Setting the Scope for M.S. Research Projects

On the Cutting Edge: Early Career Geoscience Faculty Workshop – June 2013

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(Some material adapted from a previous document by Andrew Goodliffe)

Introduction:
The scope or breadth of an M.S. research project can vary widely within a department (or smaller research group), by sub-discipline, institution, student characteristics, and stage of research development. At a particular institution, the M.S. research project may be a major or minor program requirement. The scope of an M.S. research project should also proportionally reflect the importance it has in the M.S. degree program. This session will discuss strategies for scoping M.S. research/thesis projects through consideration of institutional and disciplinary context, student goals and talents, and other opportunities and constraints.

Questions to consider:

1) What is the difference in scope between an undergraduate research project, an master's thesis, and a Ph.D. dissertation.
2) What are the needs of your research program (data collection, data analysis, experiments, measurements, modeling, etc.)?
3) What tasks completed as part of a project will feed into other aspects of your research program?
4) Who drives the research direction (you, the student, funding from an outside agency)?
5) What are your student's goals after completing the master's (why are they doing this)? And how does the student research support their long-term goals (publication, writing skills, etc.)?
6) What are the skills, interests, and abilities of the M.S. student (computing, data analysis, GIS capable, observational, experimental)?
7) Is the student a worker bee or a big-picture thinker?
8) Are you going to have to stop the student from doing too much or prompt them to do more?
9) How much time are YOU going to have to spend working with this student? Is this student self-motivated, or do they need a lot of hands-on guidance?
10) How much time is allowed for the Master's student to work on research?
11) Should a master's project be published?
12) Does funding need to be procured for the student's work?
13) What are your overall learning outcomes for an M.S. student?

General considerations:

- Keep it simple and keep it small. An M.S. thesis is not about solving the world's problems but about preparing a scientist for the next step (a job, a Ph.D. program) while making a contribution. In fact, a thesis may not necessarily be the best vehicle; often a less formal project may be the best way forward for the student and the research program. Many institutions might have non-thesis degrees where a creative component is required.
- Think of the M.S. degree as a certification of technical proficiency, rather than as a ticket to the scientific research enterprise.
- Finally, if the first idea doesn't work then redirect the student's focus earlier rather later.

Typical Challenges:
1) Teaching students to write – e.g. writing concisely, formulating an abstract, introduction, putting the results into a broader context.
2) Realizing that most students are not like us; motivation may be lacking, and the student may not be as driven.
3) Recruiting the best students for a project.
4) Limiting the scope of a project (avoiding the 5 year M.S.)

Examples:
The following are examples of projects where students met the goals of the project as well as their overall future career goals.

Cindy's Example
The Project: Ongoing work using a global climate model to examine factors influencing climate in Earth's deep past.
The Student: had very broad, multi-disciplinary interests in the Earth Sciences. The student was primarily interested in developing some new skills in computing and data analysis. For the thesis, the student learned how to use the climate model, how to design new experiments, and how to analyze output. The thesis added a key element to the overall project. Along with the numerical coding involved in running and analyzing the climate model, the student learned how to interpret the model results in larger scale climatological and geological contexts, develop and put together a talk and a poster on the work (for the department), and write a thesis.
Key Challenges: While the student was generally a good writer to begin with, key challenges involved learning numerical codes and learning to discern which of the results were most important for inclusion in a thesis or a talk, and how those results fit into the 'big picture.'

Eric's Examples
The Project: Ongoing project examining the genesis of a karst system.
The Student: had strong geologic background and work experience in the environmental consulting industry, but did not have a background in karst. The student was primarily interested in developing GIS skills in understanding karst systems. For the thesis, the student learned how to formulate and address her questions, how to use GIS to conduct spatial analysis, and how to synthesize the data in relation to her work and to the work of others. The thesis provided the critical linkage needed among three additional pieces of work. The student was instrumental in working two manuscripts derived from her thesis through the publication process.
Key Challenges: The student was generally a good writer, but lacked confidence in her writing abilities. Continued critiques, both positive and negative, helped her gain confidence. Additionally, the student was being introduced to GIS, but she was eager to learn. Used her enthusiasm in GIS and her interest in addressing the larger questions for the study area to motivate her and keep her moving forward.

The Project: Ongoing project examining the use of temperature to delineate different sources of water with a karst aquifer.
The Student: had background in geology; GPA was low but had strong GRE scores and letters of reference spoke to a new sense of maturity in the student. The student was primarily interested in understanding karst systems.
Key Challenges: The student was not a good writer and knew it. The student did not like to write and struggled to develop a strong thesis proposal. The proposal lacked direction and insight. Student gained a summer internship that restricted research. Solution to writing and thesis was to use the internship to develop an independent study project based upon the internship. Student had to write weekly progress reports and a final report. The student's writing improved, and the student gained experience towards a future position.

Use the space below to jot down one or two ideas you have that you might be able to have a Master's student begin working on immediately.