

A Focus on Helping People

Grand Challenge Scholars Program Portfolio

Engineer Better Medicines

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When colleges started sending me brochures in the mail as a sophomore in high school, I wanted to make sure I chose a major that would empower me to help people in new ways. I considered going into medicine or being a political activist, but wasn't really sure if those ambitions would lead me on a satisfying path. When Olin College sent me a brochure, their main message was that engineering was a great way to help people and make a difference in the world. This concept, along with the idea that engineering was a real challenge, made me choose to pursue engineering and to attend Olin College.

When I got to Olin as a first year, I had a really tough time. I was learning a lot of new things and working very hard, but I didn't immediately see how those things were applicable to helping people. I found that I had an aptitude and a love for electrical and computer engineering, but it bothered me that I couldn't think of how building circuits could ultimately help people in substantial ways. When I took a semester off to be an engineer for six months and explore the real world, I found that although my job was not directly helping people, I could make myself happy by being a weekly volunteer at six different places. While that was very enjoyable and engineering gave me the stability to take risks in my volunteer work, when I returned to Olin I asked myself again, "How can I use my engineering skills to help people and make a difference?"

Over the course of my junior and senior year, I searched harder for opportunities to use electrical and computer engineering to make a difference and took on projects that helped lead me to my goal. When I heard about an idea that came out of an Olin design class that I felt could help a lot of people and needed my engineering skills to become a real product, I jumped on it. When a professor mentioned she needed a student to help students with electrical and computer engineering in a new energy class with a focus on designing for the developing world, I jumped on that. From that interaction, I also began to do research with that professor, designing controls for microgrids that would bring renewable energy to hospitals in Uganda. When one of the senior capstone projects at Olin was focused on designing medical devices and needed an electrical engineering student on the team, I made my preferences known and got on that team. By seizing these opportunities and making the most of them, I have gained a much clearer view of how I can use my engineering skills to make a difference, and learned a lot about how to do that effectively. As I move forward and dedicate myself full-time to starting a company based on that idea from an Olin design class, I will use the lessons from my experiences in engineering as well as my motivation to use engineering to help others to help me succeed.

Entrepreneurship: Drawing on Others' Expertise

My first entrepreneurial engineering experience, building a stationary bicycle connected to Google street view for a class project with the intent of potentially marketing it, was a failure in that the project

took too long, was very frustrating, and ultimately led me to move on before I even started the market validation phase. The main reason for this frustration was that my comfort with the electrical and computer-hardware interface aspects of the project led me to take on the mechanical design, an area I wasn't comfortable with. This could have been a good experience, but I didn't ask for help soon enough or frequently enough to do good mechanical design, which made the project look much less professional. As I realized I needed to ask for help in the area I didn't have expertise, the project went faster and worked better, but it was too late to make a polished final demo. From this experience, I learned that your network is the most important part of a complex project because depth in a particular area will not be useful for the entirety of the project. Applying your work style when you are experienced in an area to an area you are less experienced in will take much more time than asking someone else to help you do it better the first time.

In my current venture, where I am taking another idea from a class and trying to create a business around it, I am doing a much better job of asking for help early and often. In both areas of the project I feel comfortable with and areas I have little experience with, I am asking questions of faculty members I know who have relevant expertise, as well as students who have tried to do similar things. As I ask for help, I am learning how to ask the right people the right questions so that I get the information I need and can move forward.

Grand Challenge Project: Effective Decision-Making when Designing New Tools for Medicine

For the duration of my senior year, I have worked on a consulting project for Boston Scientific as part of Olin College's SCOPE program, with a focus on designing better tools for medicine (a subset of the grand challenge of engineering better medicines). We were tasked with designing new tools for identifying, navigating to, or diagnosing lung cancer. Through a several-month process of user-oriented design and market research, we decided to create a tool that gives a physician confidence that they are in the right place in the lungs before they take a biopsy sample for cancer analysis. Going from a broad problem space to a specific solution was a very complex process, involving creativity in determining possible solution spaces, then tough decisions when trying to narrow and choose a direction. Because we had little experience with this kind of decision-making, most of our early decisions were fairly hasty, choosing the first good idea that came up. The points at which we made these narrowing decisions were determined by when we felt like it was time to move on rather than by any solid metric. Several months into the project, one of my teammates raised the concern that our decisions felt too hasty and didn't take all options into consideration. Based on that comment, we created a decision-making process that took all possibilities into account, which was more effective than before but still lacked a clear determination of when it was time to make a narrowing decision. Towards the end of the project, we had a difficult and important decision to make, and based on conversations I had with another team I decided to try a quantitative decision matrix method that defined which information we needed, then used that information to determine which solution was best. This method allowed us to know when was the right time to make a decision (when we had all the information we needed) and guided us to make a decision using all the possible options. Because of the success of this method, we used a similarly quantitative

method to set ourselves up so that we would know when the whole project was complete by defining all the possible requirements, then narrowing to a set of the most important ones. We agreed that when the most important requirements were met, the design project would be over and we could pass it on to others. Through this process of hasty decision making then trying new processes, I learned that knowing when something is finished is all about knowing which goals are most important. However, in order to find out what goals are most important, you must first think of all the goals then select down. Otherwise, you'll be limited by what first comes to mind.

Interdisciplinary Experience: The Importance of Documentation

Although I have taken many interdisciplinary courses at Olin, combining math, science, engineering, and design to create hands-on systems projects, the culmination of my interdisciplinary experience has been my grand challenge project in the SCOPE program. I've used knowledge in biology, human behavior, engineering, and business to design in a space where constraints are complex and interdependent. Designing in any one of those areas alone would not yield a viable product design, and throughout the design process I needed to make sure none of those areas were neglected. Early on in the project, we documented the biology and human behavior information we learned very well, synthesizing that information into a research report for later reference. However, we did not document engineering or business information very well, especially because as we narrowed our problem space, much of the engineering and business information did not seem relevant anymore. Later in the project, again and again, we came back to ideas that drew upon similar engineering ideas or business ideas to those we had discussed before, but we had to rely on people's memories rather than documentation, which slowed us down. In contrast, we were able to refer back to biology and human behavior information quickly, which meant we didn't have to ask questions again that had already been answered and could work more efficiently. Through this process, I learned that documenting things, even if they don't seem important or relevant, can be important because of the nonlinearity of the design process. It can be tempting to leave old work behind as you change direction and move past it, but in all likelihood it will be relevant again sometime in the future during another phase of design.

Global Experience: More Effective Communication through Iteration

During my 6-month break from college, I lived with a woman who managed several farmers from Laos. She was often burned out after working long days in a stressful work environment. She said she was very frustrated for a long time because she would ask her employees "Do you understand?" and they would say "Yes," but wouldn't actually get the message she was trying to get across. She would always try communicating in the same way, and didn't understand why the message wasn't getting across. One day I was invited to a gathering at the house of one of the farmers she managed. They were roasting a goat in the kitchen, all the dishes they brought out for dinner were foreign to me, and the only thing that was familiar was the beer they were drinking. I didn't understand most of the words they were saying, but I appreciated the friendly atmosphere. When it came time to start eating, I had a hard time

finding out whether I could eat the things on the table. I have been vegetarian for 6 years, and I wasn't about to start eating meat that day, but I was also very hungry. I asked "Is any of the food vegetarian?" and one woman pointed to a dish clearly full of meat and said "Yes, vegetarian." Rather than asking another person, I asked her the same question in a different way. "Does this dish have meat?" was met with a response of "You'll love it!" Still without an answer, I kept asking different questions until I asked "What are the ingredients?" and she listed the main ingredients of each dish. Just to make sure, I asked the friend I came with to taste each dish and confirm which ones were vegetarian, and the woman's answer matched my friend's answer. I learned through iteration that asking more specific questions was a better way to get information from this particular group of people. Because people from different cultures communicate differently, it is essential to not stick with one communication style for all interactions. In many cases, an iterative approach will allow you to communicate effectively with people from different backgrounds. As I travel to Uganda this summer to work on my microgrid research in person, I will keep this insight in mind and continue to ask different questions if my first question isn't effective.

Service Learning: Varying the Context

Ever since I came to college and began to study engineering, I've been trying to get my younger sister interested in engineering too. I've tried to get her interested in circuits through a basic light-up kit, as well as in context by explaining what projects I'm working on and how they relate to sustainability or medicine. However, she wasn't interested until she found her own applications, making a light-up dollhouse for a science fair and an indestructible Lego car that could survive long falls. I had the same problem when I mentored a FIRST robotics team during my 6-month break from college, giving examples in sustainability or my work at an automation company, which only got the attention of a couple students. One student was particularly difficult, bothering other students and not engaging in the material, so I started trying to give him new applications. I talked about all the different ways programming robots could be used, noticed which examples he was excited about, then brought up similar examples whenever he started misbehaving to get him engaged again. Keeping him engaged in learning improved his behavior significantly, and finding the right context for other students got them more engaged too. I learned that effective teaching, specifically in engineering, is a blend of learning about what areas students find interesting, then weaving examples from those areas into the lesson so that students remember specific skills in context. In order to do this, a teacher must be both perceptive to students' interests and creative in designing the lesson such that students stay engaged.