2006-304: TRANSITIONING FROM INDUSTRY TO EDUCATION: THE THIRD YEAR

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Transitioning from Industry to Education: The Third Year

Abstract

Changing careers can be a very demanding and stressful experience. Today, few people stay with the same organization or occupation their entire professional career. In fact, the transition from one career to another may actually occur multiple times. However, the interest here is on one particular transition. After 30 years as an engineer and engineering manager many skills were acquired and developed. But were any of them transferable to another career, especially to one in education as an engineering professor.

The transition from industry to education would take time and effort while presenting many trials and tribulations. The first year was full of new obligations, responsibilities, and surprises. It was truly a learning experience. However, it was discovered that many of the skills utilized as an engineer and manager were directly transferable, greatly easing the conversion. The second year brought with it even more challenges and opportunities that demanded attention revealing additional skills that were transferable and regularly used. The work load continued to increase during the third year and at times seemed unbearable. However, it became clear that the transition was successful when, for the first time, some sense of normalcy and routine was recognized. This accomplishment can be directly attributed to the engineering knowledge acquired through formal education and nurtured in industry. It formed the foundation that was relied upon throughout the entire transition process.

The process of transitioning from an engineering manager to engineering professor is now complete. It was an interesting and rewarding journey spanning three years with many peaks and valleys. Along the way many interesting discoveries were made and lessons learned. This paper describes the evolution and progress occurring during the third year and reflects briefly on the entire transition process. It offers both hope and encouragement for those in the engineering profession considering a similar career change into education.

Introduction

The third year as a full-time engineering professor began with a great deal of optimism, anticipation, and expectation. As a seasoned veteran of two successful academic years this was quite understandable. Transferred engineering skills from industry had overcome all obstacles encountered along the way. Learning from and utilizing past experience would certainly make this academic year far easier and more productive than the first two. However this hope was almost immediately shattered by a host of new duties and responsibilities.

Once again new courses had to be prepared, curriculum reviewed and revised, committee work performed, and of course the quest for tenure persisted. Additional tasks included advising students, writing grant proposals, preparing for an accreditation visit, and readying the department for a move into a new building as soon as the academic year was over. Of course

recruiting new students and retaining the current ones was of utmost priority. The list of responsibilities seemed endless.

In fact, the full scope of these new obligations wasn't fully realized for months. By then many of these tasks seemed overwhelming requiring vast amounts of time and more effort than resources allowed. Nevertheless it was not the point to panic but an occasion to once again utilize the skills and abilities acquired through engineering education and industrial experience.

Transferred Skills

Industry and academia are both similar and different in many ways. They both require a set of skills that must be mastered in order to be successful. As a result numerous comparisons can be made. Of particular interest are the skills acquired and utilized by engineers and engineering managers during the performance of their duties. Could this knowledge be successfully applied in the educational arena as well? Unfortunately the answer to this question is not generic. It actually depends entirely on the skills of the individual and how they are applied.

Engineers in industry design, develop, and implement new products and processes for an entity that is trying to remain competitive, make a profit, and stay in business. Engineering professors, on the other hand, are training and developing students to become engineers preparing them for a rewarding technical career. At first glance the two positions appear quite different and at odds with each other. In actuality they are very similar. Both utilize a vast array of engineering skills just in different ways.

The engineering professor is a facilitator and mentor guiding students through the rigorous educational process that transforms them into engineers. Likewise, the engineering manager is a director that steers teams of technically trained individuals through the imaginative process of creating new and innovative devices and procedures. The common thread is a knowledge base that can be applied to many diverse circumstances. The key is realizing that these engineering and engineering management skills can be utilized successfully in related fields and areas.

The process begins by performing a skills inventory to determine what if any of their expertise could be transferred to another occupation. Most individuals fail to consider this aspect of their talents and as a result they remain pigeonholed into a career they either dislike or have grown tired of. The results of this relatively straightforward exercise, more often than not, surprise people. They simply don't realize how much they know or how to utilize that knowledge and experience. This becomes the first hurdle to overcome for individuals considering a career transition.

An extensive skills inventory was conducted prior to beginning the first year as an educator[1]. This process starts with a brainstorming session that lists the transferable skills that can be utilized either in a different industry or career. Essentially they are the skills you have acquired that can be used in an array of different career situations. The listed skills have the potential to vary considerably since they are based upon training, experience, industry, and work responsibilities. They are derived from a variety of sources including your accomplishments, both professional and personal; your diverse work experiences; educational background; and at

work training. Basically they illustrate that you have done this before and you can do it again; and you have done something similar and you can adapt.

Every engineer and engineering manager has acquired a wealth of abilities and perspectives. This skills inventory assessment uncovered many skills including "planning, scheduling, organizing, exploring, controlling, mentoring, communicating, and leading. Other skills … pertained to management … incorporating budgeting, administrating, and allocating scarce resources" (Loendorf[l], 2004, p. 2). In order to obtain a similar list from an educator's point of view, four senior faculty members in the department were asked to list the skills required of an engineering professor. The results of their skills inventory were actually quite similar. While reviewing their perceptions they used slightly different terms to describe the skills, however they matched almost exactly the assessment made by an experienced engineering manager.

Upon completion of this skills assessment it was discovered that engineering professors and engineering managers actually have a lot in common. Interestingly enough this shouldn't come as much of a surprise. After all, many of the problems encountered in the academic arena were strikingly similar to those found in industry. Only the circumstances were different. The educational goal was to successfully transfer knowledge converting students into engineers while the industrial objective is to utilize engineering knowledge converting ideas into successful products or processes. As a result many of the same skills including exploring, mentoring, planning, organizing, scheduling, controlling, communicating, and leading could be used in both careers with little modification.

This process of utilizing acquired skills began in the first year[1] as an engineering professor and continued throughout the second year[2] and into the third as well. It is conceivable that this process will persist as long as new challenges and opportunities are encountered. New problems require new methods of solution and it is highly likely that similar issues were previously encountered. Adopting and adapting those proven solution methods to new problems leads to a high degree of success.

New Skills

Even though there are many similarities between the engineering manager and the engineering professor, there are also some differences. Perhaps the most valuable quality of any engineer or engineering manager is the ability to continually upgrade and acquire new skills. This is an equally important trait for the engineering professor as well. New concepts, ideas, and skills must continually be learned and applied to the job at hand. In addition to complete the transition from industry to academia some new skills have to be obtained and nurtured. For the engineering professor this leads to fresh new ways of presenting material, retaining student interest, and motivating students. Failing to do this leads to poor performance and obsolescence.

Learning to become an effective engineering professor is far more than preparing syllabuses and presenting lectures. New skills must be acquired that motivate students to learn while creating an environment for success. The way to begin is through research. Many excellent books and papers have been written on effective teaching techniques and practices including those by Gupta[3], Wankat and Oreovicz[4], Laurillard[5], Ramsden[6], Knight[7], and Yelon[8]. This information was

directly applied and incorporated into the course materials and presentations. For example, it was now possible to gage and determine the appropriate pace and level of difficulty to be used in the undergraduate classes. As a result preparation time decreased while the quality of the content increased. A professional demeanor could now be established allowing the new professor to effectively teach and grade all students fairly. It assisted in learning how to create and maintain the proper distance between the professor and the students. Finally it helped overcome the fear of not knowing all the answers. It is acceptable to say you don't know the answer but you will report back with it during the next class. Knowledge gained from this research made the career transition far easier and more enjoyable.

A large variety of situations were encountered during the transition years that required special attention. Suggestions presented by Kaw[9], Dean[10], and Miller[11] offered some insight but didn't always propose a solution. It then became the responsibility of the new engineering educator to become creative and formulate a solution. This was usually accomplished by combining a number of concepts or ideas into something to try. In many cases the resulting solution didn't work, but at least it didn't make matters worse. Without getting discouraged, new solutions were devised until something did work. This trial and error method of problem resolution might not be the most efficient but it did lead to the acquisition of a variety of new and useful skills.

Working with engineers that are dedicated and interested in designing and developing new products is a real joy. Occasionally as a manager, however, performance issues are encountered that must be dealt with. This usually involves some type of reprimand, transfer to another group, or dismissal. Dealing with people always requires great skill. This is especially true when dealing with students. Many students are in a class not by choice but simply because it is a requirement for graduation. In some cases these students are uninterested in the subject, unmotivated, and quite simply bored. These types of students are termed place holders or space holders because they are taking up room that could be better utilized by students who are truly interested in the subject. Dealing with them presents an especially difficult scenario. Getting them to actively participate in the class discussions was a particularly exciting challenge. However, by relating the subject matter directly to real world industrial and consumer applications tended to spark their interest. Actual products involving automotive components, robotic equipment, embedded systems, electronic appliances, and computers were extensively utilized in class. Most of these examples were drawn directly from previous industrial design, development, and implementation experience. This illustrated the importance of actual industrial experience and how it could be effectively used in the classroom. Using this applied approach improved their interest and seemed to work in almost every instance. In many cases the quiet, uninterested, and reserved students actually became motivated and productive members of the class.

During the transition years many new skills were acquired and developed leading to improved performance as a teacher. It is anticipated and expected that this trend will continue. The objective is to constantly get better since there is always room for improvement in anything worth doing. This is especially true in academic circles. As a result, continual life-long learning is the key and only way to successfully complete the career transition from industry to education.

The Six Ps

All of the transferable skills from engineering experience along with the newly acquired teaching skills were very important. Throughout the first two years of academic experience many of these skills were developed, enhanced, and refined through practice along with trial and error methods leading to improved performance. However, during the third year it became apparent that six of these skills were the most significant and as a result have been classified as the Six Ps. These skills include: planning, project management, problem solving, presentation, patience, and persistence. Each of these skills is noteworthy in their own right, but collectively they are essential for success as an engineering educator.

Planning. Perhaps planning is the first and most critical of the skills. It is the initial phase of preparation for any project. Most jobs and assignments can be considered as a project that needs to be managed including teaching a course, running a committee, or preparing curriculum. Planning involves every aspect of developing a project including a schedule or timetable right up until the actual work begins. It requires a careful thought process to include every aspect of the activity prior to starting its operation. Planning ahead greatly simplified the to-do list associated with teaching courses or running committees. It created a calendar for the academic term that was detailed, listed everything that had to be done, and was easy to follow.

Project Management. Once the planning has been completed it is time to begin the management process for its implementation. Project management is the coordination of activities necessary to complete in a timely fashion a predetermined set of tasks in order to reach an objective. Most projects involve a set time frame or temporary duration in which to form a product, process, or service. All of these aspects directly apply to the management of a course or committee. For example, during the academic term the activities related to a course must be scheduled and tracked to insure they are completed resulting in the transference of knowledge. Microsoft Project is an excellent tool that has been used with great success the past three years to manage classes as well as committee work. Everything is documented right from the start informing the students and committee members exactly who is doing what and when it is due avoiding a great deal of confusion. It requires more upfront work but returns dividends during the entire academic term or year.

Problem Solving. No matter how well you plan and manage unforeseen problems always arise. They can surface at anytime but typically appear at the worst of times. This is where your problem solving skills enter into the picture. Luckily, engineers are trained in solving problems throughout their academic years and this carries on throughout their entire career. They are trained to think in a logical and rational manner considering all possible alternatives before making the final decision. This is an easy process for problems involving inanimate objects but quite difficult whenever people are involved. At this point, experience as an engineering manager became very useful. While working with a wide variety of individuals and problems on project teams in industry significant experience was gained that was directly applicable to the academic endeavor. Granted many of the problems in academia were different than those from industry, however, the fundamental solution process could still be applied. Surprisingly many of the people problems were actually extremely similar to those previously encountered allowing for experience to guide their resolution. For example, many engineers are introverts or at least

have that tendency. They enjoy working alone on projects and often excel in their work. One approach that was successfully used in industry was to utilize this expertise in a team setting where their contribution would be significant. This increases their comfort level and has the tendency to draw them out of their shell, so to speak. It transformed them into more outgoing engineers and even lead to management positions for a few. This same approach was utilized with student project teams with equal success. Perhaps the students were shy or just unsure of their abilities; however the results were simply impressive with some now taking leadership positions in subsequent teams.

Presentations. The ability to present material in a clear and concise manner is another valuable and required skill. Everyone remembers sitting through dull and boring lectures where the speaker talks in a monotone, too fast, or too slow while looking at the whiteboard and ignoring the audience. You're thrilled when it's over but you remember nothing from the lecture. This is even more prevalent today with Microsoft PowerPoint presentations full of slides with too much information written too small and simply read by the speaker. Presentations must be fun and interesting in order to keep the audiences' attention. This is especially true for students that seem to bore and lose interest easily. Unfortunately there is not one universal solution. Rather a great deal of work is required to keep the lectures fresh and entertaining. Yes entertaining. Lectures and presentations can be treated as a show using a wide variety of techniques to keep their attention and maintain interest. Costumes and props are often used to spice up the presentations. This, of course, means more work for the instructor but a wonderful side benefit is relieving the tedious task of presenting repetitious lectures. Granted some subjects are more difficult to make interesting than others but it can be done. Always search for new and imaginative ways to make the material fun and interesting for both the instructor and the students.

Patience. One of the most difficult skills to master is patience. Our society wants everything now and is unwilling to wait for anything. In industry, for example, some engineers continually go to their manager for advice on every little detail involving their work without relying on their trained judgment. They want the answer and direction now without doing any research to determine the best approach. This is equally true for education. Students want to understand and master the material without delay using as little of their effort as is possible. Students don't take the time to read and study the textbook or complete the required homework assignments. They expect to get all of the information they need directly from the class lectures. When it is realized by the students that this is not happening they visit the instructor and spend countless hours trying to catch up. This is a continual source of frustration for the instructor requiring calmness and self control. The professor must be willing to endure the inconvenience without complaint. Office hours are scheduled to aid those students having difficulty with the course and in many cases this takes a great deal of time. One of the greatest thrills for a professor is to witness a student as they finally understand how to solve a problem and sense their feeling of accomplishment. This is what education is all about but it requires a great deal of patience from the faculty member. Unfortunately this is not necessarily a God given skill, it must be acquired. Professors must learn to be patient and calmly assist the students as they struggle to learn and understand the material. Undoubtedly this can be one of the most demanding educational tasks.

Persistence. Equally challenging is the need for persistence. This is a critical skill that must be acquired early by the engineer as well as the new engineering educator. In industry problems

occur all of the time requiring changes in plans and strategies. For example, while developing an embedded system in industry, it was discovered that both processing and memory requirements would greatly exceed the available capacity of the microcontroller selected. Cost constraints wouldn't allow for more memory or a more powerful computer. Many alternate solutions to overcome the problems were tried without success until finally a new radical set of algorithms and data reduction techniques resolved the issue. Through persistence and a never give up attitude the problem was rectified and the project successfully completed. The same traits are equally valuable in the academic world. The learning curve is steep and unforgiving requiring the new professor to remain firm and steadfast as the transition unfolds. As with any career change, a period of rapid change offers strange and unfamiliar circumstances that must be dealt with. There will be numerous obstacles, setbacks, and disappointments along the way. Many of the things tried by the new instructor will basically fail or at best return marginal results. However, don't become discouraged it is all part of the learning process. Don't give up but rather try more new things and evidentially they will begin working. The key is to learn from each experience and build on every success no matter how small. Evidentially the successes will overwhelm the mistakes creating a solid foundation for future endeavors.

The Six Ps: planning, project management, problem solving, presentation, patience and persistence were skills either transferred from industry or newly acquired. All were essential for success as an engineering educator. Each and every one played an important role in the transition process and are equally valuable today and surely will be in future years.

Quest for Tenure

The third year intensified the pursuit of tenure leading to new obligations and responsibilities. In addition, many of the tasks from the previous two years continued over into the third adding to the workload. Among the challenges were obtaining excellent ratings from the course evaluations submitted by the students at the end of each term, writing peer reviewed articles for conferences and publication, submitting grant proposals, participating in professional societies, and working on departmental and university committees.

Teaching is considered the primary activity for faculty members and carries the highest weight (65%) toward the tenure decision. As a result a great deal of effort is channeled each year into every aspect related to teaching courses. Lectures are updated to improve class discussions and understanding; laboratory exercises are restructured to provide the right emphasis; homework assignments are refreshed; and projects are rejuvenated to increase the application of the subject matter. All of this effort is aimed at increasing the students' comprehension of the material being studied. Regrettably this process creates a tremendous amount of work each year for the new engineering professor. However, the results have indicated better knowledge transfer to the students along with high scores on the student course evaluation forms making it all worthwhile.

Scholarly activity also plays an important role (25%) in the tenure decision. Faculty members are expected to conduct research of some type and publish papers. The sort of research varies greatly by faculty member with some aimed at scientific discovery while others are targeted at applied investigations. Interestingly no time is allocated during the academic term to conduct this research; it has to be done entirely on the professor's own time. This constraint strictly limits the

amount of research that can be accomplished and unfortunately actually discourages many faculty members from doing any research. However, to obtain tenure and promotion research must be conducted, published, and perhaps even presented. The area of applied research has led to a number of published papers either individually or jointly written over the past three years with more awaiting publication.

The final requirement for tenure is service (10%) to the department and university. This involves working on curriculum committees, accreditation committees, writing grant proposals, activity in professional societies, and basically anything else that needs attention. This is an extremely broad area that can easily become a enormous consumer of time and effort. Selection to the university's Course and Program Approval Committee (CPAC) along with election to the chairmanship offered campus wide exposure coupled with a huge workload. In addition department committee appointments included curriculum committees for the Computer Engineering Technology (CET), Software Engineering Technology (SET), and new Electrical Engineering (EE) programs; ABET accreditation committees for the CET, SET, and Mechanical Engineering Technology (MET) programs; along with the building committee preparing for a move into a new classroom, laboratory, and office facility. Three NSF grant proposals were written and one was funded. Finally, other functions included professional society activities and advising the student Engineering and Technology Club.

New faculty members are allowed six years before they must apply for tenure. However, this process can begin as early as the fourth year if all of the requirements have been substantially completed or more exactly exceeded. After a very busy first three years as an engineering professor all of the criteria for tenure and promotion were surpassed allowing for an early application. As a result, the process requesting tenure has begun.

Lessons Learned

Numerous lessons were learned during the first two years as the transition progressed from an engineering manager to an engineering professor. The vast majority of them were applied with great success during the third year. However, the learning process didn't stop there. It actually continued throughout the entire third year as well. In fact, every indicator points to that trend continuing as the years in engineering education pass by. That is as it should be; learning from experience is a valuable trait that everyone should embrace.

Perhaps the most valuable lesson is a recurring one, skills are transferable. Just because your training and experience are in one field doesn't mean they can't be applied to another. Performing a skills inventory will uncover many talents and abilities that could potentially be transferred to various related and even some unrelated fields. Successful career changes occur all the time and are driven by the skill set acquired and experience gained by the individual. Being an engineering professor is not that different from being an engineer or engineering manager, most of the skills are directly transferable.

Take advantage of your experience and bring it right into the classroom. Utilize real world projects to directly exhibit how theory has been applied in the past to solve problems or create new innovative products. Examples and applications add a new dimension to the classroom

experience, bringing theory to life. Incorporate it whenever and as often as possible to demonstrate the usefulness and applicability of the material being studied. Students are interested in how what they learn can be applied in their future. Share your engineering experiences.

Be flexible. Don't be afraid to try new things. Experiment with new teaching techniques to excite the students and enhance their learning experience. There is no such thing as failure, just approaches that don't work very well. Modify it and try again or move on to something else that is new and might work. Engineers have always experienced things that didn't quite go as planned leading to discoveries that usually do. It is a trial and error approach that works just as well in academia as it does in industry.

Effective management of your time is critical. Preparing for classes, committee work, and all types of unscheduled interruptions will consume the work day. Just trying to keep pace is difficult and often means staying at school late into the evening. Time management, however, is the key. Prepare a daily schedule that outlines when and what you plan to accomplish. Be specific and realistic in the time allocated for each task. Time for interruptions must be factored into the schedule as well. At first this will be a difficult task, but over time experience will better dictate the planning process.

Finally, the transition process isn't easy and doesn't occur overnight. It simply takes time and perhaps longer than planned. Judging from experience, three academic years seems about right. Don't get discouraged. Keep on track working toward that goal of becoming an engineering educator and eventually success will be yours.

Conclusions, Reflections and the Future

During the initial two years life as an engineering professor seemed chaotic lacking the rigor and routine imposed by industry. Rushing from preparing for class to committee meetings seemed relentless with no sign or hope of regularity. However, halfway through the third year some sense of normalcy and routine was recognized. This is when it became clear that the transition was indeed successful. The former engineer and engineering manager was now thriving and doing well as an engineering professor.

The transition process was full of revelations, trials, and tribulations. Armed with a toolkit full of skills and abilities first developed through engineering education and then expanded during industrial experience the engineering manager came well prepared. Whenever problems or unexpected events occurred the toolkit could be accessed for the solution or at least for something to try. It worked in many cases but new skills directly related to education needed to be learned. Once mastered and added to the toolkit the transition progressed smoothly.

Reflecting back on the past three years and entire transition process it was quite an exhilarating journey with many peaks and valleys. However, the good aspects far exceeded the bad. Working with bright students studying to become engineers became the highlight of every year. Watching them progress through the program, striving to meet their potential, and finally attaining their goal of graduation made all of the work involved with the transition process worthwhile. The

happiest and saddest day of the academic year for the new engineering educator was always graduation day as new engineers began their new journey into their new careers.

It is impossible to look into the future to see the challenges and opportunities that lay ahead, but the one thing to be certain of is surprise. Many new and amazing things will be developed in the coming years leading to astonishment. New technologies will enter the mainstream and need to be taught replacing many of today's established ones. Change will not only continue but accelerate as new ways are discovered to produce and utilize energy, eradicate pollution, and improve medical technology. New engineers will need to be educated and this new engineering professor hopes to be there for a long time facilitating the process.

Engineering and engineering management skills and experience have been found to be directly transferable from industry to academia. This should offer both hope and encouragement for those in the engineering profession to consider a similar career transition. For one new engineering professor it has truly been a satisfying and gratifying experience.

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