on the darn project).

For issues of style, references, and formatting there are numerous books on writing academic papers. I have used A Manual for Writers of Term Papers, Theses and Dissertations by K. Turebian, 6<sup>th</sup> ed., University of Chicago Press. There are many others.

### **Web Sites With Good Information**

[http://www.ldeo.columbia.edu/~martins/sen\\_res/how\\_to\\_thesis\\_proposal.html](http://www.ldeo.columbia.edu/~martins/sen_res/how_to_thesis_proposal.html)