Preparing Future Engineering Faculty:
A Professional Development Series

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Abstract

The Preparing Future Engineering Faculty Professional Development Series was initiated in 1999 as a means for engineering graduate students considering academic careers to learn more about the profession they may soon join. The series consisted of several faculty panel discussions that covered the topics of hiring, tenure, funding, teaching and service. Seed questions provided a foundation for lively, interactive discussions consisting of student-posed questions and diverse faculty perspectives. While most panelists were Northwestern University engineering faculty (to facilitate scheduling and minimize costs), a final capstone event included engineering faculty representing several different types of institutions. The capstone event highlighted similarities and differences in engineering faculty life and responsibilities between institutions. The information and perspectives students obtained through this series will assist them in determining a career path: academia, industry or government. Those choosing academic careers are better prepared to identify and select an institution that is aligned with their skills and values, and to face the challenges of the hiring and tenure processes. To enable other institutions to initiate similar programs, a discussion of the keys to success and sample seed questions are also included.

I. Preparing Future Faculty Program

The Preparing Future Faculty (PFF) program is a national initiative whose purpose is to “improve the way future faculty are prepared for the teaching, research and service responsibilities of faculty work” 1. Realizing that most graduate experiences are research-focused, PFF seeks to broaden the perspectives of potential future faculty by providing opportunities for graduate students to examine and experience the teaching and service aspects of the academic profession, including integrating and balancing these responsibilities with research. Because many new faculty members will ultimately work at institutions that are very different than their doctoral granting institution, PFF exposes students to a variety of institutions via a cluster arrangement formed between the anchor (the doctoral granting) institution and
nearby partner institutions. A cluster might include a doctoral institution, a liberal arts college, a masters institution and a community college.

Nationally, the disciplines currently involved in PFF are Biological and Life Sciences, Chemistry, Communication, Computer Science, English, History, Mathematics, Physics, Political Science, Psychology and Sociology. The PFF program, with support from the Pew Charitable Trusts, was initiated in 1993 at seventeen doctoral granting institutions. In 1997, phase two was initiated to institutionalize and spread PFF. The last two phases focused on developing PFF programs in specific disciplines. Phase three began in 1998 and focused on Science and Mathematics, while phase four, beginning in 1999, targeted Humanities and Social Sciences. Engineering is not currently included in the national effort, although some individual institutions (such as Northwestern University) may have implemented some engineering-specific programming. It is unknown if PFF has plans for a national engineering phase in the future, but the possibility of such an engineering phase is discussed in more detail later.

Northwestern University (a private, Research I institution) is the anchoring doctoral institution for a PFF cluster in the greater Chicago area that includes the following institutions. Lake Forest College is a private, residential, liberal arts college with a traditional student body (1000 students) located in an affluent northern suburb. Chicago State University is a public, urban, non-residential comprehensive university on the south side of Chicago, enrolling over 6000 students of which 75% are African-American.
and 66% are women. Northeastern Illinois University is a comprehensive state-supported commuter institution in northwest Chicago, with a diverse student body of 10,500 (25% African-American and Hispanic, 30% over age 30) many of whom are the first in their family to attend college. Oakton Community College (OCC) is a two-year institution consisting of two main suburban campuses and 60 community locations, offering vocational degrees, certificate programs and baccalaureate transfer to 11,000 full/part time students and 16,000 continuing education students (80% of all students are employed, 46% are the first in their family to attend college).²

The Northwestern University (NU) cluster achieves the PFF goals via a credit course “Preparing Future Faculty Colloquium: On the Academic Profession,” in which students participate in monthly workshops and seminars on pedagogical and professional issues, visit partner institutions, write critical essays and prepare a teaching portfolio. Additionally a student may choose to be a PFF fellow and be matched with a faculty mentor (same discipline) from a partner institution, who provides intensive mentoring and works with the fellow to develop and implement a program of hands-on teaching and service activities. Some engineering students at NU have become PFF fellows and were matched with faculty mentors from pre-engineering (OCC), mathematics, chemistry, or physics departments. The NU PFF program regularly receives excellent reviews from both student participants and fellows, who indicate that the experience has better prepared them to make career decisions and become successful faculty members. In fact, partner institutions occasionally hire the fellows they have mentored.

As recent participants, we (authors Issen and Kinsey) found that the PFF experience uncovered unknown aspects of academic life, prompted us to think critically about our future careers in academia and to ask relevant questions of our advisors/mentors and ourselves. Why do I want to teach? What is my ideal balance between research, teaching and service? What type of institution will enable me to have a productive and satisfying career? As we sought the answers to these and many other questions, it became apparent that the NU PFF cluster was not organized to address the unique needs of future engineering faculty, since none of the partner institutions have baccalaureate engineering programs (OCC has a two-year pre-engineering program). Thus, although the colloquia were useful and stimulating, the engineering participants sensed discrepancies between the colloquium discussions and what little they knew (or had heard) about engineering faculty life. We found ourselves asking, for example, do hiring engineering departments actually request teaching portfolios? How much teaching and/or post-doc experience is required to obtain an engineering faculty position? A clear gap exists in the
II. Preparing Future Engineering Faculty

After establishing that future engineering faculty have unique issues and questions, we began to identify and evaluate possible ways to address these needs. Adding one or more institutions with engineering programs to the NU cluster would bring the needed engineering faculty expertise to the colloquia and provide appropriate mentoring opportunities. However, negotiating a PFF partnership agreement can be complex and time consuming. Typically, partner institutions are non-doctoral granting institutions, whose incentive for participation is the development of a better-prepared candidate pool from which to hire. Most engineering institutions near NU are also doctoral granting, and would likely desire a co-anchor rather than partner relationship. We chose to seek a less aggressive, low-cost solution that would provide immediate benefits to future engineering faculty, while further proving the need for and benefits of a more extensive engineering-specific PFF arrangement, both at NU and nationally. Based upon feedback from the NU PFF engineering participants, we established the Preparing Future Engineering Faculty (PFEF) Professional Development Series, consisting of six panel discussions conducted over the academic year, open to all engineering graduate students, with panelists selected primarily from the NU engineering faculty.

III. 1999 – 2000 Professional Development Series

In the fall of 1999, a graduate engineering student coordinator and an engineering faculty advisor implemented the series, with some administrative and financial support from the NU PFF program. Under the guidance of the coordinator and advisor, the PFEF participants identified six topics of interest to most future engineering faculty:

- Hiring
- Tenure
- Teaching/curriculum reform
- Grant writing
- Service
- Different types of institutions

Three events were scheduled in the fall, and three in the spring, each lasting one and one half to two hours.

The coordinator and advisor met periodically (once or twice per month) to discuss possible panelists and administrative details for upcoming sessions. The faculty advisor made final decisions regarding possible panelists, contacting them individually to describe the series, the topic(s) and to invite them to participate. The coordinator also contacted a few potential panelists who were known personally. Four to six panelists from different engineering disciplines were obtained for each event. The faculty advisor served as both a panelist and
moderator during the discussions. For convenience, most panelists were NU engineering faculty, although we often recruited panelists who had previous faculty experience at another institution. Additionally, an engineering faculty member from OCC participated in some of the panels.

The capstone event, “Different Types of Engineering Faculty Positions: The Teaching to Research Spectrum,” featured panelists from different institutions. The session goal was to expose and discuss the similarities and differences between several institutions, representing the full spectrum of engineering education. Since NU (research institution) and OCC (two-year community college) represent the extremes in engineering education, we sought local panelists from institutions with other Carnegie Foundation classifications, such as Illinois Institute of Technology, Bradley University, Valparaiso University, University of Wisconsin-Milwaukee and Rose-Hulman Institute of Technology. Although travel and lodging was reimbursed and a small honorarium was provided, we encountered difficulties in locating outside faculty who were both interested and available. Ultimately, faculty from Rose-Hulman and OCC participated, while the remaining panelists were NU faculty with previous experience at other institutions.

The PFEF coordinator solicited and compiled seed questions for each topic. Seed questions were sent to panelists in advance, although little or no preparation was required, since panelists were simply asked to discuss their own perspectives on certain aspects of academic life. The seed questions were also printed and provided to the students attending the sessions, to stimulate questions and discussion. Some sample seed questions, arranged by topic, are provided in the appendix. Before each event, e-mail announcements were sent to all graduate students and flyers were posted. Students were encouraged to bring their lunch and their questions, with refreshments provided by the NU PFF program.

The session format was informal, driven primarily by student questions. The coordinator introduced the session topic and the moderator introduced the panelists. Each panelist briefly shared a few thoughts regarding the topic before the moderator opened the floor to questions. In the “Tenure” session, the faculty advisor provided more introduction than in the other events, listing items from a typical “tenure check-list” on a white board, along with some preliminary remarks. This procedure worked quite well to provide some loose organization to the complicated tenure process and helped to stimulate and focus the discussion. At all events the
discussions were lively and the students were engaged. Panelists often compared and contrasted their own experiences in different NU departments or at other institutions. The moderator and coordinator occasionally asked questions to ensure that all major points within a topic were addressed. From the questions posed by students, it was clear that most had a limited understanding of the academic profession (beyond research), but were very interested in expanding their knowledge to facilitate their career decisions. Session attendance varied somewhat, averaging about 30-40 students (the majority of the attendees were not involved in the PFF program). We estimate this to be approximately 25% of the Ph.D. students who are in their final year. The panel discussions on hiring, tenure and grant writing were the best attended. In fact, we later discovered that some faculty had specifically directed their post-doc’s to attend the grant writing session.

Informal feedback indicated that students thought the panel discussions broadened their understanding of the academic profession and would assist them in determining a career path: academia, government or industry. Those interested in academic careers felt better prepared to face the job search process, knowing what questions to ask and what to look for to find an institution aligned with their research and teaching skills and interests. These positive responses encouraged us to continue the series in 2000 – 2001, even though the coordinator, advisor and PFF support staff from the first year would not remain due to graduations and sabbaticals.

IV. 2000 – 2001 Professional Development Series

In the second year of the PF EF program, some changes were made to incorporate feedback from the previous year and to serve the interests of the new PFF participants. In 1999 – 2000, there were approximately ten engineering students in the PFF program. This large enrollment is attributed to word-of-mouth publicity about the program. For the 2000 – 2001 PFF program, only two engineering graduate students were involved, while eight graduate students from the Chemistry Department registered in the program. Therefore, PFEF was expanded to include the hard science disciplines, such as chemistry, physics, and mathematics. Graduate students in the hard sciences face similar questions concerning career choice and faculty duties as engineering graduate students face. Therefore, including this group did not affect the original goals of the PFEF events, and the new diversity of disciplines created livelier discussions. The faculty advisor for
the second year of the program was from the Chemical Engineering department, and knows many faculty members in the Chemistry department. This was helpful in recruiting panelists from the Chemistry Department to create more diverse panels and to address the needs of the PFF Chemistry participants.

One disadvantage of having a more diverse group of students is effectively addressing a greater variety of career paths. A major difference between hard science disciplines and engineering is the possibility for employment at liberal arts and community colleges. Most schools of higher learning have hard science departments; while far fewer have engineering programs. Therefore, hard science specialists have more opportunities to teach at non-research oriented schools than engineers. Additionally, engineering graduate students may not be as interested in pure teaching employment as hard science graduate students. By the end of the 2000 – 2001 academic year, we will have a better understanding of the impact of this issue on the PFEF program.

A second change from the initial year was made in response to the establishment of an ASEE student chapter at Northwestern University. The goals of the ASEE student chapters are to promote graduate school to undergraduate students, to foster discussion regarding engineering education with faculty members and graduate students alike, and to encourage graduate students to enter careers in academia. The final goal is directly aligned with the goal of our PFEF program. Therefore, all of the PFEF events for the 2000 – 2001 academic year will be co-sponsored by the ASEE student chapter. This provides more publicity for PFEF events, while encouraging the success of the ASEE student chapter at NU.

In the fall semester, one PFEF event was held on the academic hiring process, which was one of the best-attended sessions in the previous year. Again, preparation and publicity for the event was as discussed above with e-mail notifications and postings, and the event was held as a panel discussion with two faculty members from the Chemistry Department and two from engineering disciplines. Attendance was strong, approximately 30 students, and the discussion was lively. For the remainder of the year, the most successful events from the previous year (tenure and grant writing) will be repeated, while some new events will be added. In place of the previous year's teaching panel discussion, PFEF will team with the ASEE student chapter to bring representatives from the Educational Research and Methods division of ASEE to NU to discuss a topic related to engineering education. Possible topics include Cooperative Learning, Program Assessment, and Learning/Teaching Styles. This event will also serve as an opportunity for graduate students to interact with and ask questions of faculty member from other institutions, thus replacing the capstone event of the previous year. Finally, in place of the panel discussion on service, PFF participants have suggested a panel discussion on mentoring and advising graduate and undergraduate students.
V. Keys to Success

Several factors contributed to the initial and ongoing success of this series. Institutions implementing similar programs will increase their probability of success by addressing these factors. First and foremost, identify a graduate student coordinator and a faculty advisor to define, organize and implement the program. They are the co-owners of the program, and since this will undoubtedly not be their most important responsibility, they must truly believe in the need and benefits associated with implementing it. Only this level of commitment insures that the series will continue, even when other more pressing matters require attention. The coordinator should be someone who will motivate fellow students to contribute to and participate in these events. Similarly, the advisor must identify potential panelists from her/his network of fellow faculty members and convince some of them to participate. This faculty presence is very important. We discovered that faculty who were invited by a fellow faculty member were much more likely to participate than those invited by the student coordinator. Additionally, the faculty advisor may have access to needed administrative and financial resources that are unknown or unavailable to students. Alternatively, this program could be run through an ASEE student chapter if one exists at the university.

Access to administrative support is also helpful, to reserve rooms and to create, send and print event announcements. This person can also arrange for refreshments and coordinate travel and reimbursement for guest panelists. For our PFEF program, the NU PFF coordinator, in addition to her routine PFF responsibilities, provided this support. This enabled the PFEF coordinator and faculty advisor to focus on session content and panelist selection.

Several steps were taken to insure that graduate students were able to attend the PFEF events. The PFEF participants carefully selected the weekday and time of the events to avoid common class times or routine department seminars or meetings. The advisor set actual dates after consulting with panelists. Announcements were e-mailed to all engineering graduate students approximately two weeks prior to the event, again a day or two before, and once more on the day of the event. We found that students often intended to participate, but forgot if they did not receive frequent reminders. The coordinator also enlisted PFEF participants to post flyers on department bulletin boards, laboratories and student offices. Each announcement and flyer also contained the schedule for future PFEF events. Knowing that students were not inclined to attend events in “far-away” buildings, all PFEF panel discussions were scheduled in the engineering building. Finally, we found that when an event was co-sponsored by an engineering department and held during their normal seminar day and time, attendance was increased.
Through this mutually beneficial solution, departments filled their seminar slots, and PFEF reached larger audiences. Alternatively, co-sponsoring events with other student groups or a teaching center on campus could also increase attendance.

VI. Ideas for the Future

After two successful years, we have identified many exciting opportunities for the future, both short and long term. First, we address short-term ideas, most of which could be implemented immediately when institutions initiate their own PFEF programs. Although we sent announcements only to graduate students, we noticed that post-doc’s often attended sessions, and therefore, recommend that post-doc’s be formally included in any PFEF programming. Additionally, we recommend developing and implementing evaluation forms, which all participants and panelists complete at the end of each session. As we prepared this paper, we realized that all evidence of success was anecdotal. Receiving quantifiable feedback could prompt changes in topics, format, panelists, etc., thus improving the effectiveness and applicability of the series. These evaluations could also be used to document the student needs for and benefits from this and similar programs. This evidence would be useful in driving the establishment of more extensive local and national programs, which could include mentoring and hands-on teaching/service activities for future engineering faculty, similar to those available to students in PFF sponsored disciplines.

In several sessions, panelists were often asked to contrast academic careers with those in industry or government research laboratories. Since panelists were selected for their academic experiences, often they were unable to adequately address these questions. As the need for talented technical staff increases, along with starting salaries in many industries, graduate students will face difficult career choices. Therefore, we recommend programming a panel discussion to explore the differences between industry, academia and government careers. Ideally, this panel would include people from local industries and government laboratories, although faculty with applicable experience could be utilized if necessary. While this panel may be difficult to organize, the differences in industry, academic and government careers are significant and are sharply defined. Students who do not explore these differences are much less likely to choose the path leading to career satisfaction.

Alternative event formats, in addition to panel discussions, could increase the benefit to the attendees. For instance, a panel discussion addressing the hiring process could include a presentation on preparing an effective application. Such topics as writing persuasive cover letters, statement of research interests, and statement of teaching interests could be covered. However, organizing this type of event would require an additional time commitment from the faculty advisor.

Ultimately, PFEF, like many new programs, is ensured long-term success only when it becomes institutionalized, so when coordinators graduate, advisors take sabbaticals and administrators
leave, PFEF continues to prepare future engineering faculty. The creation of a national PFF engineering phase would certainly promote this institutionalization. This paper is not intended to detail such an effort; however, we will point out one essential aspect of the two most recent PFF phases (see the PFF National Initiative web site\(^1\), for more information). At its core, each phase has sponsorship from key professional organizations. In phase three, these include the American Association of Physics Teachers, the American Chemical Society and the Mathematical Association of America, with support from the National Science Foundation. In phase four, these include the American Historical Association, American Political Science Association, American Psychological Association, American Sociological Association, National Communication Association, and National Council of Teachers of English. Thus we suggest that a successful national PFEF phase will require sponsorship from at least some professional engineering societies, such as ASEE, ASME (American Society of Mechanical Engineers), ASCE (American Society of Civil Engineers), AIChE (American Institute of Chemical Engineers) and IEEE (Institute of Electrical and Electronics Engineers).

VII. Conclusions

The primary purpose of this paper was to share our experiences in developing the Preparing Future Engineering Faculty (PFEF) Professional Development Series at Northwestern University and to assist other institutions in founding similar programs. To this end, sample seed questions from our panel discussions are provided in the appendix. The cost and time required to produce this series were minimized by utilizing the expertise of the NU’s own engineering faculty. While we selectively supplemented panels with faculty from other local institutions, a series using only the faculty from the institution could still be very successful. From student questions and informal feedback, we determined that while most graduate students possess only a limited knowledge of the academic profession they are about to enter, they are very interested in expanding this knowledge to facilitate future career decisions. We discussed several factors that lead to a successful program, and identified new opportunities for the future. Specifically, we recommended the addition of an event to expose and discuss the differences between academic, industry and government career paths, which will address the increasingly difficult choice graduate students face as many industries offer large starting salaries to fill technical positions. We also recommended implementing session evaluations to document the need for and benefits of PFEF programming, the results of which can be used to improve local programs and drive the establishment of national programs. The possibility of alternative event formats, in addition to panel discussions, was also presented. Finally, we identified the need for institutionalizing PFEF programs and suggested that a PFF national engineering initiative, requiring the involvement of professional engineering societies, is an important step in this process.
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Appendix
Below are some sample seed questions from events in the 1999 – 2000 Professional Development Series.

1. The Hiring Process for Engineering Faculty Positions
   a. What application materials (teaching portfolio, CV, cover letter, statements of research and teaching interests, references, etc.) are typically requested by hiring departments?
   b. How many publications should be listed in my CV?
   c. Do most hiring departments require/prefer post doc experience? What are advantages/disadvantages of doing or not doing a post doc?
   d. How much/what kinds of teaching experience do hiring institutions require? Is TA experience sufficient?
   e. How do I find out about faculty openings?
   f. How many candidates typically apply for an open position? How many are interviewed?
   g. Describe the interview process. Who do I meet with? How long? What are some common questions?
   h. What is a “job talk?” What is the topic & how long is it? Who is the audience? How important is it?
   i. Will I be required to teach a class during the interview?
   j. Should I have a sample grant proposal prepared for my next planned research phase?
   k. Once an offer is made, what is negotiable? Starting salary, start-up funds, lab space/equipment, graduate student funding, moving expenses? Assistance in finding my spouse a position?

2. Service Contributions and Daily Life as a Faculty Member
   a. Describe a typical faculty workweek. What % of time is spent on research, teaching and service?
   b. What are some typical administrative activities – department, college and/or university level?
   c. Which service activities should new faculty pursue/avoid (from a “gaining tenure” perspective)?
   d. Describe the process of organizing a conference session. Why is this a valuable activity?
   e. Describe how research proposal review committees work. Why is this a valuable activity?
   f. Describe different mentoring/advising activities (undergrad, grad, student societies, teams).
   g. What is the value in participating in professional society committees/office positions? What is the time commitment?

3. The Tenure Process – How it Works
   a. Give an overview of the tenure process. What are the steps, and who does what?
   b. When does tenure review (and pre-tenure review) typically occur?
   c. What is the relative importance of research, teaching and service in the tenure decision? What key accomplishments do they look for?
   d. How many publications do I need? Are all publication types (e.g., journal vs. conference, peer reviewed or not) weighted equally?
   e. What materials are included in a tenure package? What else does the tenure committee consider?
   f. How many references will I need to provide, and who should these people be? How do I cultivate possible references?
   g. How much funding will I be expected to have obtained since hire?
   h. How many graduate students (MS, PhD) should I have “graduated” by tenure review?
   i. What % of faculty are denied tenure? What happens if I am denied tenure?
   j. Is it OK to ask about tenure practices and processes during an interview?

4. NU’s Engineering First Curriculum and Teaching Engineering
   a. What are the differences in teaching/preparing graduate vs. undergraduate courses?
   b. How much flexibility do faculty have in selecting course content?
   c. How can grad students prepare for teaching? What training or teaching opportunities exist?
   d. What are the key issues driving curriculum reform today?
   e. How does industry and ABET influence curriculum development?
   f. How many classes will I be expected to teach? How much preparation time is involved?
g. How difficult is it to move from a research-focused institution to a teaching-focused institution? What about the reverse?

h. What is “peer instruction” and “collaborative learning?” How have you used these techniques in your class?

5. Grant Writing – The Funding Process
   a. Provide an overview of the grant writing, application, review and selection process to obtain funding.
   b. Is it better to choose a research area and then find funding, or find out the “hot” areas are for a particular funding agency and tailor a research proposal around it?
   c. Do most institutions have a Research Office that assists in finding funding and preparing proposals?
   d. Is it “good” or “bad” for new faculty to collaborate with others (either new or established faculty in same or different discipline)? Many agencies seem to want collaborative proposals, but how can I clearly demonstrate my contribution to collaborative work for tenure purposes?
   e. Since previous research reputation is important in obtaining funding, how do new researchers get funding?
   f. What is the funding rate for most agencies? How many proposals should I be sending out each year?
   g. How much summer salary and/or academic year salary is typically funded on grants?
   h. Describe aspects of a successful proposal. What are some common mistakes?
   i. When writing a grant proposal, who is the audience? How familiar will they be with my specific field?
   j. How do I find out which agencies fund research in my field?
   k. What are the differences between grants from government agencies, private foundations and industry?
   l. Are there different grants for funding equipment purchase vs. funding actual research?

6. Different Types of Engineering Faculty Positions: the Teaching to Research Spectrum
   This session focused on the similarities and differences between different kinds of engineering institutions. Therefore, all seed questions from the previous five sessions were utilized.