

Faculty Mentoring A Unique Approach to Training Graduate Students How to Teach

Juli L. Sherwood, James N. Petersen, Julie M. Grandzielwski
Washington State University, Department of Chemical Engineering

Abstract

This paper contains a summary of the motivations and observations of a recent faculty mentoring project designed to provide a graduate student with practical teaching experience. The motivation for the project, the approach taken, and the results of the project are described from the perspective of the faculty mentor, the student trainee, and the student being taught in the class.

Introduction

Only the rare individual is born to teach, being somehow naturally equipped with the ability to effectively communicate new ideas and spark imaginations that marks the best instructors. For the rest of us, learning to be a good teacher can be an awkward, sometimes frustrating, process of trial and error that is oftentimes unsatisfactory to both the fledgling instructor and to the students. To overcome these limitations, individuals who are preparing for careers as elementary or secondary education instructors are required to complete a program of study that includes a core of professional education and methodology courses, as well as a supervised teaching practicum, before they are considered ready to mold the minds of America's youth. In contrast, those individuals pursuing doctoral degrees and who intend to teach at the university level are neither required, nor seldom even offered, the opportunity to take courses pertaining to their future roles as educators. How, then, are the professors of tomorrow expected to learn the skills required to become successful instructors? We propose that one approach to accomplish this process is via mentoring.

Mentoring has long been seen as a means of cultivating and encouraging new talent, and indeed the role of mentor is already assumed to a large degree by the graduate student's thesis advisor. However, the advisor-student relationship often focuses almost exclusively on research endeavors, with little if any exploration of the student's other potential career goals. Since those students intent on pursuing careers in academia will be expected to instruct as well as develop meaningful research programs, faculty advisors should be involved in nurturing the teaching potential in their graduate students as much as they are involved in nurturing their students' research potential.



Whether formally instituted by colleges and departments or informally organized between a single faculty member and graduate student, a program of supervised practical training is an excellent way for future professors to gain skills and confidence in classroom instruction. In this manuscript, we present the motivations, observations, and lessons learned during a recent instructor-in-training mentoring experience, described from both the mentor's and the trainee's perspective. Where appropriate, the students' perspective has been included also.

Motivation

Trainee's Perspective When I made the decision to pursue my Ph.D. in Chemical Engineering, it was a choice motivated in large part by a desire to teach. Past experience with tutoring had shown me that I truly enjoyed helping people learn. It felt great when I knew I had made a connection and that the student I was helping really understood the material that I was trying to communicate. Yet, I still had doubts. Having a desire to teach is not the same thing as having the ability to teach. I was worried that, no matter how strongly I wanted it, I might not be a good teacher. Thus I took my concerns to my advisor, explaining my belief that, although I thought I wanted to teach, I really couldn't be sure until I had tried my hand at it. In answer to this, Dr. Petersen made a unexpected proposal: he offered to let me teach his senior-level process control course in the fall semester, under his tutelage. He told me that I would be the course instructor for the class, responsible for preparing each lecture, assigning homework and projects, and writing exams. His role would be that of advisor, reviewing materials to ensure completeness and accuracy and attending each class to provide me with feedback on my lecturing techniques. It was an offer I could not refuse.

Mentor's Perspective As described in the introduction, I firmly believe that the role of the graduate advisor is to facilitate the development of the student in all ways to ensure future success. Hence, when Juli described her desire to eventually become a university professor, and the associated desire to obtain experience in teaching, I very much wanted to provide an opportunity for her to do so. However, two problems stood in the way: First, departmental policy discourages graduate students from performing classroom instruction in our undergraduate courses. This problem, I was confident, could be avoided by obtaining a position for Juli in another department without such policies. Yet, I also did not want to just "dump" Juli in a course; I wanted her to have a successful teaching experience in which she learned effective teaching techniques and obtained feedback on the methods she was employing. For these reasons, I decided to try mentoring Juli in one of my courses. By attending the course, and providing feedback on a consistent basis, I felt that both of the above problems could be circumvented. I would retain instructional responsibility for the course, ensuring that the lectures were to my standards and that the material covered was consistent with my goals for the course, while also providing an opportunity for Juli to try her hand at identifying course objectives, delivering lectures, preparing meaningful exams, etc. I was able to convince our department chair, who is also extremely interested in developing the entire student, that this idea would work. Hence, we were off and running with the concept by the middle of the summer.



Course Preparation

Trainee's Perspective To begin preparing for my new course, Dr. Petersen provided me with all the reference materials I would need: several textbooks on process control with their respective solutions manuals, a copy of the computer program PICLES¹ for simulating process control problems, and copies of his own lecture notes, homework problems, and exams from previous semesters.

For a general outline of the topics I wished to cover, I referred to the previous year's course syllabus. I then started putting together my own set of lecture notes for the course. After I finished each lecture, I would give it to Dr. Petersen to review. He would look them over, write comments on them, and then discuss his comments with me. Oftentimes he would tell me things like "I have found that students have a difficult time with this concept. Be sure to provide several examples in class." This type of feedback was invaluable to me.

Although I had taken process control myself as an undergraduate, and I remembered which areas of the course were most troubling for me at the time, it was extremely helpful to have Dr. Petersen's broader experience with students at my disposal. Also, knowing that he had reviewed my notes and found them satisfactory went a long way toward increasing my self-confidence when it came time to present the material in class.

Homework assignments were prepared and evaluated in a similar manner. Here again I benefited from Dr. Petersen's guidance in determining how much time students would require for completing assignments, and which concepts should be emphasized.

When it came time to write my first exam, my advisor's role became even more crucial. As a new instructor, I found I had a very difficult time judging how much material could be covered easily in an hour exam. I think this is a common problem for first-time teachers. In this instance, I wrote an exam with four problems which took me 30 minutes to complete. Since the students would have a full hour to take the test, I thought that I had prepared an exam that was just about the right length. However, when Dr. Petersen reviewed the exam, he suggested that I shorten two of the problems. Although I wasn't certain it was necessary, I did as he advised and administered the abbreviated exam. To my surprise, there were still several students who did not complete the exam in the allotted time.

Yet, without Dr. Petersen's input on that first test, I would have unwittingly given an exam that the majority of the class would have been unable to finish. This would have been disappointing for both the students and me, since I had no intention of making the exam a speed contest. I remember all too well the feelings of frustration and resentment when one receives a low score on a test as the result of insufficient time to complete the problems. I have since learned that the students will probably need three to four times longer than myself to complete an exam, and I have planned subsequent tests accordingly.

Mentor's Perspective The enthusiasm with which Juli started into the development of the lectures for this course was an inspiration for me. I had taught the process control course in our department for each of



the past 16 years, and, although I consistently try to add new materials to the course, the topic had become quite routine. Juli, however, was able to see the material from a fresh perspective and to see innovative ways to present the materials. I quickly found that as I reviewed the lectures she prepared, I was not only looking at the content to ensure that the right material was there and that it was being presented in the correct fashion, but I was also looking for ways in which I could incorporate some of her ideas when I next taught the course.

In reviewing the course outline that she developed at the start of the course, I had two objectives. Of primary importance, I was careful to ensure that she would cover the topics that I felt were essential. In addition, however, I wanted to give her as much freedom as possible to develop the class such that it was “her” course. In other words, I wanted to give her the freedom to include new topics that she deemed important, or new instructional techniques that she wanted to employ. Hence, in addition to the course text that I had previously specified, I provided additional texts so that she could have the benefits of others’ thoughts about how the course should be organized, and how the various topics should be presented. Again, my goal was to provide a more mature perspective so that course quality would be maintained, while ensuring that Juli could exercise as much creativity as possible in developing the material.

I gave additional freedom to Juli as she developed new homework assignments. Here again, my objective was to examine the pedagogical components of the problem, to ensure that the problems emphasized these important concepts and that the students would not lose these concepts as they struggled to complete the exercises. Because Juli strongly desired to provide the students with a positive learning experience, this evaluation was quite easy; she proved to be an excellent trainee, able to see how to present the homework in a positive fashion.

When I first developed the concept of allowing Juli to teach the class, I had thought that I would prepare and grade the exams so that I was responsible for the majority of each student’s grade. However, my wife, who was a professor in Civil and Environmental Engineering at WSU, convinced me that by doing so I would be robbing Juli of an important part of the teaching process. In addition, my wife made the point that by not allowing Juli to prepare and grade exams, I would not allow her to obtain important feedback from the students concerning holes in their understanding. My wife argued that in grading a test, we can see where we have miscommunicated important concepts. Without this information, Juli would not be able to see ways in which she needed to modify future lectures in order to cover these holes. Instead, she would be dependent upon me communicating this information to her. For these reasons, I decided that I would allow her to prepare and grade the exams, but that I would review the exams before they were administered, and that I would review them again after she had assigned the grades. In this way, I could ensure that Juli tested on the most important concepts, and that she assigned partial credit in proportion to the knowledge and understanding demonstrated by the students. In evaluating the grades that she assigned on the first test, for example, I found that several students consistently demonstrated a lack of understanding in an important topic, yet Juli had deducted few points for this problem. I identified those students to Juli, told her that they seemed to have missed the concept, and suggested that she again review those exams. After such a review, she took additional points off and emphasized this topic in later lectures.



Class Lectures

Trainee's Perspective Having a mentor present for every class period was wonderful, especially early on in the semester. Dr. Petersen attended each class and sat in the back of the room taking notes, just as if he were another student. After each class, we would discuss my day's performance and he would offer constructive advice, such as "I noticed that you were standing in front of what you just wrote on the board," or "I think you went over that last part a little quickly. You may want to take it slower next time."

This type of immediate feedback was crucial to my progress as an instructor. While my students undoubtedly noticed these same problems, no one was willing to mention them to me. This was not really surprising as students are usually loath to criticize a teacher to his or her face, even when the teacher is an instructor-in-training. The comments they have concerning a teacher's abilities are reserved for the course evaluations administered at the completion of the class. Such post-course student evaluations are useful in evaluating how well an instructor has performed, but offer nothing in the way of guidance for helping the teacher alter his or her teaching style while the course is being taught.

Receiving input from Dr. Petersen on a regular basis throughout the duration of the course allowed me to identify the areas in which I was weak, and to work on improving them. I found myself consciously remembering to move out of the way after I had written something on the chalkboard, and pausing frequently to allow students to absorb material and formulate questions. Making these seemingly minor adjustments enhanced the effectiveness of my classroom presentations and increased the students' understanding of the topics I covered. Moreover, their increased understanding boosted my own faith in my ability to teach.

Mentor's Perspective By attending the lectures, I was able to observe, from the student's standpoint, the quality of the lecture. By taking notes, I was able to assess whether lectures were being given too fast or slow; and whether the students perceived that concepts were presented in a logical fashion. In addition, by sitting among the students, I could hear their whispered comments. This feedback allowed me to help Juli read students' reactions to the lectures so that she could better assess their understanding as the lecture was being given.

Further, once Juli started to implement the teaching techniques espoused by Smith and Felder^{2,3,4} that she describes in the next section, I was able to assess the effectiveness of these techniques by again listening to the students reactions. If they didn't seem to understand what was requested, I could provide additional feedback to the students.

During the lecture, however, I was careful to communicate to the students that Juli was the authority. I did not want the students turning to me to have their questions answered and in so doing implicitly undercutting Juli's authority. Had I done this, it would have been difficult for her to maintain the respect needed to teach effectively. Only once during the semester did I feel that I needed to make an in-class correction to a statement that Juli made during the lecture. On all other occasions, I felt that any mispoken



comments could be best corrected by talking to Juli outside of class and allowing her to make corrections during future lectures.

Student's Perspective Juli's presentations were so clear that it is still difficult to believe this was her first experience teaching. In the course of my undergraduate studies, I have never attended lectures more thorough or effective than Juli's. As a rule in college, I have turned to the textbook to clear up questions about material presented in class. This wasn't the case in Juli's course; her presentations were more understandable than the text.

It is clear from the quality of the course that Juli and Dr. Petersen have put hard work into developing the lectures, and their work definitely paid off. It has given confidence to a gifted teacher who might otherwise have shied away from the profession.

Additional Assistance

Trainee's Perspective In addition to working one-on-one with me, Dr. Petersen also made sure that I was welcome at the College of Engineering's bi-weekly Teaching Improvement support group. While TA's are welcome at these meetings, they don't routinely attend. In addition, since I was not a TA, I was in a special class and did not receive the announcements of these meetings. By attending, I received exposure to many of the latest concepts and techniques in engineering education.

The most important of these seminars was a teleconference series on cooperative learning, an instructional approach that involves students working in teams on structured learning tasks^{2,3,4}. Before attending this lecture, I had never given much thought to incorporating team learning into my course. I suppose I was like many new instructors in that I patterned my own lesson plans on the class structure I had experienced as a student, namely a traditional lecture format. However, I was intrigued by the assertions of Drs. Smith and Felder that team-based learning would increase student interest and retention, so I decided to experiment with some informal cooperative learning exercises.

In my next class period, I started out by dividing the students into groups of three or four and asking them to take five minutes to write down everything they could remember about our previous lecture. At the end of the allotted time, I called on each group to tell me one thing from their list and proceeded to write it on the board. By going from group to group in this manner, and with a little prodding from me, we managed to reconstruct the essential information from my previous lecture in about 15 minutes. The dialogue usually went something like

ME: All right, group number one, what do you remember about the last lecture?

STUDENTS: We remember an 'S'-shaped curve.

ME: OK. What does this 'S'-shaped curve represent?



STUDENTS: It's the response of the system to a step input.

ME: Right. And what does an 'S'-shaped response curve tell you about the system?

STUDENTS: It means the system is an overdamped, second-order system.

ME: Great!

What was truly remarkable to me about this exercise was not that the students remembered so much of the material; I figured that a class of 33 students, given sufficient time to pick their own brains, should be able to come up with the main points of what we had discussed only two days previously. The enthusiasm with which they tackled this task, however, did surprise me. I had students who usually sat in the back of the room with their heads down suddenly raising their hands and eagerly volunteering information. It made me feel good to get confirmation that I had actually imparted the information I had set out to teach, and I believe it made the students feel good to realize how much of the material they actually understood.

After the success of this preliminary experiment, I began to routinely incorporate these informal cooperative exercises into my lectures. The tasks given to the groups varied. Sometimes I would ask them to review previous material as I did that first day, other times I would ask the group to complete a portion of an example problem we were working in class, and on several occasions I asked the students to extend their knowledge to areas that we had not yet covered in class.

Each application of this group-learning technique brought positive results, most immediately apparent in the increased attention paid by the students to the remaining portion of the lecture. However, I believe that the results were much more long reaching. The average score on the first of three hour exams, administered before the implementation of cooperative learning tasks, was 61. The average score on the second exam, administered after cooperative learning was incorporated, was 77. While I realize that first exam scores are often lower than those on subsequent tests simply due to the students' unfamiliarity with the testing style of a new instructor, I believe that the team-based learning exercises also contributed to the rising average.

If Dr. Petersen had not encouraged me to attend these workshops, I would not have been exposed to the concept of team-based learning within the context of my tenure as an instructor-in-training. Thus it was once again my faculty mentor who provided me with the opportunity to gain new skills and insights into the classroom learning environment.

Mentor's Perspective The administrators in the College of Engineering and Architecture at WSU are committed to developing better teaching techniques for the faculty in the college. For this reason, they have developed this bi-weekly forum in which effective teaching techniques can be shared. I knew that I did not have all the answers, and that by attending these sessions Juli could benefit from interactions with other instructors within the college.



Again, seeing the enthusiasm with which Juli implemented these new instructional techniques was exciting to me. By sitting in on the lectures, I improved my understanding of why these exercises help the students better retain the concepts that they are exploring. In addition, I plan to incorporate some of the exercises that Juli developed into the next year's course.

Student's Perspective The short sessions that we spent completing example problems allowed us to check our understanding of the material as it was presented and definitely contributed to our success in this course. The brief group reviews throughout the course reinforced the important concepts and allowed us to immediately identify material at which we should take a second look. Each of these activities helped us to be well prepared for the exams.

Conclusions

Many of the graduate students pursuing doctoral degrees today hope to become the professors of tomorrow. Yet universities with structured programs in place designed to provide these students with counseling and experience relating to classroom instruction are rare. This approach to training graduate students for careers as instructors is unique in the university setting, but we feel it should be seriously considered by all schools with an interest in graduating Ph.D.'s who not only possess knowledge in a subject area, but also the skills required to pass that knowledge on to another generation of engineers.

From our own experience, we can testify to the benefits of practical, supervised teaching experience in terms of increasing one's facility in organizing cohesive lectures, constructing meaningful exams and assignments, and fine-tuning presentation skills. Moreover, the effectiveness of the mentoring program in fostering Juli's teaching skills is reflected in the results of the comprehensive teaching summary compiled by the college from student course evaluations. On a scale from 1 to 5 Juli was given an overall rating of 4.34, compared to a college-wide average of 4.12.

Another important, and unexpected, benefit to the mentoring program is the growth experienced by the mentor. By helping another think through the process of teaching, of effectively presenting the material, and of assessing the student's understanding, the mentor's skills in these areas can also be improved. Additionally, enthusiasm is contagious, and interacting with young, energetic instructors can also help rejuvenate the attitudes of the mentor.

In addition to training graduate students how to teach, however, we would suggest that such a mentoring relationship be established for new college professors. Many of these new instructors do not have any training in how to effectively teach; yet they are required to teach several courses, as well as develop an effective research program. By having senior faculty, who have been recognized as effective teachers, be involved in an organized mentoring program, the development of these junior faculty will be greatly facilitated.



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Biographical Information

JULI L. SHERWOOD is a Ph.D. candidate in the Chemical Engineering Department at Washington State University. She is currently performing research on the biodegradation of chlorinated solvents, and is also a tutor in the Minorities Engineering Program.

JAMES N. PETERSEN is a Professor in the Chemical Engineering Department at Washington State University. For the past seven years, he has been actively involved in experimental and theoretical aspects of bioremediation technology, and in the instruction of numerical methods, process optimization, and process control.

JULIE M. GRANDZIELWSKI will receive a B.S. in Chemical Engineering from Washington State University in May 1996. She is President of WSU's student chapter of the Society of Women Engineers and is involved in Tau Beta Pi and AIChE. She also serves as a tutor and mentor in the Women Engineering Program.

