

Chapter 5

Prospects for the Future

This initiative to launch Preparing Future Faculty programs in the sciences and mathematics was prompted by the need to involve more graduate faculty in bringing their doctoral programs into closer alignment with the many expectations of new faculty. The most important expectation, of course, is to provide excellent science education. It is now time to draw from what has been learned to help chart the future course for PFF.

Higher education has a long history of educational innovations emerging, gaining widespread attention, and then disappearing from the landscape, especially those dependent on external funding. A major challenge for the future of PFF is to sustain the programs. This challenge is especially problematic in science and mathematics, because programs in these disciplines have had only three years to experiment with these innovations. It is encouraging that leaders at all of the participating societies and at most of the clusters have indicated they intend to continue with their initiatives. However, three years is hardly enough time to change the “culture of preparation” in a single department, let alone within a discipline or throughout such a large, complex, and decentralized operation as doctoral education.

One of the most important forces that makes PFF timely is the much anticipated generational change taking place among college faculties. Large numbers of professors are retiring, and the academy has an historic opportunity to prepare their successors more effectively, so they can provide academic

leadership for decades in the future. If PFF is to successfully respond to this opportunity, further strategic actions will be required, including:

- ▲ embedding within graduate education elements of professional preparation for the professoriate
- ▲ increasing the responsiveness of PFF to demographic changes
- ▲ stimulating a demand for professionally prepared faculty
- ▲ continuing leadership by the disciplinary societies
- ▲ expanding PFF to more doctoral programs
- ▲ linking PFF to important reforms in undergraduate education
- ▲ fostering professional development as a component in programs of financial support of graduate students.

Embedding within graduate education elements of professional preparation for the professoriate

A fundamental premise of professional education is that one prepares for a profession by experiencing it in the variety of settings in which it is practiced. Preparation for a number of professions takes advantage of a wide variety of internships, residencies, and fieldwork that are seldom found in preparation for the academy. Medical students, for example, work on hospital floors and in a variety of clinics early in their training, later serving as interns and residents with increased responsibilities. Some law students work in clinical courses and others work as interns in law firms or with judges practicing the legal work they aspire to do. Seminarians, while still studying toward their degrees, work in parishes and preach. These practices are more than simply experiential education, as valuable as that may be. A new doctor must know a great deal about anatomy and pharmaceuticals

but also must have experience treating patients. Similarly, it is not sufficient for faculty to know only the content of their fields; they also must understand effective teaching and advising and understand how to relate to students as learners.

A significant body of research exists on the academic profession, which could greatly benefit graduate students. For example, this literature discusses effectiveness of different approaches to teaching (McKeachie 1999; Menges, Weimer, and Associates 1996); learning (Bransford, et al. 1999; Chickering and Gamson 1987); the curriculum (Gaff and Ratcliff 1997); assessment (López 1999); and the impact of college on students (Astin, 1993; Pascarella and Terenzini 1991), among others. Faculty members can learn a great deal about their professional practice from this scholarly work, which should be used more broadly.

Similarly, there is a scholarly literature about the operation of colleges and universities and about professional concepts such as academic freedom, shared governance, and peer review, which students seldom encounter in graduate school.

Barbara Van Dresek, a graduate student in geography at the University of Minnesota, spoke for many when she said, “Professional development for graduate students is a subversive activity.” It doesn’t have to be that way. Doctoral education should be rich in opportunities for professional development, assuredly in the conduct of research, but also in other ways that are important to the future careers of graduate students.

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Increasing the responsiveness of PFF programs to demographic changes

The demographic composition of the U.S. population poses distinct challenges for the preparation of future faculty in the sciences and mathematics. Underrepresentation can be seen in a few statistics: in 2000, 17,064

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science and engineering doctoral degrees were awarded to U.S. citizens and permanent residents, but only eighty-eight doctoral degrees were awarded to American Indians, 704 to Hispanic Americans, and 728 to African Americans (NSF 2001). It is also reflected in the ranks of science and mathematics faculty. In 1999, underrepresented minorities accounted for 6.0 percent of full-time faculty in the physical sciences, 5.3 percent in mathematics, 6.0 percent in computer science, and 5.3 percent in life sciences (NSF 2002b).

Thus, a challenge for PFF programs is to recruit students from underrepresented groups in order to produce a cohort of diverse, well-trained faculty. Several programs, such as NSF's Alliances for Graduate Education and the Professoriate (AGEP), are working to increase the numbers of underrepresented students who aspire to academic careers in the sciences and mathematics. Other programs such as NSF's Louis Stokes Alliances for Minority Participation (LSAMP) are successfully producing large increases of non-traditional stu-

dents completing bachelor's degrees in sciences and mathematics. The U.S. Department of Education's Ronald E. McNair Postbaccalaureate Achievement Program prepares underrepresented groups for graduate studies through involvement in research and other scholarly activities. The Compact for Faculty Diversity is quite successful in producing minority Ph.D.s and encouraging them to seek faculty positions. Individual PFF programs need to deliberately seek partnerships with such programs to identify and attract underrepresented students. The rich resources of best practices that have been assembled by PFF programs and posted or linked through the PFF Web site can help leaders achieve their goals for participation of underrepresented groups (www.preparing-faculty.org).

A second set of challenges centers around developing in all PFF students an understanding of instructional and curricular issues involved in educating the next generation of scientists and mathematicians. Retention data from the National Science Foundation (NSF 2002c) reflect this point.

Although approximately 25–30 percent of students entering college in the United States intend to major in S&E [science and engineering] fields, a considerable gap exists between freshman intentions and successful completion of S&E degrees. . . . The study also shows that underrepresented minorities complete S&E programs at a lower rate than other groups.

Because the increased need for highly developed scientific talent has created an emphasis on human resources, the pressure is strong to educate nontraditional students, including persons with disabilities. Instructional issues include low expectations from faculty, poor quality of teaching, and

an inflexible curriculum (NSF 2000). Curriculum issues center around choices that are made about topics for study in both individual courses and degree programs, around printed and audiovisual materials, and around topics for assignments, research projects, or theses and dissertations (Chism and Pruitt 1995).

PFF programs such as the one at Arizona State University already teach aspiring faculty about the interpersonal and pedagogical approaches that should be used by faculty in effectively communicating with persons from a broad range of cultural and ethnic backgrounds. The goal is to strengthen teaching skills and overall effectiveness as educators and mentors. Clusters, such as the one anchored by the University of Colorado at Boulder, that include colleges and universities with a wide range of underrepresented groups, help to sensitize future science and mathematics faculty to these teaching and learning challenges. The need is to support and promote such partnerships.

It is clear that individual PFF programs must be much more aggressive in ensuring that they include underrepresented students as both PFF participants and as part of classroom populations that PFF participants experience.

Stimulating a demand for professionally prepared faculty

The task of enhancing the preparation of new science and mathematics faculty members is much too complex an undertaking to leave to a single initiative. To succeed, it will require strategic partnerships and alliances involving college and university senior faculty, and support from central administrators, governing bodies, and other policy makers. One example of an attempt



to affect the market is a joint statement (Commonwealth Partnership 1996) by the Commonwealth Colleges of Pennsylvania, a consortium of liberal arts colleges, specifying the qualities they are seeking in new faculty. These include the very qualities PFF programs seek to develop – strengths in teaching, research, and service. Central administrators, members of governing boards, and policy makers can insist on hiring faculty who are broadly prepared in teaching, research, and service.

Similarly, faculty search committees could set higher expectations and look to candidates to provide more documentation of their professional accomplishments. A recent review of research about what colleges and universities want in new faculty (Adams 2002) identifies several common expectations: effective teaching that engages students and supports learning; a program of research suited to the circumstances and resources of the institution; and active involvement in the academic life of the campus, including shared governance. Adams makes specific recommendations to include these elements more prominently in doctoral programs. Adams also cites evidence that graduate students need more assistance with job searches and greater awareness of career options that are available in a wide variety of colleges and universities.

These kinds of actions can stimulate the market demand for more effectively prepared new faculty. If the institutions that hire faculty put a premium on PFF, that will help convince graduate departments that they should provide this training for their graduate students. It would be refreshing to see more advertisements for faculty like the one issued by the department of psychology at Occidental College in November 2001, which states explicitly, “PFF experience preferred.”

Continuing leadership by disciplinary societies

The work of changing the shape of doctoral education for future professors in the sciences and mathematics needs to be continued and expanded. The disciplinary societies participating in this project have been pioneers in

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exploring a new approach to the preparation of future faculty, and yet there are many other disciplinary societies in science, mathematics, and engineering fields that have yet to grasp the potential of PFF. One challenge is for this initial group of societies to serve as models for other societies, and for their leaders to spread PFF ideas and programs to other fields, where some interest in PFF has already been expressed. For example, the National League for Nursing has established its Think Tank on Graduate Preparation for the Nurse Educator Role, the board endorsed a statement supporting greater attention to preparing nurse educators,

and members are eager to learn of initiatives such as PFF that might guide their work.

Participation in PFF typically reinforces other educational reform initiatives at the societies, including promoting the scholarship of teaching and learning, seeking to increase access for underrepresented groups, and providing professional development opportunities for new faculty. Collectively, these kinds of activities are making the disciplinary societies significant

players in science education reform and in the national effort to improve the quality of teaching and learning. James Applegate (2002, 1), past president of the National Communication Association, articulates the rationale for the leadership role of disciplinary societies in campus educational improvement agendas:

Disciplinary societies signal what is important and define quality in their fields by the content of their journals, the programs at their conferences, and the special activities they sponsor. If it is important for the academy to do a better job preparing future faculty, creating socially engaged campuses, or embedding the scholarship of teaching and learning into campus classrooms, these agendas need to be embraced by disciplinary societies.

Expanding PFF to more doctoral programs

Although this report documents the creation of nineteen new departmental PFF programs that supplement those created in the first two phases, this is a small fraction of the total number of Ph.D. programs in the sciences and mathematics. Clearly, PFF programs are available to only a small proportion of doctoral students preparing for an academic career. As more faculty members and other leaders of doctoral programs learn about PFF programs, and as more evidence about their effectiveness develops, we may expect more institutions, disciplinary societies, and other organizations that constitute the infrastructure of graduate education to embrace them. As PFF becomes both more widespread and more visible, it will become an ever more potent force in the doctoral preparation of the professoriate.

Although the national PFF program has provided grants to departments and universities to develop PFF programs, several institutions have established PFF programs utilizing only their own resources. For example, Claremont Graduate University, University of Michigan, University of Missouri, Vanderbilt University, and Virginia Commonwealth University all have created their own university-wide programs in the last three years. Typically, leaders at these institutions have had extensive conversations with PFF leaders, often inviting speakers and consultants from other institutions and borrowing from the extensive programmatic resources that have been accumulated. More initiatives of this kind are needed.

Linking PFF to important reforms in undergraduate education

Forces for changing undergraduate education are in motion in both research universities that anchor the clusters and at the partner institutions. These include reforms that promote higher quality and more coherent general education programs. Faculty in science and mathematics are being called on to assist with the development of important skills, such as writing and speaking, analyzing values, and using the computer as a tool for learning. Interdisciplinary learning communities are found in many institutions to personalize education, integrate knowledge across the disciplines, and study problems and issues that transcend individual disciplines. Undergraduate curricula increasingly include courses on aspects of both domestic and global diversity. New faculty need to be active participants in these initiatives.

Improving the quality of undergraduate education is not as simple as establishing learning goals and setting requirements. At a time when nearly 70 percent of high school graduates go on to some form of postsecondary



education, professors must address a significant variety of students in terms of preparation, culture, expectations, and aspirations. Professors must be creative, clever, and persistent in both offering intellectual challenges and providing support to their students to meet those challenges.

Regional accrediting bodies are now requiring that colleges and universities assess student learning and demonstrate educational effectiveness as a condition of accreditation. To maintain accreditation, institutions must establish clear learning goals, design curricula to help students achieve those goals, and demonstrate that goals are met. Being responsive to these challenges will require substantial effort and commitment from faculty to a new way of thinking about education. PFF programs can provide the linkage between graduate education and these new challenges for undergraduate education.

Fostering professional development as a component in programs of financial support of graduate students.

Graduate students typically are supported financially by research assistantships, teaching assistantships, and graduate fellowships. Conditions for funding can substantially influence policies and practices at universities. Agencies that support graduate students can therefore promote professional development programs for students by considering such programs as positive factors in funding decisions.

Research assistantships traditionally support learning the protocols and disciplinary practices of conducting research. More professional development opportunities would broaden graduate students' range of competencies and result in more mature researchers. For example, graduate students

could be provided opportunities to explore the ethical issues and social implications of their research, provided with information about identifying appropriate programs at funding agencies, and trained in grant writing.

They could also be assisted in making presentations of their findings to the public and given guidance about explaining complex phenomena in terms that laypersons understand.

Although excellent teaching assistant development programs do exist, they do not reach all graduate students who could benefit from them, and often they focus on classroom management rather than the intellectual challenges of teaching a range of students.

Teaching assistantships, too often, are seen largely as a way to cover instructional obligations rather than opportunities for graduate students to grow as teachers and scholars (Nyquist, et al. 2001). Although excellent teaching assistant development programs do exist (Marincovich, et al. 1998), they do not reach all graduate students who could benefit from them, and often they focus on classroom management rather than the intellectual challenges of teaching a range of students. If graduate students were introduced to the rich literature on teaching and learning, involved in instructional problems and devising solutions to them, asked to

engage their disciplines in regard to relevant social needs and problems, or invited to devise more effective ways of assessing learning than classroom tests, those experiences would provide them with more opportunities to grow as teachers.

Fellowships are highly valued funding mechanisms because they free students from the responsibility to work either in research or teaching. But fellowship holders with an interest in teaching have asked to be included in several PFF programs. They recognize the importance of workshops, seminars, and internships in being prepared and competitive for faculty positions. Inclusion in PFF programs may also help integrate fellowship holders into the social fabric of their graduate programs, as Barbara Lovitts (2001) suggests.

When Syracuse University created its Future Professoriate Project (FPP), it gave participants an opportunity to teach, provided a “teaching mentor,” encouraged students to develop a “teaching portfolio,” and awarded a Certificate in College Teaching. When the university’s fellowship holders found out about this, they wanted to have the same opportunities, so the university developed a modified FPP program for them. Similarly, Howard University requires PFF participation for students funded by all educational grants secured by the Graduate School of Arts and Sciences, because it wants to support the professional development of all its students. These examples illustrate the value of organizations that award graduate fellowships encouraging recipients to take advantage of professional development opportunities. Coincidentally, this would make it necessary for the department to *have* a program for their students.

The postdoctoral experience is becoming more common as preparation for a faculty career, especially in the biological and life sciences. Although many postdoctoral fellows anticipate a career in the academy, their experiences do little to prepare them for any except a research position. Most have few credentials that would qualify them for any faculty job where good teaching is a high priority and where new faculty members are expected to

contribute to curricular or institutional initiatives. That is why several postdoctoral fellows—at Duke University and the University of Cincinnati, for example—have been attracted to the PFF programs as core participants. This broader preparation of fellows complements the recent call from the National Academies (Committee on Science, Engineering, and Public Policy 2000) to enhance the postdoctoral experience for scientists and engineers.

We urge graduate faculty members in the sciences and mathematics to consider these ideas and incorporate them into their departmental requirements for the Ph.D. degree.

A Confluence of Forces for Change

A confluence of forces—including disciplinary societies and departmental clusters involved in this project—has come together in recent years to promote improvement in the preparation of future faculty. All of these efforts are compatible with the vision of PFF, and many are to some extent stimulated by PFF. They reinforce each other and collectively point toward a change in the “culture of preparation,” not only of future science and mathematics faculty, but of all faculty.

- ▲ Many research studies of graduate students, new faculty, and Ph.D. alumni that empirically document the need for programs like PFF have been completed. For example, the survey of over 32,000 graduate students conducted by the National Association of Graduate and Professional Students (2001) found that fewer than half of respondents across all disciplines agreed that teaching assistants are appropriately prepared and trained before they enter the classroom. Only 52 percent agreed that doctoral students in their programs receive

training in ethics and professional responsibilities.

- ▲ *The Compact for Faculty Diversity* brought together three regional higher educational compacts, Southern Regional Education Board, Western Interstate Commission for Higher Education, and New England Board of Higher Education, for the purpose of preparing more people of color for faculty positions. Working in partnership with the states in their regions, the compacts arranged for financial support of doctoral education for hundreds of individuals and provided them with faculty mentors and professional development experiences.
- ▲ *The Re-envisioning the Ph.D.* project allowed Jody Nyquist and a small staff at the University of Washington to collect a wealth of information about graduate education—data about its strengths and weaknesses, criticisms and calls for change, innovations, initiatives of disciplinary associations, needs of colleges and universities as well as businesses that hire Ph.D.s, fellowship programs, and others. A major national conference brought together all major constituencies to discuss specific actions that each group could take to improve graduate preparation—graduate students, graduate faculty, colleges and universities that hire new faculty, disciplinary societies, fellowship providers, educational associations, businesses, and government agencies. The rich repository of resources from these activities is available on the Web site www.grad.washington.edu/envision/.
- ▲ *The Forum on Faculty Roles and Rewards* of the American Association for Higher Education has become a clearinghouse of information about the changing roles of faculty. Eugene Rice and his colleagues have made it the premier intellectual center for broadening the defi-

nition of scholarship, studying transitions in faculty roles throughout the academic career, and analyzing such aspects of faculty working conditions as post-tenure review, faculty reward systems, and tenure—all of which inform doctoral preparation.

- ▲ *Preparing Future Professionals* programs have been launched at many universities to prepare graduate students for positions outside the academy. The logic is that if it is good to acquaint graduate students seeking a faculty position with a variety of colleges and universities, then it also would be helpful to give those students seeking non-academic careers a chance to explore opportunities in organizations where they might work. Programs such as these have been developed at universities where PFF programs flourish, such as Arizona State University, University of Minnesota, and University of Texas, Austin.
- ▲ *The Responsive PhD* is a project of the Woodrow Wilson National Fellowship Foundation. Under the leadership of President Robert Weisbuch, it has selected a group of fourteen doctoral universities (nine of them involved in the PFF program) to hold a series of forums to devise ways to create a doctorate that is more responsive to social and academic changes. In particular, it is addressing new paradigms (including interdisciplinarity and scholarship that emphasize national and community issues), new practices (including preparation for teaching and other forms of professional development), and new people (including service to more diverse populations and diversifying the American intellect).
- ▲ *Pedagogies of the Disciplines* is an initiative of the Carnegie Foundation for the Advancement of Teaching. It emphasizes “stewardship of the discipline” in six different fields. Led by George

Walker, a prominent leader of PFF at Indiana University, it will commission essays on central aspects of the disciplines, encourage groups of faculty members to consider improvements in doctoral education, support innovations, and study the consequences of the new practices. It seeks nothing less than to embed the scholarship of teaching and learning, championed by Carnegie president Lee Shulman and his colleagues, into the heart of doctoral education.

These several initiatives, based on a growing body of research, hold promise for developing more welcoming, more informative, and more supportive pathways for graduate students to become faculty members. These important initiatives and other variations on PFF themes will contribute to a broader vision of graduate education, incorporating many of the values of PFF. Because the disciplinary societies and clusters in this project have gained experience with PFF, have come to see its benefits, and have vowed to stay the course, we are optimistic about the future of Preparing Future Faculty.

If this optimism is warranted, if PFF programs become a new standard for faculty preparation, then four consequences may be expected to follow. First, a transformation will take place in the culture of doctoral preparation from one based solely on research preparation to one that includes preparation for a range of professional

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responsibilities. Graduate students seeking an academic career will begin to learn about teaching and professional service as well as research and to balance and integrate these several responsibilities.

Second, PFF will foster a closer collaboration between doctoral degree-granting universities and the institutions that hire new doctoral degree holders and mostly emphasize undergraduate education. This will bring the realities of undergraduate education—its rationale, challenges, successes, and alternatives—into dialogue with graduate education that is reshaping itself to better prepare faculty.

Third, new faculty will have a better understanding of the academic profession and of the institutions where it is practiced. If new faculty members understand how institutions of higher learning work, they will be better able to use organizations to create conditions of learning for their students and better working conditions for themselves and their colleagues.

Finally, all of this adds up to better education for students, whether undergraduate or graduate. Faculty in the future will be able to create learning communities that are effective for future generations of students, and the as-yet-unknown futures that they will face.

