Setting the Scope for M.S. Research Projects

On the Cutting Edge: Early Career Geoscience Faculty Workshop – June 2012

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Introduction:

The scope or breadth of an M.S. research project can vary widely within a department (or smaller research group), by subdiscipline, 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) The important definition of the difference between an M.S. thesis and a Ph.D. dissertation.
2) Who drives the research direction (you, the student, an outside funder)?
3) What are the needs of your research program (data collection, data analysis, experiments, measurements, modeling, etc)?
4) What completed tasks feed important content into your research program?
5) Should an M.S. project be published?
6) What are your student's goals after completing the M.S. (why are they doing this)?
7) How does the student research support their long-term goals (publication, writing skills, etc)?
8) What are the skills, interests, and abilities of the M.S. student (computing, data analysis, GIS-capable, observational, experimental)?
9) Is the student a worker bee or a big-picture thinker?
10) Are you going to have to stop the student from doing too much or prompt them to do more?
11) How much time is allowed for the Master's student to work on research?
12) 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 didn't work then redirect the student's focus earlier rather later.

Typical Challenges:

1) Writing – 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:

Two very different students and two very different projects. Both met the goals of the overall funded project and both students met their future career goals.

- Funded 3 year DOE proposal to geologically characterize an area for CO_2 sequestration. Involves multi-disciplinary analysis of well and geophysical data, complex numerical modeling of CO_2 in the subsurface. For the M.S. thesis:
    - Student had a broad interest in carbon sequestration.
    - The student wanted to became familiar with sophisticated software to process and interpret down hole logs, interpret and depth convert seismic data (ultimately for a career in the energy industry).
    - A piece was cut out of the project that involved correlating the down hole log and seismic data.
    - The M.S. thesis fulfilled a deliverable required for the project.
    - Student learned to (with varying degrees of difficulty):
        - Intelligently work with oil industry software.
        - Interpret the results in a larger scale geological context.
        - Present at a conference.
        - Work in a team environment.
        - Write a thesis.
        - Prepare for manuscript submission.
    - Challenges:
        - Writing.
        - Writing a proposal.
        - Thoroughness of work.
        - Working in a team.
        - Evolving the project into something publishable.
        - Big picture thinking.
    - Student is now employed at a major oil company.

- Funded 3 year NSF proposal to characterize a continental rifting to seafloor spreading transition. Involved processing and interpretation of a wide range of geophysical data types, kinematic and rift evolution modeling. For the M.S. thesis:
    - Student had a broad interest in the geosciences.
    - The student was a great field geologist and excellent at working with code (a rare combination).
    - A piece was cut out of the project that involved re-processing of seismic and bathymetry data. The student ended up developing code to look at basin extension and subsidence.
    - A paper was submitted to Tectonophysics within 1.5 years of starting the program
    - The M.S. thesis fulfilled a deliverable required for the project.
    - Student learned to (with varying degrees of difficulty):
        - Write code for basin reconstruction.
        - Interpret the results in a larger scale context.
        - Interpret the results in a larger scale geological context.
        - Present at a conference.
        - Work in a team environment.
        - Prepare for manuscript submission.
        - Write a thesis.
    - Challenges:

        - Keeping student focused on the problem.
        - Stopping the project from expanding beyond the scope of an M.S. project.
    - Student has just completed a very successful Ph.D. dissertation.

What will this session involve?

We will have a general discussion about the points above and my two examples. Please also think about the following beforehand:

1) What are your institutional requirements for an M.S. thesis/project?
2) What are your expectations?
3) What are some example projects?
4) What are your bigger picture learning outcomes for an M.S. student?