

A Cultural Change in Graduate Education: The NSF IGERT Program

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NSF IGERT is the flagship Ph.D. education program of the National Science Foundation. IGERT stands for Integrative Graduate Education and Research Traineeships. The aim of the program, according to NSF is as follows:

The Integrative Graduate Education and Research Traineeship (IGERT) program has been developed to meet the challenges of educating U.S. Ph.D. scientists and engineers who will pursue careers in research and education, with the interdisciplinary backgrounds, deep knowledge in chosen disciplines, and technical, professional, and personal skills to become, in their own careers, leaders and creative agents for change. The program is intended to catalyze a cultural change in graduate education, for students, faculty, and institutions, by establishing innovative new models for graduate education and training in a fertile environment for collaborative research that transcends traditional disciplinary boundaries. It is also intended to facilitate diversity in student participation and preparation, and to contribute to the development of a diverse, globally-engaged, science and engineering workforce. (http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12759&from=fund Accessed on October 18, 2006)

It provides the same level of stipend as an NSF graduate fellowship for students, but it does so via specialized academic programs at universities. In other words, the traditional NSF fellowship is awarded to the individual, while IGERTs are awarded by the programs at particular universities who have IGERT-funded Ph.D. programs. The way it works is that faculty teams from one or more universities propose an idea for a multi or interdisciplinary Ph.D. program. Typical funding is \$3.5-4 million over five years. They are renewable, but those have to meet even higher standards of proof that they are successful.

Here are some websites:

General:

<http://www.igert.org/>

Rrelevant NSF Social Sciences-related IGERTS.

<http://www.igert.org/programs.asp?sort=cat&subsort=Social+Sciences>

The IGERT I am CoPI on:

<http://www.sfi.mtu.edu/IGERT/>

Successful IGERT programs are all characterized by the following three main features:

1. The integrative research is hypothesis driven.
2. The integration of different disciplines in the education program is clear and innovative.
3. The attention to broadening the participation of underrepresented groups is clearly articulated.

My aim in discussion at the TLC conference is two fold. First, I would like to discuss ways to advance graduate political science education through interdisciplinary research and teaching. Second, I would like to share best practices from the IGERT experience in recruiting a diverse set of Ph.D. students.

Lessons for Interdisciplinary Research and Teaching

Below are key lessons from the Michigan Tech/Southern University IGERT in Sustainability, which seeks to blend elements of policy and engineering to advance a new metadiscipline of sustainability that moves far beyond “we have a problem” to change in policy, law, economics, and material culture as expressed in engineering.

- 1.** It isn't easy to do and the bigger the reach, the harder it is. You are likely to fail a few times, but don't give up. If you are a chair or dean, limit—but don't forbid— untenured faculty from doing this work.
- 2.** It is increasingly well-funded, however. (IGERT/GANN/REUs/NIH, etc.)
- 3.** You need to build some trust. In big reaches, try the following:
 - a. working through UG classes (example: At Tech our first year seminar was one reason we got our first NSF grant in nanotechnology);
 - b. inviting other scholars into your major classes;
 - c. encouraging your grad students to include courses and people from outside the department—example from Michigan Tech (a USAID funded project to develop faculty for the University of Sonora in water resources; both sides are benefiting).
- 4.** Look for methods or approaches that might link fields. Political Science and remote sensing or complex adaptive systems research could make Social Sciences/Engineering and even natural sciences work together effectively. The arts and politics could be another path.
- 5.** What's really tricky is that you want each member of the teaching team to bring their particular expertise, but you want research questions that can't possibly be answered by one kind of expert. It is also likely that your graduate students will be very differently trained than you were, if you go down this path.
- 6.** If you build graduate programs with other departments—even in the same university—be aware that different fields have remarkably different ways of educating graduate students. Students will NOT all be on the same timeline. This was a serious problem in the first few IGERTs, for example. We encounter it in Sustainable Futures.
- 7.** Try to have some real-live projects to work on whether doing teaching or research. Interdisciplinary work, in my view, can't last too long just on theory. Struggling with projects like improved land use in an arid region or protecting privacy while using sensors for Homeland Security helps each individual expert teach core language to others while allowing expertise to light up a part of the larger problem.

What I've begun to Learn About Teaching IGERT Grad students

- 8.** Encourage and reward their efforts to work with other grad students in another discipline. Tell them you expect it to happen. Highlight it in reports and newsletters when it does.
- 9.** The students far from your field will not even understand why you think X is worth teaching or reading. Explain why, but keep going. At every opportunity point out the connections between their work and the other field. Eventually they will do this themselves.
- 10.** Conversely, have them (and their faculty) explain to you the significance of their work. Why is X test a good one? Why are engineers/economists/psychologists worried about some problem you don't follow?
- 11.** As with any Ph.D. student, there comes a time when they are supposed to push back and say, "No, I don't think that idea would work because..." What's different with the IGERT Trainees is that they will ultimately provide the integrative translation between fields. They will say that "concept A seems to be important in your field because of a, b, c reasons. But engineering sees the critical concept to be G for x, y, z reasons. I have devised concept Q for reasons l,m,n."
- 12.** They will be very critical of your educational program. In many of the IGERTs, the trainees redid the core integrative classes after they got through them. It's beginning to happen in our IGERT, which we take as a measure of success. Let them take this task over. You are not trained the way they were. Besides, the development of Ph.D.s includes helping them become educators.
- 13.** Involve your students in regular discussions of professional practices like how to write an abstract, applying for grants, or working with a mentor AND in the substantive issues of the integrative effort.
- 14.** Advisors will be uncomfortable. No solutions here. If the Ph.D. student is mostly in a core discipline and can do the integrative translation between fields noted in #12, all will be well.

Things I've Begun to Learn from the Sciences and Engineering

- 15.** Data support models. Don't propose to develop models alone.
- 16.** The point of science (and engineering, but less so) is the elimination of theory.
- 17.** Scientists like words; engineers like drawings.

18. Engineering education is more like political education, or at least policy education, is the case with the natural sciences. I think this is because both engineering and politics have to solve real problems with uncertainty in them in a reasonable amount of time.

19. The engineers really, really want our help. But we are not very articulate or open to this. Some of it is the conversational scale involved. So, questions from the engineers sound incoherent or so excessively narrow that we can't understand them. We come back at too large a scale or start at a different spot in the problem space.

