

Lessons Learned Mentoring Senior Theses⁵

Background and Context

Supervising the senior thesis for an undergraduate student is an exciting and daunting opportunity often available to mathematics faculty in their early career. At some schools, a senior thesis is a requirement for graduation, and every faculty member is expected to mentor students in accomplishing this goal. I will use The College of Wooster as an example and give some advice on mentoring undergraduate senior theses to get you on your way.

The College of Wooster is a small private four-year residential liberal arts college located in rural Ohio. It enrolls approximately 2,000 students from 47 states and 45 different countries; 20 percent domestic students of color, 13 percent international students, and 55 percent students identifying as female. Each and every student is required, for graduation, to complete a two-semester capstone senior thesis that Wooster affectionately dubs *Independent Study* (IS). Students are encouraged to devote themselves to a sustained topic that they are passionate about; this experience allows them intellectual independence not necessarily available in other liberal arts curricula. Wooster touts this flagship centerpiece experience effectively as a class of ‘one,’ guided by a faculty mentor; IS takes the place of one of their four classes each semester of their final undergraduate year. Hence, IS positions Wooster as “America’s Premier College for Mentored Undergraduate Research.”

Every student develops a research idea (in their major or majors) to complete two semesters worth of in-depth examination. Students get individual support and guidance from a faculty member in their major. A student with a double major completes an integrated comprehensive project fulfilling both majors’ requirements, advised by a faculty member in each major discipline. In the Department of Mathematics and Computer Science, students typically write 70-100 pages as a final thesis product. The process culminates with an oral defense during the second semester.

A continuing faculty member’s course load is 5.5 courses per year; five IS students per year constitute a course in this system. Over the course of my 12 years at Wooster, I have advised 27 students; averaging 2-3 students per academic year. IS topics have ranged from *The 6,670,903,752,021,072,936,960 Reasons Why Sudoku is a Puzzle Worth Solving* and *Economic Benefits of Foot-Voting: Game Theoretic Approach*, to *Iteration Digraphs* and *Tighten*

Up: a Preliminary Study of Knots. Some projects are publishable in undergraduate mathematics research journals, while others approach a new area in an innovative way for the individual student.

Nuts and Bolts

The best advice I was given when I started as a faculty member at Wooster was, “it’s called *Independent Study*, not *Codependent study!*” It is difficult to advise thesis topics that are sometimes only tangentially related to your area of expertise. In getting started as an IS faculty advisor, this is a really experiential organic process—you are learning the mentoring ‘system’ as you go along. Faculty members are expected to meet their IS advisees one hour per week during the semester. Students expect to treat IS as a course, demanding the time equivalent of any other semester-long classroom course.

From a purely nuts and bolts perspective, I have learned, once your student has narrowed down a topic, facilitate your IS student in deciding on multiple small projects within the larger research project. Set small deadlines punctuated across the course of each semester. I do this with their narrowed down topic and a preliminary Annotated Bibliography due in the third week of the semester. Students are encouraged to add to this annotated bibliography throughout the project. An official project proposal—a one-page description of what their project will be about—is due the sixth week of the semester. In the twelfth week of the semester, students need to submit a detailed outline of their thesis (or a tentative table of contents and plan for the remainder of the project) and a comprehensive narrative, that could be a background exposition, a history chapter describing the general area of research, a literature review, or a later chapter in the planned thesis. In any case, it needs to be a substantial written portion of the thesis, at least 20 pages long. Keep in mind that grading for the first semester of IS is on a pass-fail basis.

In the second semester, an updated table of contents and a second chapter of writing are due in the second week of classes. The table of contents should closely reflect the planned-for final product. IS is always due the first Monday after the College’s two-week spring break. As such, I require a final complete draft of the IS thesis one week prior to the start of spring break. I advise students that changes beyond this copy should only be editorial and a minimum of new material should be written after I read this final draft.

The final component of the project, during the last month of classes, is an hour-long oral defense (a 20-minute student presentation followed by a question-and-answer period from the advisor and a second reader) and public poster presentation. Evaluation of this project is on an Honors-Good-Satisfactory-No Credit (H-G-S-NC) basis. It is helpful to assess student gains across the whole two-semester project. Our IS rubric for Mathematics evaluates extent of material covered (investigation or application);

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appropriate use of resources (prior literature and/or computational tools); writing quality; oral presentation; overall independence of learning; and student understanding and mastery of the subject—weighting each of these equally in the final project assessment.

Relax, Students are Human

Each spring, our department meets junior-level students preparing for their IS proposal (i.e. identifying a feasible topic for study). I always invite near-finished seniors to comment to the junior group about their best advice for IS. Across my time at Wooster, the best advice was, “If you never have any easy days, you’ll never have any hard days.” An easy quip, but it stays with me year after year.

Weekly meetings with IS students can be complex. It is helpful to vary your meeting location—your office, the dining hall, or the library. Throughout their final year, students commonly put off active job-seeking and future plans because they are “working on IS.” I use preliminary meetings in the first semester, also looping back after fall break and winter break, to assign students to create an up-to-date resume for their dream job out of college, write the first draft of their personal statement for the Peace Corps, or research a compelling and plausible list of possible graduate programs.

Practice deep and active listening with your students. What other classes, projects, activities, or students are causing them distress? Often IS can be the great equalizer for students (and faculty): if you are at a program where each and every student has to complete IS to graduate, what also comes along with this is a common community and common peer pressure. Beware of signs of mental health stress throughout your student interactions and be able to connect them with appropriate institutional resources. Inevitably, sometimes weaker students shine in this process while strong students falter without a clear textbook syllabus. Senior students will constantly compare themselves to one another (independent of their major disciplines!). Careful assessment of a student’s academic and community presence can prove helpful in gauging their progress in a two-semester senior thesis project.

Lessons

I offer a quick checklist as you prepare to mentor senior theses:

- Invite more experienced students to meet beginning students to give advice;
- Plan projects close to your area of expertise;
- Guide students in breaking their larger thesis topic into smaller topics;
- Devise a timeline that includes due dates for an annotated bibliography, project proposal, outline, etc.; and
- Circle back to address students’ emotional wellbeing during the thesis experience.



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Credits

Author photo is courtesy of Jennifer R. Bowen.