Evolving as an Empowered Learner

Advance Personalized Learning

Asa Eckert-Erdheim
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Introduction

Had you asked me why I was attending college when I first came to Olin, I likely would have answered, "Because I want to be an engineer." Taken at face value, this would seem a reasonable answer, but my inability to better justify such an important decision just highlights my perspective at the time that college was simply a necessary step in a path to do the kind of work I thought I was interested in. Doing things because I thought it was expected of me fairly well characterized my first few semesters at Olin, be it the classes I took or the activities I engaged in.

After having spent 4 years at Olin, my perspective on my education has changed radically. Rather than trying to meet external pressure, I aim to do things because they interest me. This has enabled me to explore a much broader range of topics and draw connections between a variety of fields which I otherwise would not have been exposed to. Ultimately, choosing to tailor my educational experience has led to me being far more engaged in my learning and developing significantly as a learner. Given the impact of this on me while at Olin and how I expect it to impact me after Olin, I chose to focus my GCSP portfolio on Personalized Learning.

A Major Conundrum

While at Olin, I have had exposure to a range of "entrepreneurial experiences" through a number of classes I have taken. In all of these though, a key element was missing: risk. Such a large part of entrepreneurship is about accepting risk given the potential for reward and all of these class experiences happened in a safe, risk-free environment. Thinking about what part of my education has had the most genuine risk, I immediately think of my decision to choose an general engineering major with a concentration (E:___) rather than a predefined major (ME or ECE).

As a brief background to my major decision, I came to Olin thinking I would be a Mechanical Engineer because all of my experience prior to Olin was in building all types of things, be it LEGOs, houses or theater sets. Unsurprisingly, of all the first semester courses, I most enjoyed the mechanical design elements of Design Nature, a bioinspired design class. More surprisingly, I enjoyed a number of the other classes, especially the programming elements of Modeling and Simulation and Modeling and Control. I was still resolute though - I was going to be a Mechanical Engineer. As I took more classes, my interest in Mechanical Engineering remained, but my interest in other topics continued to grow.

When it came time to declare a major, I declared Mechanical Engineering as it was the easiest and safest thing to do with regards to post graduate plans. Moving forward, my interests continued on a similar trajectory: mechanical first with a sizable chunk of other stuff. Eventually, at the start of the spring semester sophomore year, I started to consider switching majors to E:___. Although this may seem like a fairly easy thing to do, it was a leap for me. Not only was mechanical engineering what I had wanted to do for a long time, but I was considering changing to one of Olin's "weird" majors that no one really understood. This was a major concern for me. Especially at that point, I was not at all confident about my

ability to present myself to others for jobs and internships. With a recognizable degree, I at least had something to fall back on. People know what a mechanical engineer does. By thinking about switching majors, I was effectively choosing to subject myself to a lot more worry with how to describe who I am as an engineer to potential employers.

To make matters worse, my top choice major at the time was E:Systems, a major even I didn't fully understand. In talking with a number of faculty at Olin, my concerns were upheld. Most people I spoke with suggested staying a Mechanical Engineer because everyone knew what it meant. This left me in quite the quandary: choose my major to be something that other people would recognize or choose my major to allow me more freedom to learn the topics I was most passionate about. I was particularly interested in taking more classes in software and robotics. Although there was some room within the ME degree to take other classes, it was relatively limited and I wanted to leave room for new courses being taught as well. This internal debate raged for over a semester with me changing my mind at least twice daily.

Ultimately, I chose to major in Engineering with a Robotics Concentration. For me, this was one of my first real opportunities to do something because I was passionate about it rather than do something based on perceived external pressure. Even more importantly, this was a big risk for my prospects after Olin. Thinking about this experience from the frame of risk taking, it is an application of entrepreneurial thinking applied to my own learning. Much more so than starting a business, entrepreneurship is about accepting risk given the potential for reward. Applied to my own education and major decision, this meant recognizing that although going with a less recognizable major might have implications on my job prospects, it also enabled me to much more effectively tailor my education and develop into the engineer I wanted to be rather than the engineer I thought I was expected to be.

Sustaining my Personalized Learning

Once I had made the decision to go with E: Robotics, a whole new world opened up to me. A world of experiences with no direct impact to my future plans but a huge impact to my own learning and passions. Perhaps the most impactful of these experiences was choosing to be one of the first students to enroll in the Babson - Olin - Wellesley Sustainability Certificate Program. This program requires a total of 6 classes: an introduction class, 4 elective classes (at least one at all three colleges), and a synthesis class. Although I am not interested in pursuing a career directly related to sustainability, I chose to participate in this program as a way of exploring a field that interested me.

A major driving factor behind choosing to participate in this program was the interdisciplinary aspect of it. Particularly interesting to me were the Introduction and Synthesis classes which are co-taught by professors from all three colleges and co-enrolled with students from all three schools. I was hoping that these courses would help me better communicate my ideas to audiences beyond just engineers. While these courses did help me develop my communication skills, the main takeaway was just how critical interdisciplinary collaboration is and how difficult it is. This lesson came not from interacting with the students, but in how the course was taught by the professors. Each professor

brought their own expertise and experience from teaching other classes and other disciplines. The end result was at times an incoherent mess of instruction that each individual professor thought aligned with the other professors but oftentimes was in opposition.

Although this led to the classes not being as effective as I would have liked, it did help me to reach a point of feeling comfortable challenging professors. Being in a class with a single professor, their word can oftentimes seem to be as sacrosanct. Being in a class where the professors disagreed with each other for most of the course helped me fully recognize that professors, while more experienced, are as fallible as anyone else. This was further encouraged by professors I had in other classes who very explicitly stated that they did not always have the answers and were open to conversation regarding the material and class structure. This manifested itself most clearly in the Sustainability Synthesis when my perspective on the course differed significantly from that of the professors. The course was structured as being a consulting experience with an outside group. For me, this meant we should have flexibility on the type of deliverables we created so that we could tailor them to be most useful to the clients. The professors disagreed and were insisting that each team create all of the same things and do all of the same activities even though it did not always make sense in the context we were working in. Midway through the course, I talked with a few other students and the professors about having a feedback session for the course. We were given the opportunity to do course feedback, but it was through a survey and seemed to have little impact on the course. After efforts to get the professors to dedicate class time to feedback, I spoke with all the students in the class and ended up holding an impromptu course feedback session during one of the course meetings. This self-organized session helped significantly over the survey based feedback session the professors created. By recognizing that the professors did not always hold the answers, I reached a point where even though the professors did not believe more feedback was necessary, I felt comfortable pushing for something that I thought would dramatically improve my experience in that course. This has continued to influence my experience in other classes in my preference to be much more vocal about my feelings on courses when I think they could be better rather than simply suffering through them.

The Collaboratory

As I spent more time at Olin, I realized how different the Olin experience was from high school and how beneficial it had been for me to grow as a student, engineer, and individual. Given how much Olin had given me, I wanted to give something back to Olin. A major part of this was getting more involved in curricular improvement efforts at Olin and beyond Olin. Within Olin, I've worked on range of topics, including course improvements, faculty orientation, and faculty searches. Outside of Olin, I have been a student liaison for the Collaboratory (formerly I2E2) for a number of years. The Collaboratory is the umbrella organization for Olin's outreach to other groups, including K-12 teachers interested in improving their schools and courses, college/ university professors and administrators, business leaders, and organizations with an investment in education.

Part of being a student liaison is being a face and voice for Olin to increase awareness of what Olin is trying to accomplish. More than that, it is about helping change education around the world. Even if Olin's name is not attached to it, if more people take lessons they learn here back to their countries and organizations, education and those being educated will hopefully improve around the world. One of the most rewarding experiences I've had as a liaison was working with a group from Insper in Brazil. Insper is a well-known business school that is interested in developing their own engineering program. Unlike most visitors, the visitors from Insper were here for multiple weeks, meaning I had the chance to see how their understanding evolved over time. When they first pitched their course ideas, many of them were still firmly rooted in the basis of education being about learning content. Students and faculty, myself included, worked with them over the course of multiple weeks to help them broaden their perspectives and think about how to apply Olin concepts to their unique situation. At the end of their time at Olin, they pitched their ideas again. This time, much more consideration had been paid to how students learn, not just what they learn. Furthermore, I was able to see how some of the suggestions I had for them had been worked into classes that will hopefully be taught to new students in the coming years.

Tying these experiences back to personalized learning, I have also found that working for the Collaboratory has helped me develop my own understanding of my education. When I first became a student liaison, I saw it entirely as an opportunity to help Olin's mission of spreading the lessons learned here. In answering visitors' questions, however, I found that I was being pushed to reflect upon my own experiences. The clearest example of this is recognizing the role failure had taken in my education experiences. Until giving tours, I had never fully appreciated the value of having an environment that was supportive of failure. In speaking with visitors about experiences I had on projects, I realized that many of the formative experiences I was describing had involved some form of failure and the process of understanding and recovering from that failure. By recognizing this, it allowed me to better reflect on previous experiences and also embrace failure in future projects I worked on.

Olin Robotics and Bioinspiration (ORB) Lab Research

In the fall of my sophomore year, I took Principles of Engineering with Aaron Hoover. Following up with this, I joined his research lab (the Olin Robotics and Bioinspiration Lab) in the spring semester and have been doing research with him ever since. At the time of joining the lab, I was looking for a way to get engaged in longer term projects. Course projects, while fun, were often cut off after a single functional prototype and I was interested in being more meaningfully involved with my work. As time went on though, choosing to join the ORB Lab became one of my best decisions I made at Olin.

In the spring semester, I worked with Shivam Desai, a member of my Principles of Engineering team, on a small project studying shape memory alloys and their integration with small robots. I then worked with Shivam for a summer, fall, and spring semester on an optical force sensor. The purpose of the force sensor was to allow for measurement of ground reaction forces from small legged things (animals or robots). When working at small

scale, it is often impractical or impossible to add sensors directly to the measurement target, making it necessary to create external sensors. Our sensor allowed us to easily measure multiple ground reaction forces and combine our data with kinematic state data from a motion capture system to more completely characterize the legged robots we use in the lab. My current work, starting in the fall semester of my senior year, is individual work redesigning dynaRoACH, a small hexapod robot that we use extensively in the lab (that was the target for measuring forces from). In its original design state, dynaRoACH is a very capable, robust robot that was able to run 16 bodylengths/s (~1.6 m/s) using a single actuator. Small, inexpensive robots such as dynaRoACH have a wide range of applications including search and rescue, environmental monitoring, and biologic studies. However, there is a variety of performance and manufacturing issues with dynaRoACH that need to be resolved before it can be more widely used. My work has thus far involved tackling these problems. As of writing this, I am on my fifth major design revision and have made a wide range of other small changes to improve the design.

At the end of my work on the optical force sensor, I submitted a research paper that was accepted to the International Conference on Intelligent Robots and Systems (IRoS) in Tokyo, Japan. In November 2013, I travelled to Japan with Shivam and Aaron to present our work. Being in Tokyo and interacting with so many engineers from Japan and the rest of the world helped me learn a lot about the engineering culture around the world. I saw just how different everything was from Olin - at times, people would focus on technical minutia rather than presenting any broad context. This seemed particularly prevalent in the talks from many East Asian presenters where they would spend almost all of their time presenting the mathematical background and very little actually discussing their work. This was similar for some American and European presenters, but there was generally more focus on the work itself, not the background. This directly influenced my desire to find engineering positions in Europe. I had been interested for a while with the idea of working abroad for a few years - both my parents were involved in the Peace Corps and seemed to get a lot out of it. Working abroad seems like a much better way to learn about different people and cultures than visiting as a tourist. The experiences I had in Tokyo, both at the conference and in the city, were some of the most transformative Global Awareness experiences I had while at Olin.

Beyond the conference, simply working in the ORB lab was a very different experience than I had ever had at Olin. I had a lot of freedom to pick the projects I worked on and the type of work I did. For example, when working on the force sensor, I did most of the software systems and Shivam did most of the mechanical design even though our expertise was the reverse of the work we did. We weren't constrained by needing to churn out a project in a semester, so we had a lot more flexibility. Being able to work on a project over such an extended period was also very different. Besides SCOPE, no classes support multi-semester projects. Oftentimes, this means that the entire semester is spent pushing for the final deliverable and very little time is allotted to thinking about processes. In research, in part due to the timeframe and in part due to the lab structure, we were always thinking about how we were working and trying to improve everything. Lastly, having long-term projects allowed us to push our work much farther. Class projects often aim to get

something to work once; research is trying to build a system that can be used in the lab for many years to come.

Prior to my work in the ORB lab, I saw myself as definitely going into industry after Olin. Learning more about the research community, I became much more interested in research positions, either in industry or academia. Eventually, I decided to not to go to graduate school right away so I could get experience on a wide range of topics before choosing what I wanted to focus on. However, I realized that I did want to find a research position. Based on these criteria, I found a position with the Mobile Robotics Group at the University of Oxford and will be working there after graduation.

Conclusion

In coming to Olin, I was mostly hoping to get a great technical engineering education. Four years later, I have gotten much more than that. I've learned the human elements of engineering that are often missing and can design with the end user in mind rather than just designing to set of specifications. I've learned to tackle boundless problems with little fear of failure. I've overcome a nervousness of public speaking and become comfortable presenting my work through giving presentations in courses, in Tokyo, and during tours. All of these indicate a success in Olin's curriculum, but there has been much more to my experience here than the sum total of prescribed experiences. I have learned to create a learning experience that benefits me best. This has enabled me to better learn to be an engineer in the full sense of the word and, perhaps more importantly, rejuvenated my love for learning. Leaving Olin, I won't be satisfied with simply finding a place to work but instead hope to be somewhere that will support me continuing to grow as an engineer and learner.