A SEMINAR SERIES ON ACADEMIC CAREERS FOR CHEMICAL ENGINEERING GRADUATE STUDENTS

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The primary focus of an engineering education tends to be on honing the technical skills of our students and not on dealing with their career development, at least not in an explicit way. Consequently, many (if not the majority of) engineering students at both the undergraduate and graduate levels are not well informed about various career options available to them at the end of their study.

One particularly difficult decision PhD students face is whether or not they should pursue an academic career. Students often have unrealistic or distorted views on the advantages, disadvantages, and responsibilities of a faculty position. In order to help our students understand what an academic career entails, I initiated an informal seminar series in the summer of 1994 to take an honest look at the professoriate.

The purpose of the seminar series was to *inform*, not to *entice*, our students about becoming a professor. But for those who would decide to pursue this career path, the seminar series also aimed at providing them with concrete tips and resources. At a more fundamental level, this activity represented our attempt at exposing explicitly our graduate students to nontechnical issues that are important in a well-rounded education.

We are fortunate at Carnegie Mellon to have formal programs at the university and college levels that help prepare our graduate students for academic careers. The University Teaching Center (UTC) offers a program that prepares graduate students to be confident and effective teachers. It also sponsors a series of seminars on topics ranging from overviews of student cognition and motivation to course and syllabus design.

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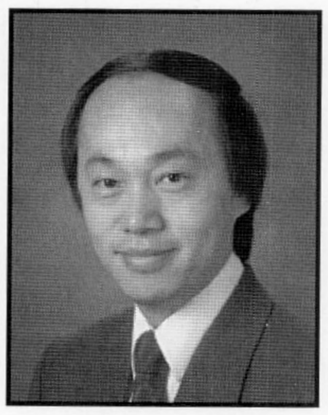
Our College of Engineering offers a course (0 units, graded pass/fail) that consists of 12 seminars over a two-year period. There are six seminars on teaching (*e.g.,* how students learn, lecturing) and six on research (*e.g.,* writing proposals, delivering presentations). Our departmental seminar series was designed to complement these ongoing programs by focusing on issues that are unique to the chemical engineering academic community and inviting only chemical engineering graduate students to participate.

ORGANIZATION OF THE SEMINAR SERIES

Since the purpose of the seminar series was to provide students with the pertinent information, my first step was to meet with four graduate students to simply write down as many questions on an academic career as they could come up with. Then, together we grouped these questions into seven themes that became the seven seminar topics summarized in Table 1.

We met once every two weeks in the summer of 1994 to discuss these seven topics. Invitations to attend any or all of



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the seminars were sent to the entire chemical engineering graduate student body. Throughout the summer, the attendance fluctuated between 15 and 20 people, most of whom were third- or fourth-year students. Each participant was given some reading materials at least several days before the meeting so they could come prepared with comments and questions (and many of them did). References of selected handout materials are shown in Table 2. Note that some of the materials appeared after the seminar series and are included here for completeness.

Each meeting started with a lunch that lasted about thirty minutes. I, or one or more invited guests, then made some opening remarks that lasted between ten and thirty minutes, after which the floor was open for discussion. I played the role of moderator and timekeeper and tried to limit each meeting to ninety minutes, which was not always easy because of the lively discussions we had.

One important feature of the seminars was that each had one or two invited guests. In Seminar 1, when we talked about the differences between academic and industrial research, I invited two industrial researchers to share their experiences with the students. In Seminar 2 on applying for an academic job, our two most recently hired junior faculty talked about what they went through in their job search. In Seminar 3 on interview skills, a professional recruiter came and discussed some common questions that are asked and what interviewers usually look for. In Seminar 4 on teaching, the Director of UTC described her efforts in improving the teaching of faculty in a research university.

I invited senior faculty members, including our Department Head, for Seminars 5-7 so that students could hear from people who have extensive experiences with these processes. My overall intent was to expose the students to a wide variety of viewpoints by experts other than chemical engineering professors. All the guests told me afterward that they enjoyed interacting with our students in this format, and the feedback from students on this aspect was equally positive.

TABLE 1
Topics of the Seminar Series

Seminar 1: *Is an Academic Career for You?*
Why are you thinking about an academic career? At what types of schools are you interested in teaching? What are the skills required to be a faculty member at various types of schools? What are the differences between academic and industrial researchers? What are the rewards in academic versus industrial careers?

Seminar 2: *Putting an Application Packet Together*
What can I do to make my application stand out? What should I include in the packet? Should I pursue a post-doctoral appointment first? What is the timing? How specific should my teaching/research plans be?

Seminar 3: *Going Through an Interview*
What are people looking for? What are the questions that I will be asked? What are the questions that I should ask?

Seminar 4: *About Teaching*
Is teaching really important? Will I be rewarded for being good at it? What can I do to be good at it? Is teaching limited to classroom activities? If not, what else is there?

Seminar 5: *Communicating Research Ideas*
How do I give a good talk? Write a good paper? Write a successful proposal? How do I excite people about what I do in general?

Seminar 6: *Sustaining a Research Group*
How do I attract students to work with me? To find the funding to support them? How should I act as an advisor? How do I keep coming up with new research ideas?

Seminar 7: *Getting Tenured*
What are the criteria for tenure? How are they different from one institution to the next? How should I step through the tenure process? Is there life after tenure?

STUDENT'S REACTIONS TO THE SERIES

Several students stopped attending the series after the first couple of meetings because, as one put it, "I now know for sure that I do not want to be a professor." I view this comment as a measure of the success of the series since it helped some students to make career decisions. Two fifth-year students who attended this series ended up interviewing for academic jobs over the last year. One of them went to visit three schools, received one offer, and eventually accepted an industrial offer. The other student interviewed at five universities but did not receive an offer.

At the last meeting I gave each student a copy of the book by Davidson and Ambrose (see Table 2, next page) as a gift and asked them to fill out a questionnaire that was designed to solicit open-ended comments. Below are some responses:

"This seminar series has provided exactly what I sought to know about an academic career. I did not seek to find that being a faculty member is easier or nicer than what it sounds; rather, I wanted to know what the position does in fact require. Knowing that I can make informed decisions during graduate school and at the beginning of my career."

"The series provided the kind of information I had hoped it would. I found especially helpful the faculty members' descriptions of some of the 'academic nuances' that are not really understood until after becoming a member of the academic community."

"I have a much more realistic picture of what a career in academia entails now that I participated in this series. Although I have not made a decision between academia and industry as of yet, this opportunity will allow me to make a more informed decision in the future."

TABLE 2
Recommended Reading Materials

- Raymond B. Landis, "An Academic Career: It Could Be for You," American Society for Engineering Education (1989)
- Philip C. Wankat and Frank S. Oreovicz, "The Graduate Student's Guide to Academic Job Hunting," *Chem. Eng. Ed.*, **17**(4), 178 (1983)
- Christopher N. Bowman, "Teaching in the First Few Years: From the Perspective of a New Faculty Member," *Chem. Eng. Ed.*, **28**(4), 280 (1994)
- Deborah Olsen and Mary Deane Soprcinelli, "The Pretenure Years: A Longitudinal Perspective," *New Directions for Teaching and Learning,* **50,** 15 (1992)
- Jeff Meade, "Life Before Tenure," *ASEE Prism,* November (1992)
- "How to Write a Scholarly Paper," *ASEE Prism,* February (1994)
- "Survival Kit for New Engineering Educators," *ASEE Prism,* October (1994)
- Anne Eisenberg, *Effective Technical Communication,* McGraw-Hill (1982)
- Philip C. Wankat and Frank S. Oreovicz, *Teaching Engineering,* McGraw-Hill (1993)
- Kenneth E. Eble, *The Craft of Teaching,* 2nd ed., Jossey-Bass (1988)
- Cliff I. Davidson and Susan A. Ambrose, *The New Professor's Handbook,* Anker Publishing (1994)
- "Survival Skills for Scholars," a series of fourteen volumes published in 1993-94 by Sage Publications, Inc., covering a wide range of topics related to an academic career. Some examples are: Volume 1, Improving Your Classroom Teaching; Volume 5, Coping with Faculty Stress; Volume 8, Getting Tenure; Volume 11, Successful Publishing in Scholarly Journals

"I would like to thank you and all the guests for sharing your experiences. It is always rewarding to be reminded that graduate school is not only confined to science."

SUMMARY

It has often been said that being a university professor is the only profession that requires no formal training. While this may be an overstatement, it does underscore the fact that almost the entire graduate education is geared toward preparing our students to be research scholars, which is just one of the many roles a faculty member plays. Even though such preparation is indeed critically important, it should not preclude development of other skills. After all, as most people would agree, having content expertise is a necessary but insufficient condition for being an effective teacher.

Our seminar series is a small step, but in our view a step in the right direction, toward making our students aware of both the multifaceted nature of a faculty career and the wide array of skills that are necessary to succeed in it. Together with the college and university programs mentioned earlier, we have made available to our students ample resources that will better prepare them to become the next generation of chemical engineering educators.

As a result of our positive experience, we intend to offer the same seminar series in the future, most likely once every two years, so that different groups of students can participate. It is my hope that this article will lead to the development of similar activities in other chemical engineering departments.

ACKNOWLEDGMENT

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ChE book review

PROCESS ENGINEERING ANALYSIS IN SEMICONDUCTOR DEVICE FABRICATION

by S. Middleman and A.K. Hochberg
McGraw Hill, New York, NY; $60.50 (1992)

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The authors of this text state that their goal is to demonstrate that chemical technology plays a central role in microelectronic device fabrication. The text fulfills this stated purpose and is relatively complete for use in an undergraduate course focused on process analysis. It not only provides focus for a course, but also helps convince the reader/student that chemical engineering fundamentals can and should be applied in the microelectronics industry. The demand for courses that introduce students to microelectronic devices, industrial terminology, and the unit operations associated with device fabrication has increased as more and more chemical engineering graduates are employed in the microelectronics industry.

The first two chapters serve to introduce solid state physics and its application to solid state device operation and performance. These chapters motivate much of the processing analyzed in the remainder of the text, and the basic bipolar process flow presented emphasizes the complexity