The 2-4 Project in the Natural Sciences and Engineering

Natural science and engineering students represent slightly more than one half of the Graduate School's total enrollment. Doctoral students in this division have the school's highest completion rate (75%) and a median time to degree of 5.7 years. During the 2006/7 academic year, 190 Ph.D. degrees were awarded in the Natural Sciences and Engineering. This brief summary provides an overview of the 2-4 Project reports submitted by the departments and programs in the division.

The central goal of the 2-4 Project was to ameliorate problems arising during the transition in a graduate student's education between taking courses and carrying out independent research. In most Humanities and Social Science programs, the transition to research take place sometime during years 3 to 4. Most Ph.D. programs in the sciences have students beginning their dissertation research by the end of their first year of study. This fundamental difference in the timing of dissertation research results in science students taking a very different approach and path to the Ph.D. For example, science students tend to complete fewer formal courses than their peers in other divisions. In addition, science students more often select courses based specifically on the needs of their dissertation projects. In light of this, it is not surprising that the majority of the reports received from the sciences focused on years 1 and 2 of study.

The submitted reports, while diverse in depth and breath, have some central themes that reoccur. Some of these reflect past and ongoing initiatives of the Graduate School, while others are in response to comments provided by graduate students.

Mentoring and Communication

Typically, we think of mentoring at the doctoral level involving one on one interactions of a student and their dissertation advisor. However, especially early in the experiences of science graduate students, rotation advisors, Directors of Graduate Studies (DGS), and other faculty play critical roles in mentoring. Routinely, students ask for more timely and substantial feedback from advisors.

A large number of reports describe the development of better mechanisms for providing feedback to students concerning their research progress. There is particular emphasis on providing appropriate feedback to first year students as they rotate through laboratories in search of dissertation projects and advisors. The development of forms, advisory groups and oral rotation presentations all ultimately lead to providing students with written feedback concerning their performance.

In several instances, students report "not knowing where they stand" in the eyes of their dissertation advisor. Interestingly, some students indicate that they have a better feel for their standing with the DGS than they do with their dissertation advisor. Departments and programs

have addressed this concern in many fashions from encouraging advisors to be more forthcoming to instituting written audits. A unique program of having students submit confidential evaluations of their advisors and committees is being instituted by the Engineering faculty. Student comments will be viewed only the DGS. The DGS will use this information to influence the mentoring of specific advisors and to counsel/restructure advisory committees.

For mentoring to be effective, a student needs to fully understand his or her program's academic expectations. Many reports describe efforts to create or improve program-based graduate student handbooks and to update websites. One department noted that without an up-to-date handbook, many faculty were unaware of requirements and deadlines. While it may seem a small matter to develop such materials, in fact, describing in writing the details of a program's expectations requires the faculty to come to a consensus on issues of "general knowledge". For example, the Cell Biology faculty have approved a rather unique listing of yearly benchmarks that outline expectations for satisfactory research progress. These benchmarks describe growth as a researcher rather than simply listing the typical program hurtles (e.g., courses and exams).

Although most programs require that students meet with their dissertation committees once or twice per year, the reports make it clear that the programs plan to better enforce this requirement.

Courses and Examinations

Continuing a recent trend, a few Ph.D. programs have changed their course requirements by lowering the number of required "core" courses and increasing the number of electives students must complete. In addition, a couple of programs have instituted mechanisms for new students to "test out" of introductory graduate-level courses when they enter the program with advanced training from their undergraduate programs.

In a reversal of recent developments, a few programs have decided to increase the coverage of general field knowledge and background reading in their oral qualifying exams and lessen the time spent examining experimental proposals and protocols.

Several programs are instituting or planning to institute courses, seminars, or departmental series that provide students with additional opportunities for public speaking and practice in developing and presenting scientific talks. All of the new and proposed activities include faculty assistance in preparing for the talks and feedback after the presentations.

Through an initiative of the Graduate School, several programs have instituted new writing curricula. The reports indicate that additional programs are considering the addition of writing instruction, especially in the areas of manuscript and grant writing.

A few reports indicate that students have expressed concern about the quantity and/or quality of substantive graduate-level course offerings. This concern is most often expressed in FAS programs that have a large number of dual listed (graduate-undergraduate) courses. In general,

the 2-4 Program resulted in the faculty developing new ideas and immediately addressing concerns and ideas brought forward by graduate student. However, solutions to concerns about graduate-level courses were often not identified. For example, in Computer Science, where students have taken it upon themselves to organize their own seminars to supplement the current courses, the DGS reports the following. "The problem of graduate-student courses is a severe one. We don't know of any way to eliminate it given the existing personnel without shortchanging the undergraduates, and just pushing the problem somewhere else."

Interdisciplinary Programs

The Graduate School is fortunate to have a variety of excellent freestanding interdisciplinary degree programs (e.g., the Interdisciplinary Neuroscience Program). These programs operate with students and faculty located across the campus. While the reports from these programs contain findings and solutions common to the department-based program, all of them indicate similar unique challenges. Each of the programs will strive to enhance its unique identity and to maintain consistency in expectations and performance among its students and faculty. To achieve this, students and participating faculty must understand the program's expectations concerning advising, testing and research, and must be able to distinguish these from their "host" department's program. The individual reports outline various approaches to this common goal. In addition, the programs look to expand their group interactions, both social and academic.

Summary

In general, the 2-4 Program reports submitted by the Natural Sciences and Engineering reflect vibrant and successful educational programs. The programs continue to evolve along with their disciplines and with very few exceptions the aspirations of students and faculty are in concordance.

The central focus of the 2-4 Program was the transition between course work and dissertation research. This transition does not appear to be a significant problem in the sciences. Thus, the reports tend to focus on associated issues. One focus of the science faculty is the initial evaluation of students during laboratory rotations and the process of associating students with dissertation advisors early in their studies. Other focuses include improved communication of dissertation research expectations, active mentoring, and enhanced evaluation of ongoing dissertation research. In all of these areas, departments and programs plan to provide more frequent and more expansive written communications to students.

A few reports indicate concerns about the quantity and quality of graduate-level classes. Active involvement of the Graduate School might keep this issue under active study and facilitate the identification of solutions.