Counter Current - Perspectives from My Move to the Corporate World from Academia

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Dr. John C. Oliva has had a diverse career spanning the fields of academia and industry. John spent the first half of his career teaching mechanical engineering as a fulltime faculty member, first at Kettering University and later at Grand Valley State University. He then transitioned to the corporate world where he has spent the more recent half of his career as a professional engineer. John currently works as an engineering analyst at Hemlock Semiconductor Corporation. His primary focus in this role is computer based simulations of mechanical systems, using both finite element and computational fluid dynamics methods to design and optimize industrial equipment.

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Abstract

At this point in my career, I have spent half of my career in academia, and the latter half in industry. Having bridged this divide between the two worlds, I believe that my perspectives can be beneficial to both sides of the matter, bringing attention to ways in which collaborative partnerships between industry and academia can be enhanced. In this paper I address several classifications of topics related to the general theme of my transition from academia to the corporate world. I share an insider's perspective that I have within my current workplace regarding the academic world. Conversely, I reflect on the opposite perspectives that I recall from my academic days, and the extent to which those beliefs have been disproven or fortified since I walked away from the classroom. Finally, I address the opportunities and challenges that exist to build collaborative efforts between professionals working in both academic and industrial settings. The nature of this paper is to share anecdotal evidence as gathered through my own experiences. If nothing else, I strive to share the lessons that I have learned, while prompting thought, discussion, and perhaps even collaborative opportunities between the world that I currently work in, and the world that I left behind.

Introduction

A milestone in my career has just been surpassed that serves as a halfway demarcation. I have officially spent half of my career in academia, and half in industry, with the latter now gaining ground. This is unusual in and of itself. During my career, I have met many people that have transitioned from the corporate world to the university setting, but the number going in the opposite direction seems to be quite smaller. My own observations are consistent with the findings of Cox et al in their research that looked at the career paths of a population of engineering PhD's. They too found that the career path leading from academia to industry is followed by only a small minority of professionals.[1 2] Having bridged this divide between the two worlds, my perspectives can be beneficial to both sides of the matter, bringing attention to ways in which collaborative partnerships and relationships in general between industry and academia can be enhanced.

In this paper my goal will be to share viewpoints from both sides of the fence that I have witnessed while working in the respective environments. I will discuss issues specific to co-op programs, internships, and mentoring initiatives, and highlight some deficiencies in university-

industry collaborations. I will also take this opportunity to voice my concerns regarding the educational state of my own field of specialization, computer-aided engineering.

From the onset, I want to make it clear that the evidence cited within this paper is merely based on my own experiences and should be considered anecdotal at best. I am very cognizant that experiences and viewpoints outside of the small sampling of work settings that I have been in could lead to vastly different conclusions. With that being said though, I also want to caution against devaluing the experiences I have had as being without merit. One man's observations are still able to provide some insight, which is what I hope to share here.

Biographical Background

I spent the first half of my career teaching in academic institutions that focus on undergraduate education. This was first at Kettering University in Flint, Michigan as a mechanical engineering lecturer, and later I accepted a visiting professor of engineering appointment at Grand Valley State University in Grand Rapids, Michigan. Although this transition was from a small private college to a large public university, their two engineering schools have a lot of common ground. Both are primarily undergraduate institutions, offering master's programs, but no doctoral degrees. Greater emphasis is given to teaching rather than to research. Each also emphasizes practical experience, with mandatory co-op job placements woven through the curriculum in a "one academic semester, one work semester" fashion. In both of these roles I taught many computer aided design and computer aided engineering courses (CAD/CAE), but thrown into the mix were also classes in engineering graphics, design, solid mechanics, machine design, and the like. By the time I left GVSU, I had become a permanent tenure track faculty member. Perceiving that an industrial job might offer me a better work-life balance, I sought out a job away from academia. This was also motivated by a sense that my growth potential in a university setting was restricted due to my lack of "real world" experience. At the time, I was unsure whether this was going to be a permanent transition away from academia, or just a trial period. I was open to letting the path forward evolve as I went along.

My first leap to the corporate world was when I took a position at L3 – Combat Propulsion Systems in Muskegon, Michigan. Admittedly, I had difficulty getting any companies to show an interest in me. I had to apply to a lot of different jobs (approximately 30) before being offered this position. L3-CPS is a defense contractor that manufacturers a variety of systems for land based military vehicles. While working there, I managed their mechanical CAD group. After only a short time with them, I accepted a different job at the National Superconducting Cyclotron Laboratory in East Lansing, Michigan. There I was the team leader for the mechanical design department's Analysis & Simulation group. NSCL is a nuclear physics research facility that produces continuous beams of rare isotopes used in experiments conducted by researchers that come from around the world to use the facility. After serving in that role for a bit over four

years, my most recent job change emerged which brought me to Hemlock Semiconductor Corporation in Hemlock, Michigan. HSC is a manufacturer of high purity polycrystalline polysilicon that is used in semiconductor (computer chip) and solar panel applications. HSC hired me as an engineering analyst, in a non-managerial role. My work focuses on mechanical simulations using finite element and computational fluid dynamics techniques to analyze our production equipment. I am also involved with some design and optimization activities.

Observed Perspectives

One of the first things that I noticed when transitioning from an academic role to that of a practicing engineer was the "us versus them" mentality. This is said not necessarily in a negative sense, but so far as that individuals tend to self-identify with one group or the other, and they have developed strong opinions about those from the other side. In this regard, I had not just changed jobs when I first went to L3-CPS; it was more like I was switching teams. Similar sentiments have been echoed in the 2013 Workshop Report from ASEE's series on Transforming Undergraduate Education in Engineering.[3]

On the positive side of this matter, there is a lot of mutual respect going in both directions. Many times, when I worked for a university, we looked toward the professional engineers to provide guidance in how the engineering profession was being put into practice. In our modern world, things change fast, and this is even more relevant in technical fields like engineering. For professors that had left the corporate world 10 or more years earlier, they were quite cognizant that things had changed since they took up teaching, and current professional engineers could provide insight into the modern approaches used in practice. Industry advisory boards, employer surveys, and consulting subject matter experts are a few examples of this type of information sharing.

In this same vein, during my days in industry, I have found that many practicing engineers look to academia as early adopters of the latest and greatest methodologies and technologies. Many engineers view the academics with a sense that they are the ones doing truly advanced research that is out of the grasp of the more practically minded industry engineers. For many, the primary exposure to professors, or PhD's in general was during their own schooling, and as a result of this, they still look up to university faculty with an aura of respect.

Of course, there is a dark side to this stereotyping as well. When I worked in academia, I would pick up on attitudes that the faculty tended to believe that they were superior to those engineers that worked outside of scholarly endeavors. A common consensus was that corporate engineers tended to be sloppy in their work, cutting corners or using quick fix methods to arrive at less than perfect solutions as fast as possible. In this manner, engineers in industry were cast as greedy hacks that did not appreciate the principles of engineering enough to attend graduate school.

Likewise, there are those in industry that perhaps had a negative experience with a professor back during their college days, and this has tainted their view of academia permanently. To these individuals, the adage of "those who can't, teach" rings true. These engineers look at their own college experience in large part as a series of hoops they had to jump through to earn a piece of paper. To them, the absent minded professors that spend their lives dwelling on abstract mathematics have nothing to offer the practical problems of industry. Others have also noted a negative view towards engineering PhD's preparedness for the professional workplace.[2]

As is usually the case, stereotypes have a way of exaggerating reality, and the fact is that the two populations are probably closer together along the spectrum than most think. From my perspective, there are advantages to each field, and opportunities exist to form mutually beneficial relationships between the professions. However, like the middle school dance where the boys are lined up against one wall of the gym and the girls are lined up against the opposite wall, coaxing opportunities to meet out in the middle of the dance floor between industry and academia is not often comfortable or easy.

Co-Op Programs, Internships, and Mentoring

As mentioned in the introduction of this paper, both universities that I taught at, Kettering University and Grand Valley State University, have strong co-op programs in their respective engineering schools. Although some of the details between the two programs vary, the basic framework is similar. In each, the students are required to work at an engineering job for a set number of hours as part of their degree requirements. The student's schedules are staggered such that they attend one semester of classes, then go to their co-op job for a semester, and so on until graduation. As a teaching faculty member, I did not have much direct interaction with the co-op program myself aside from very occasionally meeting with some employers during their campus visits, and hearing stories from the students about their different job placements.

Once I left academia and began working as an engineer, I began to have more involvement with co-op programs as an employer. When I was in a management position at the National Superconducting Cyclotron Laboratory, I had the luxury of building my own team from the ground up, and this included hiring many co-ops through the years. In my current position, we also have a fair number of co-op students and interns, although they do not report to me.

A perspective that I have developed from both sides of the fence - academic and industry - regarding student workers is in regards to expectation setting. It has been my experience that students have unrealistically high expectations when it comes to the work assignments that they think they should be getting during their co-op experiences. The reality is that student workers are often viewed as a source of cheap labor, capable of doing repetitive tasks that the fulltime professional engineers would rather not do. Part of this is also a matter of practicality though. For the co-op's manager, more elaborate work tasks also mean that the student will need a lot

more instruction and time commitment to progress in the right direction. Mundane tasks like updating engineering drawings, or tedious spreadsheet work can be taught quickly, and then keep the student employee occupied for large blocks of time. It would benefit students to be taught this reality during their co-op preparation courses more thoroughly. Granted, some employers take this to extremes. I recall hearing stories from students being assigned to sweeping floors and scrubbing equipment for twelve weeks. There is a line between paying one's dues and being exploited. Moreover, because there are few jobs that are purely technical engineering one hundred percent of the time, students should understand that part of their co-op position will be routine non-engineering overhead that goes along with any job. Attending department meetings, submitting effort reports, taking safety training; these are all parts of a normal engineer's everyday life, and as such, should be part of every engineering internship too. It is not glamorous, but it is reality.

Of course, both sides are in need of some realistic expectation setting. While observing how my coworkers have utilized student workers, it is clear that they could use better training in terms of how to reach a good balance between providing a meaningful learning experience for the student while also getting some needed work done. This point was made clear to me when one of my co-op students wound up getting transferred to a different team within our department. I had found that the student was quite capable and proficient when she worked for me. But when transferred to the new group, her manager said to me "The co-op cannot do very much without being told exactly what to do". I had viewed the co-op as a student, and would take the opportunity to teach her how to complete a task, and then assign her other similar duties that built upon those basic skills. My colleague viewed her as a degreed engineer, and then became frustrated when she lacked the skills that came along with completion of a degree. This difference in perspective resulted in a completely different evaluation of her job performance. Here too, both sides could benefit with a bit of guidance for the managers of student workers as to what students should be expected to do, and how much employers can expect from the students.

Going hand-in-hand with expectation setting is a need to caution against broad generalizations. In this sense, my observations have been that mentors at co-op employers are too quick to make generalizing statements, and students are all too willing to believe them. When I was teaching, I would hear students come back from their work semester with sentiments such as "My boss told me that it is a waste of time to get a master's degree…nobody in the real world cares about a graduate degree." Or, similarly "This guy I work with, he says that he never uses any math as an engineer, and they just make us take all of those math classes to weed the weaker students out of the career." In both of these instances, and many more like them, there is no doubt that the mentor was relaying what they believed was factual information. However, I have seen enough different companies to know that one cannot make such simplifying blanket statements. Is it true that some employers do not value advanced degrees? Absolutely. I have met people working in industry as "engineers" with only a high school diploma, yet they are on equal footing in their

companies as their degreed coworkers. Likewise, I have seen companies that will not look at a candidate for a certain position unless they at least have a PhD in a given field. So, the opposite is also true. The same goes for math usage, writing requirements, dress code, work hours, or any other measure that may get tossed out in a broad sweeping statement in the interest of providing advice. The bottom line is to stress to students that their co-op placement is only one look at the working world, and to emphasize to employers not to assume that the entire world operates exactly as it does within their fence line.

In terms of faculty co-op arrangements, I only have a single experience to share, but that may be a result of its unsuccessful outcome. At one point, I worked to get a faculty co-op position approved on my engineering team. The concept was that we would bring in a professor during his or her non-teaching term (most likely during the summer), and we would have them work side-by-side with our regular engineers on whatever projects we were already working on. We viewed this as a high-end version of a student co-op. Presumably, the faculty member would be able to hit the ground running regarding many of the tasks we were working on. There would be opportunities for the faculty member to learn how we did things in our organization, and they could recognize and suggest improvements to the ways that we were doing things. In addition to the work experience that the faculty member would acquire through this co-op, providing them with real-world accounts to take back to their classroom, we also offered a stipend intended to cover living expenses for the few months that we expected the position to last. We went ahead and posted the job, and circulated it through our local ASEE chapter. In the end, we had only a single applicant, and that candidate's background was a poor fit for the projects we were working on. His areas of specialization and teaching / research interests were completely outside of any of the type of work that we were involved with. The position went unfilled, and we did not attempt such a faculty co-op again.

In hindsight, I am not sure what went wrong with the faculty co-op experiment. Perhaps it was merely a marketing deficiency and we did not do a good job of advertising the position. Maybe we insulted potential candidates with the admittedly modest stipend that was offered. Or, it is possible that we overestimated the appetite for faculty's willingness to participate in such an activity during a time period that already becomes a catch all for so many other responsibilities.

University-Industry Collaboration

The engineering literature has no shortage for suggestions of ways that industry and academia can collaborate. Common outlets for such collaborative efforts include senior design projects, the already mentioned co-op job placements, mentoring opportunities, joint research endeavors, and guest lecturing. [3 4 5] My experience has been that initiation of the relationship is often a critical barrier. Furthermore, when it comes to university-industry collaboration, there are many willing participants, but another hurdle is a lack of communication. The connections that do

exist between corporate world and university will often form at a manager level; say for example between an engineering dean at a university and an engineering manager at a company. Or, perhaps the connection is made from a single engineer to a single professor. In either case, the vast majority of engineers and faculty that might be interested in pursuing some avenue of collaboration do not have an easily accessible mechanism for doing so. Rojas-Oviedo et al point out that interaction on all levels should be encouraged to promote relationships that are consistent and sustainable.[5] What follows is a short list of opportunities that could benefit engineers, faculty, students, and the engineering profession as a whole.

- Opportunities for Professional Engineers – In the rare occasion where a request is made to have an engineer volunteer in some capacity, my coworkers appear to jump at the chance. For example, I recently met a young engineering student that had expressed some interest in coming to visit my current employer for a day in a casual job shadowing experience. When I asked around to see if anybody would be interested in hosting this student, there were many volunteers. This indicates to me that the interest exists, but it is not often that such requestors come knocking on our door. A job shadowing experience like this would be just one option. Others might include having professional engineers volunteer to do mock interviews with students, guest lecturing a class on a topic of particular expertise, or to meet with the student chapter of a professional society for a question and answer session. The possibilities seem endless, but again, opening the lines of communication may be the difficult part. Admittedly, companies often intentionally keep their employee lists confidential. It is unusual for a business to have their employee directory online like a school would have. Universities could tap into professional societies to make the needed connections, or maybe make greater use of alumni networking avenues. I personally get contacted by my alma maters (all of them!) several times per year seeking donations. However, I have never been asked to volunteer my time with current students currently attending those institutions in any capacity.

- Opportunities for Faculty – Going in the other direction, there are likely just as many potential opportunities for university faculty members to become involved with local industry if the lines of communication were opened, and if both sides were made aware of mutual interests. I have already discussed my own attempts at a small scale faculty co-op program. With better publicity, this could be more successful. Similarly, most companies could benefit from a faculty member coming on site to conduct training for the organization's engineers in a particular topic area, or by offering some other form of consultation work. Here too, I recall from my own academic days being interested in getting involved with any number of these activities, but not being presented with many openings to get started. An untapped networking opportunity here might come in the way of recent graduate hires that have maintained contact with some of their professors from their alma mater.

- Institutional Opportunities – As mentioned above, most colleges already have some type of relationship with companies in their geographic region. However, the extent to which these connections are utilized may be limited. By expanding on the types of collaborative activities that are pursued between the two institutions, the bonds can grow stronger, and cooperation can feed upon itself. Expanding on already existing relationships is thus perhaps the easiest road toward introducing new university-industry collaboration initiatives of the sort discussed above.

Computer Aided Engineering

During the biographical background provided in the beginning of this paper, I highlighted that my experience in the academic world and the world of industry have both had a heavy portion of CAD/CAE applications. As a professional CAE analyst, I would be remiss if I did not focus my attention on this particular field even if only briefly.

When I was a fulltime faculty member, I did my part to integrate computational methods like finite element modeling or rigid body dynamic simulations into the undergraduate curriculum.[6] [7] [8] Through those efforts, the resistance that many traditionalist faculty have against bringing such tools into the classroom for fear of dumbing down the coursework was evident, and they feared making it too easy to arrive at engineering answers without the rigor of analytical approaches. It then comes as no surprise to me that many of the young engineering hires that I see come out of college yet today do so with little or no experience using the commercial engineering tools that are in such wide use across engineering disciplines. This lack of preparation to me seems irresponsible.

Unlike the unfounded broad generalizations warned against earlier in this paper, it is arguable that few systems or processes are built today without being touched by some form of computer simulation. Because graduates are not taught even the basics of using commercial engineering applications during their schooling, they are forced to learn the tools on their own on the job. By not teaching these tools as part of the undergraduate engineering curriculum, university professors are missing an opportunity to formally instruct students on how to use the tools effectively and with proper engineering judgment. Unfortunately, all too often when CAE topics are addressed in the classroom, practical elements are stripped away to focus on the mathematics that go on "behind the screen". As far as many employers are concerned, this teaching approach has as much benefit as if the entire topic were ignored all together. In order to properly prepare engineers for the jobs that they will be working in today, they need to be taught how to use the engineering programs that industries most commonly use. Doing otherwise is an exercise in preparing graduates for the jobs of yesterday. As noted by the Transforming Undergraduate Education in Engineering committee, the responsibility to instruct young engineers in modern engineering tools is shared by both industry and academia[3].

Conclusions

In this paper I have attempted to share some of the perspectives I have acquired on college-industry relations through spending the first half of my career in academia, and the latter half in the corporate world. Hopefully this has not only provided food for thought, but I also expect to begin a conversation regarding how to build better relationships between universities and companies by opening communication between faculty and engineers.

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