Training Future Professors: The Preparing Future Faculty Program in Electrical and Computer Engineering and Computer Science at the University of Cincinnati

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Abstract

In the rapidly evolving fields of computing and electrical engineering, many graduate students have little opportunity to learn teaching skills necessary for success in an academic career or to become familiar with the benefits of faculty life. In the combined Electrical and Computer Engineering and Computer Science (ECECS) Department at the University of Cincinnati, for example, between 1993/94 and 1998-99, 75 students graduated with a Ph.D., but only three chose to pursue an academic career. To encourage and prepare potential future faculty, we have developed a "Preparing Future Faculty" program in our department. We discuss the outcomes of this program, its potential for impacting projected faculty shortages, options for sustaining the program, benefits to graduate students, faculty, and undergraduates, and whether it should be mandatory in a high-quality Ph.D. program.

1. Introduction

The Preparing Future Faculty (PFF) program in the Department of Electrical and Computer Engineering and Computer Science (ECECS) at the University of Cincinnati (UC) is a component of Phase 3 of the ongoing PFF program begun in 1993 by the Council of Graduate Schools and the American Association of Colleges and Universities, with support from the National Science Foundation, the Pew Charitable Trust, and a private donor³. The UC ECECS program is administered through the Association for Computing Machinery's Special Interest Group on Computer Science Education (SIGCSE). The PFF programs have as their overall goal the improvement of undergraduate and graduate education. To achieve these goals each PFF program relies on three core activities:

- formation of a "cluster" consisting of one Ph.D.-granting institution, along with other nearby institutions of higher learning to provide Ph.D. students information and experience related to the broad range of faculty positions available. The Cincinnati cluster includes the University of Cincinnati, with a Ph.D. program; Northern Kentucky University, which offers B.S. and M.S. degrees; and Xavier University and the College of Mt. St. Joseph, which offer 4-year degrees in computing;
- emphasis on the full scope of faculty roles, including teaching, research, and service, and on how these roles are fulfilled at diverse types of institutions;
- provision of multiple mentors for Ph.D. students and feedback not only for research but also for teaching and service activities they may undertake while in graduate school.

Earlier PFF programs have tended to focus on disciplines, such as history and English, where academic jobs are scarce. However, both the Cincinnati ECECS program and a second program in computer science at the University of Iowa were established in particular to explore the potential for PFF programs to ameliorate the faculty situation in computer science, where increasing undergraduate enrollments and a plethora of employment opportunities at all levels have made faculty shortages severe¹. Because the UC computer science program is part of a larger department, the other Ph.D. programs in that department, in computer engineering, systems, and electrical engineering, were also able to participate.

The Cincinnati program is one of only two programs in computer science funded nationally and the only one in a college of engineering. Our pilot two-year program is also associated with a well-established University-wide PFF program, as well as with other discipline-specific programs in chemical engineering, biological sciences, and the College of Business. Thus our program has individual flexibility for scheduling activities as well as support and potential resource sharing available from the other UC programs. Support from the national PFF program also includes publications, annual meetings, and an electronic news list. However, each cluster is free to develop its own activities to maximize its specific local impact.

Currently the program is in the middle of the second of the two years initially funded. Here we describe the program briefly and list the many advantages it offers to our Ph.D. students. We also discuss how the program can be sustained after this second funded year. Overall, the program has been enthusiastically received, both by students and faculty. While it is still too early to tell if it will have a lasting effect on increasing the numbers of our students remaining in academia, it has already had several positive effects, and seems well worth continuing.

2. PFF activities at the University of Cincinnati

Because research students in our department already have heavy demands on their time, and because many of our students do little or no teaching at present, we have designed our program to provide maximum flexibility and convenience. The program is laid out so that students will move from discussion and "practicing" their teaching on one another to more extensive teaching opportunities and interaction with faculty at other near-by institutions.

The program began with formation of a steering committee, with one faculty representative from each cluster school, and recruitment of student participants through letters to both faculty and Ph.D. students. No restriction was placed on how advanced a student needed to be in order to join the program; however, each student did require their advisor's approval. In all cases, this approval was readily obtained. Initially 16 students, 6 in computer engineering, 5 in computer science, 3 in systems engineering, and 2 in electronic materials and devices, with 9 different advisors, chose to participate. This represented about one quarter of the total number of Ph.D. students currently in the department and was about twice the number of students we had originally predicted would want to participate.

In the first year we conducted two quarter-long seminars, each of which met for 90 minutes once a week. The first seminar focused on the range of careers and faculty roles at diverse types of institutions. The participants and faculty members from the cluster schools discussed the duties of a professor outside of research, tenure requirements, the academic job search, and the preparation of resumes and a teaching portfolio. Participants also practiced giving brief talks to each other. For this activity, the breadth of our department became a real plus, especially for

students who had never given any talks except to specialists in their own field of research. For the first seminar, input from recently hired faculty members was also solicited. The participating students found much of the information in this seminar invaluable. Many basic questions about the job search in particular and faculty careers in general ("what is tenure", "what's the difference between an assistant professor and a professor", etc.) were asked and answered.

In the second seminar, the concentration was on teaching techniques. A teaching manual originally prepared for engineering faculty development was used as a basis for this seminar², with each participant responsible for presenting one lesson from the manual, along with one "in-class" activity and one "homework" which could be added to the teaching portfolios. Discussions in this seminar were lively and wide-ranging, covering different learning styles, diverse teaching styles and techniques, and cultural differences which could affect learning. A web site was constructed for maintaining the teaching manual and sharing other information⁶.

In the third quarter of the first year, students were matched with teaching mentors and made individual plans for their second year activities. These plans included not only teaching opportunities but also attendance at faculty and committee meetings and arrangements for mentoring an undergraduate working on a research or senior project, if possible.

Participants have also attended several local and national meetings where academic careers and teaching are discussed. These include the annual SIGCSE Technical Symposium and an annual PFF conference held each June. In addition, speakers on topics such as preparing a teaching portfolio, diversity, and distance learning have or will make presentations.

While the first year program was similar to UC's central PFF program, having the seminar meetings in our department and specializing to the disciplines represented in that department helped relieve time pressure on the students. The second year of the program is very different from the central program, however. In the central program, each student is required to teach at least 30 hours to earn a completion certificate. In our departmental program there was a wide range of teaching experience among the participants. Some had already taught an undergraduate class, while others had never done any teaching. In addition, two of the participants already had adjunct teaching positions at one of the cluster institutions. Thus individual plans for the second year seemed most appropriate, with emphasis on individual mentoring both of and by each student. Second-year participants also attended a grant-writing workshop, organized by UC's Office of Research and Sponsored Programs, in December, and a mentoring workshop, organized by UC's central PFF program, at the end of January.

3. Preliminary results of the program

Of the 16 students who started the program, 4 graduated in Summer 2000, with 3 of those students taking academic jobs. All four students commented repeatedly on how helpful the program was to their job search, particularly in providing opportunities for giving technical talks to nonspecialists in preparation for their interviews and in providing a forum for discussing all aspects of the job search. Of the remaining 12 students, 7 are participating in the second-year mentoring and teaching activities and are either applying for academic positions or plan to when their research is further advanced. All 16 students, even those who chose not to participate in the second year mentoring activities, have given the program high ratings for providing information and allowing them to make a well-informed choice among their career options.

4. Program benefits

While our PFF experiment is still in progress and while the numbers are too small for statistical analysis, the results so far do seem to indicate that the program is encouraging more students to pursue academic careers. Comments from the first year participants who have graduated indicate that there are two possible reasons for this. In the first place, the PFF seminars and interaction with faculty provided a means for disseminating information about academic careers and a central point for students to bring their questions, even those that may have seemed trivial, to get answers. The informal atmosphere of the seminars and the knowledge that there were other students who were also in need of answers, may have helped to give these students the confidence they needed to choose this path. Second, the PFF program gave students with little or no teaching experience a chance to gain that experience and to see if teaching was an activity which they found rewarding. Students also reported back that interviewers, even at institutions where research was highly emphasized, were impressed with their teaching preparation, obtained in addition to strong research credentials.

Other benefits from the program are also evident. For example, PFF students are a valuable resource for helping to recruit strong undergraduates into graduate programs, either here at UC or at other institutions. In addition, the existence of a seminar to discuss teaching techniques provides graduate students who do have teaching duties with a structured opportunity to discuss any problems they may be having and to learn to do their teaching jobs better. Also, new advances in teaching, and new technical tools such as distance learning aids, could be presented in such a seminar. Finally, it has been documented that many undergraduates "give up" on engineering degrees early in their programs, often because the level of teaching in introductory courses is not what they expected⁴. It has also been documented that there is a need for providing more training to engineering graduate students who are assigned teaching duties⁵. So any program which can provide support for better teaching and which prepares future faculty to be better teachers will be valuable.

5. Sustaining the program

As our program ends its two years with specific financial support, we are currently studying ways to sustain it. The actual resources required are not large. Faculty need to be willing to lead the seminars during the first year of the program and to be given teaching or service credit for doing so. In addition, faculty in cluster partner institutions need to perceive the mentoring they do as beneficial to them. Here in Cincinnati there also exist several opportunities for sharing resources to sustain this and other PFF programs. These include sharing activities with the central UC PFF program, which conducts similar seminars, and also possibly combining some of the teaching seminar activities with the orientation for new faculty members in the department. We are also looking at ways to expand the PFF program to other departments in the College of Engineering, as a way of improving our students' Ph.D. experience. This would also allow for sharing of resources across the college to support the program. In addition, other discipline-specific PFF programs can help with resources. For example, the PFF program in the College of Business has developed a course on distance learning and internet tools which we may be able to take advantage of. Also, the national PFF program³ can provide a clearinghouse for sharing information with other programs and an ongoing electronic list to maintain communication among such programs. Finally, some PFF activities could be incorporated into training for teaching assistants which may already exist.

6. Conclusions

We have described here the University of Cincinnati Preparing Future Faculty in ECECS program. While the program is quite new, it seems already to be encouraging more of our Ph.D. students to seek out academic careers. Although specific funding for the program will end in 2001, we should be able to sustain it with minimal college and departmental support. Programs such as this will improve teaching in our disciplines and encourage more talented young people to make their careers in academia. Similar programs can be instantiated elsewhere with little overhead and similar successful results.

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