

What You Need to Know about Becoming an Academic in Engineering: A Woman's Point of View

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Abstract

An academic career offers many advantages: choice of research area, choice of teaching style, flexibility in scheduling, a new start each semester, options on how the summer is spent, working with really great people, and after tenure, job stability, to name a few. Academia is an opportunity to help people directly, to be able to see the "light bulb turn on," to be a mentor, to be a role model.

The academic profession also has some disadvantages. There are areas of academia that are frightening, not the least of which is struggling to achieve "tenure." There may also be a perception of boredom, repetition, and that academia is either a very easy profession or a very difficult one in terms of hours and effort required.

The author will give her perceptions of what she has learned over more than three decades of serving in academia, including being the first female faculty member on an engineering faculty. Factors such as a sense of humor, "getting it in writing," and a sense of satisfaction in knowing that you made a difference will be discussed. The career/family balance will also be examined.

I. Introduction

My mother was a teacher (grades 1-8) before she married and had children. I had decided by age six to be a teacher (better than a nurse or a secretary, I reasoned), so then I only had to decide what I would teach and at what level. In first grade I wanted to be a first grade teacher. As a second grader I went back and corrected papers of the first graders. As I progressed to each grade, I wanted to teach at that level. I soon saw the pattern and concluded that I would want to teach in college. In high school I knew that I wanted to get a Ph.D. to give me the most options for a teaching career. By the end of high school I narrowed my major choices to English or mathematics. I considered mathematics because my high school teacher had urged me to take a third year of math. I did not take mathematics my sophomore year because the sophomore girls' basketball team had gym together that hour and practiced. During my senior year, as I first took a trigonometry class by myself and then joined the six boys in that class in the spring, I realized that math had always been easy and I sort of liked it, so maybe that is what I should study. In college I chose the mathematics over English because I liked my mathematics instructors, and other freshmen in my residence house were majoring in mathematics. In graduate school, I chose statistics as my area of interest because, again, I liked the faculty. I did not use a very rational system to decide to major in statistics, but it is a decision I have never regretted.

II. Early Career Thoughts

They really do know what you are doing. After completing my Master's and Ph.D. in Statistics, my husband and I began our teaching careers at Arizona State University. I recall walking to class the first day and thinking, "This is incredible! They don't really know what I will do in the classroom and they trust me completely. No one is even checking up on me." The fact is that "they" do soon know what is going on in the classroom. You were hired because you have completed a Ph.D., you've probably already taught some classes ("they" got feedback on how well you taught before you were hired), and you are a responsible person with a reputation to build. You do not intend to go into class and make a fool of yourself. However, if teaching in the classroom should go wrong (you do not use the text, you come to class unprepared), the students are usually quick to inform the proper authorities and someone will come to talk to you.

You know more than the students do. Another thought early in my career was, "What if the students in my class know a lot more than I do?" This is a very natural feeling of some insecurity at the beginning of a career. The fact is that this is extremely unlikely. You usually know much more about the subject than your students. However, if you do get a class-related question for which you do not know the answer, just say, "I am not sure about that; let me get back to you next period." I remember professors who would say that, and we, as students, did not think badly of the professor. When a professor really did not know an answer, but tried to bluff their way through (especially in graduate school), then students lost respect for the professor.

Have complete class notes. After I had been teaching at the university level for a few months, I rode the elevator with a colleague. He was intently reading some papers. I asked him what he was doing. He said that he was going over his notes. Notes! So I should have notes! OK! Every since that time I have had complete notes when I walk into class and have worked all of the problems for that chapter. The result is that I don't get stuck working a problem for a class which can really be a time waster. I am also less nervous when teaching class: even if my mind gets ahead of my mouth or I happen to go completely blank, I have my notes and can pick up and continue immediately. By the way, do update and improve your notes each time you teach. You can always make them a little better.

Be professional. This needs to be true in your life, in your demeanor as a faculty member, and in your dress. I believe that this is especially important for young faculty and female faculty. There may be a lack of respect for you or a disbelief that you could be competent by a predominantly male audience, especially if some of the men are nearly twice your age. Be professional in your dress, taking stock of what is standard for your institution. Be professional in your working relationship with students. I have always called them as Mister or Miss and have found that formality to work very well. Early in my teaching career, a male faculty told me that he had tried one semester to be really friendly with his class, predominantly male. He said it did not work and the students mistook his casualness with them to mean they did not have to perform as well as usual to get a good grade. The students tried to take advantage of the situation. As a graduate student, especially, I did not feel comfortable that a professor called some students by their first name (the same students that he drank beer with at a local pub) and

other were formally addressed. In turn, when students are no longer a student, then they may call me by my first name instead of Dr. Anderson-Rowland or Dr. A-R.

Have a sense of humor. Remember that these students are 18-25 years old, primarily. They are young and often very unsophisticated. Often their frustration is with themselves and not really you, especially if they are a freshman and are experiencing all the changes from high school and being away from home for the first time. If you find yourself in an administrative role and you need to deal with faculty who are often much more experienced and much older than you, have a sense of humor. I have a House Rules sign on my desk. It was very helpful when I first became an administrator in the Fulton School. A happy face is at the top and the sign reads:

HOUSE RULES

1. Acknowledge that this is NOT a matter of life and death.
2. Remember that there are at least four billion people who could not care less about this matter.
3. Smile at least TWICE during this discussion.

This sign has helped me on several occasions. One time I did need to remind a colleague about rule number three. As much as he could manage was to change a down turn to a straight line, but it accomplished the purpose.

Be adventurous and willing to change. You have probably all experienced the professor with the yellowed notes and the exams that are the same each year. One of my best compliments from a student was that he complained rather angrily that he had studied all of my old exams in the fraternity file and he still only got a "C" on my exam. He was very upset. I change my exams each time and was satisfied then that students who had access to the fraternity files really did not have an advantage. I was told one semester that I would be teaching FORTRAN the next. I had never had FORTRAN or any computer science class. So, I sat in on the FORTRAN class that semester and taught it the next. I was only one day ahead of the class and I was never accused of going over their heads. The class and I learned a lot! It seemed a little risky to me to introduce computer applications in my classes, some years ago, since I did not have a strong background in computers. However, teaching assistants and student helpers can help you a lot with areas such as these, in which you may not be an expert. Again, you and your students will learn.

Use your sabbatical to stretch your mind. Although I had consulted in industry over several years, I had not ever worked in industry. I felt that I could be a more effective professor and advisor if I learned more about industry and if I could talk from personal experience when advising young women, especially, to choose a career in engineering. I chose to spend my sabbatical year, 1987-88, in industry. I consulted for an engineering manufacturing company the summer of 1987, spent my entire academic year there, and then continued with them in summers and part-time during the academic year for a total of five years. I was very afraid when I first started working at the company. I felt that I not only had my reputation at stake, but also that of my school. I felt that I had to succeed and I was assigned to an area of which I knew very little. I was hired to develop a Statistical Process Control (SPC) system for the company. At that time I knew very little about Quality Control. I was taken under the wing of a long-time engineering

manager. The experience was exhilarating! My head seemed to swell with all of the new language and ideas that I learned. The entire experience was one of growth, excitement, and accomplishment. I was able to use my statistical background to develop original control charts for the precise machining that was demanded.^{1,2} The experience also involved working with operators and management and developing and delivering training for the SPC program. When I returned to the classroom, I was assigned to teach Quality Control. Quality Control immediately became my favorite course to teach. I was able to communicate from experience and better understood the working engineering students in my class.

Homework should often be done in teams. During my first years of teaching, I always made the students do their own homework. However, in later years I changed to allowing them to choose a team of 1-3 students for a team for homework, if they wished. Students in most courses will soon learn that if they do not do and understand the homework themselves, they will not really learn the material and they will not be able to do well on exams. Allowing students to work by themselves is very helpful for international female students who may not be permitted by their religion to work in a group with a man. The credit for homework has to be enough that it serves as an incentive for the student, however I believe students always need to be reminded that homework grades weighting is not given relative to the time spent on the homework. In the same way, students do not get “credit” just for reading an assignment. Students may need to be reminded that some of engineering is like learning a new language. It is important to keep up with the vocabulary on a daily basis. Just studying the night before an exam will not usually work.

Introduce active learning in your classroom. You may wish to introduce a topic, work an example, and then have the students work on a similar problem in teams at tables. The students will be able to see immediately if there are parts of the problem that they do not understand. As instructor you can go from group to group to see how they are doing and to answer questions. There are good training sessions and literature available to give you many ideas on how you can include active learning in your classroom.

Get it in writing. If you have been given a verbal agreement for something different from the ordinary rules of the institution, get it in writing. Although the administrator that made the agreement with you may honor it, he or she may no longer be in that administrative position at a later time when that agreement is important to your academic career. If you go part-time and have been promised you can go back to full-time at any time, get it in writing. If your tenure clock will be slowed while you are part-time, get it in writing. Enough said.

III. Challenges of an Academic Career

There are areas of academia which are not well understood and may cause a lot of pressure: one of them is “tenure.” This is a rite of passage that most schools require of their faculty. The university needs to have a say in whom they will commit a career for life. It is very important to know as much about the tenure process as possible at a school before accepting a position there. If the requirements for tenure (get them in writing) are requirements that you don’t wish to do, then that institution is not for you. Make sure that you keep in touch with your department chair and ask for frequent reviews if you are not given them or if you have any doubt that you may not

be performing up to the expected standard for tenure. The tenure process is well worth it, though, because it basically guarantees you a job for life as long as you are a responsible faculty member.

There are some perceptions that academia is very boring or repetitious. On the contrary, each day when class is over, class is over. After 50 minutes, an hour and a half, or even a two or three hour class, when class is over there is a fresh start to be made in the next class. Each semester, the classes bring a new set of students with their own distinct personality. One class may have a lot of students in the last row who really enjoy the course. Another class may have two or three tables of students who are all top students and love your course! Usually you have some say in what classes you will teach and when you will teach them. In addition, if you are improving your classes each semester, you are building up a good set of notes and teaching the class again should become easier. In addition, the service that you do and the research that you do are all up to you. You have the option of how you will spend your time.

There may be a perception that academia is tough work. I agree, but there are some things you can do to make your life a bit easier: work smarter. Having basic notes for each class certainly makes it easier to teach a second or third time. I have found that by giving solutions of homework to the student grader with the partial credit marked (yes, I believe in partial credit) and then having the grader report back how many students missed what parts of what problems, you can quickly see what topics need more work. The grader can also help with grading exams while you maintain quality control on the grading. I give the grader an exam solution with partial credit given for parts of each problem. Working together at the same table, I have the grader grade all the correct answers and I grade the incorrect parts. In this way, the grading time is cut in half, the grading is consistent, and I have a good feel for how well the class understood the material. The work is tough, but there are many rewards.

IV. Some Additional Advice

A convenient grading system that I use is that I grade on the curve and I give partial credit. This is what I wanted when I was a student, how I wanted my children to be treated, and how I treat my students. Each exam is curved, say: 88-100, A; 75-87 B; 60-74 C; 50-59 D; and 0-49 E (or F). Of course, how you curve the exam depends on the difficulty of the exam. I often look at the lowest A exam and ask if this looks like an A paper or a B paper in terms of what I expect the student to know. The curve is announced to the students after each exam. The total homework is also curved. Each of three exams may be worth 100 points, homework 100 points, and the final 150 points. If, at the end of the semester, the total of the points earned by a student is one point higher than the highest B, for example, the student receives an A. For example, if the total of the points of the highest B for all exams and homework is 515, then if a student has 516 points, the grade is an A. In other words, the students get the benefit of the "space" between grades. The instructor always reserves the right, however, to raise a grade. This may occur if a student was ill and did not do well on the first exam, but did top A work for the rest of the semester. Students seem to find this a fair system and they always have a good idea of how they stand relative to their grade in the class.

Work the hours that are best for you. I am not a morning person. I try to have classes that are scheduled later in the day. I can be very productive at night, when there are no interruptions by phone or people. Work with your chair to make sure they know that although you may not come in until 9 or 10 am, that you are routinely working until 7, 8, 9, or 10 pm. As a faculty member you may well find yourself working in the evenings and on weekends, but at least you are in control of what you work on and when.

Have a support system. When I first entered as the first woman in the Fulton School of Engineering, the men did not throw a party for me. I was told by a friend that they were upset, saw no need for a woman faculty member, and wanted to know what I was trying to prove. Since I was the only woman, I made friends with women faculty across campus in Business and Communications. I joined the Faculty Women's Association, which became quite powerful and made public all university salaries.³ This support was very helpful and important. Having a husband that was also on the ASU faculty gave me another sounding board. It is difficult to go through life alone. A good support system of a spouse or of friends is essential and a sense of humor is helpful.

Choose research that is interesting to you. I have done research in the areas of statistics and quality control. I have done more grant writing and research in the area of recruiting and retaining of engineering and computer science students. As a statistician and industrial engineer, I enjoy analyzing data and using my background to help design and manage more effective programs for students. My first research and grant in this area was with graduate school career change women, who, often without an engineering degree, came back to school to take prerequisites and to earn a Master's degree in Industrial Engineering.⁴ Other research has included the topics of retention⁵ and recruitment.⁶

Consider an administrative position down the line. Take care of tenure and promotion first, and then look at administration. The negative with administration is that you then live in a glass house and your time is no longer your own. However, there are deep satisfactions that come with changes you can make from that position that would not be possible without the administrative appointment. I would especially urge women and underrepresented minorities to consider administration, since their representation is very low in engineering. I have served as an Assistant to a Dean, an Associate Chair of a department, and now as an Associate Dean in the Fulton School of Engineering. I accepted the Associate Dean position primarily because in that position one of the first orders of business was to establish a Women in Engineering Program, primarily for undergraduate women in the School.⁷ Women faculty and administrators can play very important roles in retention programs for women in engineering.⁸ Other programs begun during my term as Associate Dean include an Inclusive Living and Learning Communities⁹ and a WISE Investments program for middle school and high school teachers and young girls.¹⁰

Keep healthy spiritual and physically. Pay attention to your spiritual life. Have a meaning and purpose for your life. Stay healthy and exercise. Start walking short distances and then running and walking. Great ideas will come to you while you are exercising. Try a 5K, a 10K, or a marathon. You'll be glad that you did. Don't worry about keep your home ready for House Beautiful to photograph at any time. No one yet ever died of dust. Dust every other week, save

half the time, and take time to watch your children play ball. Have your children help you with the housework. This is especially true for boys, and your daughters-in-law will thank you later.

V. Pleasures and Advantages of an Academic Career

An academic career is family friendly in most cases, especially for women with children or men who want to be able to spend more time with their family or children. An academic career and a family can work. Summers are free, if not different. You should be able to watch your children take swimming lessons. The academic class schedule is usually similar to the K-12 school schedule in your area. When your children are home on Christmas vacation, you can be, too. There is also the possibility of going part-time. I went part-time for 10 years until my boys were 10 and 8. In many institutions, the tenure clock can be adjusted to account for the part-time. Please note that I have friends who chose to work full-time with children and used a helper who tended the children during the day and had dinner on the table each night when mom and dad came home. They were then free to play with their children in the evening. This is a very individual decision: to stay home, to work part-time, or to work full-time right through. Because the faculty schedule is not 8-5, adjustments can be made in your schedule to drop children off at school, to take a child to the doctor, or to tend to family emergencies. Remember, you will be working at night, on weekends, and on breaks.

A tenured professor is a secure professor. It is extremely unlikely that your institution will go under. Occasionally, programs are eliminated, but the university usually tries to give the tenured professor an option of working somewhere else on campus. Short of a felony and as long as you are a responsible person, you will remain employed. Granted universities usually do not pay as well as industry, but industry usually does not have the job security, the option of working your own hours, and the option of being able to choose your own research topic or projects in which you become engaged. Also, academia usually provides good health and retirement benefits.

There is deep satisfaction in helping students. There is always the joy of seeing “the light bulb turn on” for a student when you are explaining a difficult concept. Sometimes compliments can come at strange times. I once talked at the end of the semester with a student that had taken my class and received a “D.” I asked him, what I could have done as an instructor to have enabled him to receive a higher grade. His answer surprised me: “You are a great teacher! There is nothing more that you could have done. I work and have no time to study or do the homework. I simply attended the classes and I learned enough in class to pass the course with a D!” A young woman came to me for help. She had failed a course two times, under extenuating circumstances including health matters, and by university rules was unable to take the course a third time. The course was needed for her graduation as an engineering major. Another professor and I helped her state her case clearly on paper and organize her appeal before a jury of faculty and staff. She said that she knew she did not have a great background when she came to ASU and that she wasn’t the smartest kid in the class, but she was good enough that with hard work she could do the engineering curriculum and become a good engineer. The young woman won her appeal and graduated in December 2003. The joy of working with students sometimes continues after their graduation. For example, it is very enjoyable to be invited to celebrate with them at their wedding.

When former students tell me that I was their role model, I am always surprised and sometimes completely unaware of what transacted. I was on a panel a few years ago, and a young woman identified me and said that she had heard me speak at a conference several years before (she even remembered the outline of my talk), and she had then decided to become an engineering professor and had succeeded. Another woman said that I was the only female engineering professor that she had and she is now an Associate Dean working with students, as I am, in a College of Engineering. Another former student has told me that she has been watching what I have been doing for years: I am her role model. This information is very flattering, but also humbling. When people are watching, you want to be sure they are watching worthwhile behavior.

VI. Conclusions

Although I am spending my 38th year at Arizona State University, my career here has had a lot of variation over the years. I have worked both in the College of Liberal Arts and Sciences and now the Fulton School of Engineering since 1974. I was part-time for ten years. I have taught several different courses and usually at late times. I have been a program administrator and am currently the PI on three academic scholarship programs and a project with a community college district. I have joined several organizations for which I regularly present and publish papers. One of my organizations is international and this has led to making friends around the world and traveling around the world to attend various conferences. I had the distinct privilege of becoming the first woman in our School's Dean's Office in 1993 and was given as one of my tasks the opportunity to start a Women in Engineering Program. Blessed with excellent people to work with, our student recruitment and retention programs is now nationally known. My research has changed over the years and now I am enjoying using my statistical background to do research and writing about better ways to recruit and to retain engineering students, especially women and underrepresented students. I made a great decision when I was 6!

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Biographical Information

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