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**LEARNING TO LEARN:  
REFLECTIONS ON AN EDUCATION**  
GRAND CHALLENGE SCHOLARS PROGRAM PORTFOLIO

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Olin was an opportunity I had never planned on taking. In applying to colleges I was looking to pursue aerospace engineering and applied to all the schools well known for aerospace engineering. These were all traditional schools with large lecture halls, entire freshmen and sophomore years dedicated to physics and calculus. Olin was the oddball of the bunch and felt like an once-in-a-lifetime opportunity – a chance to get my hands dirty in engineering right off the bat. I couldn't resist the lure of Olin's unique education and community.

I have never once regretted the academic experience I have had at Olin. The hands-on experience and self-directed nature of my education has allowed me to grow as a student and an individual in ways that I cannot imagine happening had I attended another school.

Throughout my education at Olin I have been forced to take the reins of my own learning. I have frequently been placed into situations where the right path was not immediately clear, where I had to figure out on my own what to do. In most cases I did not have the background knowledge necessary to take the right path thus I had to discover and absorb that knowledge on my own to move forward. This has admittedly been frustrating at times but I could not be more thankful for how that style of learning has allowed me to grow as an independent student.

Olin has granted me countless opportunities to pursue whatever areas I am passionate about. In nearly all my courses I have been encouraged to find ways to connect my studies to my passions even when it would require significant extra effort on behalf of the professor. Professors are always eager to ensure that students are passionate about what they are doing and that no one feels that a course is merely "busy work."

Olin has not only fostered my understanding of engineering concepts but has truly set me on the path to be a lifelong learner. By showing me that I am fully capable of learning anything that I set my heart on and by helping me understand that passion and learning are not separate areas but are deeply integrated with another, Olin has helped me grow as a student, a learner, and a member of the world community.

My Olin courses and projects are never without a greater meaning or message beyond their immediate context. Professors are quick to point out the importance of having a view greater than just your project. With any work it is critical to consider the bigger picture – the ecosystem that surrounds the immediate problem including the people it will impact, the environment it will impact and so on. My engineering coursework has allowed me to work on big problems – from helping soldiers on the ground in foreign countries to encouraging Olin students to be more active in their day to day lives. These big problems include the Grand Challenges that our world faces today. My work has had context far beyond the math, science, and other educational topics it embodied.

As I look forward to my impending graduation, I am excited to take the skills I have learned out into the real world. What I have learned at Olin goes far beyond the theoretical skills I have picked up. I have learned the value of education itself as well as the value of being able to teach oneself anything. I am going into the world excited to solve the big problems we face in society today and feel that I am well armed to tackle anything that comes my way.

## Grand Challenge Project

The Grand Challenges are deeply intertwined with the Olin education. As such, I have worked on many projects relevant to the grand challenges. One grand challenge that I have found particularly inspiring is the challenge to make solar energy economical. During my Senior year at Olin I worked to design a low-cost solar pool heater. I conducted this work as a research component for my thermodynamics course. I did extensive research into current solutions for solar pool heaters and then designed my own system based on a particular pool. During the upcoming summer I will be building out the system I designed and comparing the solar gain from the actual system to the solar gain that I calculated the system should produce.

One of my goals for this project was to analyze the pros and cons of current solutions. The greatest con I noticed across all the commercial systems was that they were prohibitively expensive. An expensive system is not a usable solution for most solar water heating opportunities (particularly in developing countries). Throughout my research I identified many low-cost do-it-yourself systems that can be easily built using easily found low-cost materials such as PVC pipe and plywood. These systems can be used not only to heat swimming pools but any water source such as water for showers or cooking.

For my project I designed a solar water heating system that could heat my parent's swimming pool. This design could easily be used to heat a water tank or other water system and would work in any area that gets a reasonable amount of sun. The system I designed cost only \$200 and used materials that could be easily found around the house or neighborhood. The solar heater should raise the temperature of the pool by at least 10 degrees Fahrenheit.

In completing this project I learned several important things. First, it doesn't take decades of experience to tackle a grand challenge – They are accessible to all of us. I was able to design an efficient and low cost system with only an intro understanding of thermodynamics. As I learn even more in the coming years, I will be able to tackle this and other challenges with even more expertise. Second, this project instilled in me a new appreciation of the sustainable resources available to all of us as we tackle the challenges of the world. Solar energy has incredible potential as a sustainable energy source in many, many fields.

The use of solar energy for heating is a strong interest of mine. Solar power is a renewable energy source that we as a world community are definitely not making the most use of. As I graduate and head into the real world I hope to continue to pursue my research in this area and maybe one day work on it full time.



*Figure 1: A Solar Pool Heater Similar to my Design*

## Interdisciplinary Experience

All Olin Seniors are expected to complete a two semester Capstone engineering project. For my project I worked with a team of five other Olin seniors to design and fabricate a robot to be used for sensor and algorithm testing for the Army Research Laboratory. The sector of the Army Research Laboratory (ARL) that our team works with writes autonomy algorithms that enable robots to search buildings and other areas without any human needing to be present. This technology saves soldiers' lives as it can be used to detect explosives within buildings without any soldiers needing to enter the building.

This project was heavily interdisciplinary. It involved mechanical, electrical, and software engineering components along with non-technical skills such as user design. As the project was a research project it also involved an extensive report writing component. Furthermore, we were working with an external client and communication skills were critical. Not only did we communicate our design process at the end of the project, we collaborated with ARL throughout development to ensure that we were meeting their needs.

My teammates and I had very different background experiences. This enabled us to work together as a highly effective team as we all understand each other's different strengths and weaknesses. We were able to break up project work based on areas of strength and also allow team members to develop experiences in new areas by working with a team member with more experience. It also enabled us to develop some interesting and novel solutions, as those fluent in a particular area could consult with those with less experience in the area. We found that this approach allowed us to come up with some creative solutions that we wouldn't have otherwise found. This was due to the fact that team members without a lot of experience in a particular area could approach certain problems with a completely fresh eye, uninhibited by previous (possible negative) experiences. The variety of backgrounds also helped us when writing out research report as all the members of the team picked up on different areas of the paper that didn't make sense from an outside perspective.

Our variety of background helped us in unexpected ways at times. For example, one teammate turned out to have extensive experience with video production and was able to help assemble demo videos of our robot at work to send to our project sponsor.

This project has been one of my favorite Olin experiences. I have immensely enjoyed working with such a diverse group of students and seeing what amazing output can come out of a great team experience.



*Figure 2: A Prototype of Our Robot*

## Entrepreneurial Experience

My junior year at Olin I took The Entrepreneurial Initiative, an Olin course in which students start and maintain their own start-up for a semester. My team started Phoenix Fitness, an Olin based start-up aimed at encouraging students to be more physically active.

At Olin, one of the main methods of transportation is unicycle and the largest club on campus involves fire spinning. We are a quirky bunch no doubt, but sometimes it can be difficult to drag us away from our computer screens. My teammates and I, fitness lovers ourselves, wanted to find a way for Oliners to be active without conflicting with the Olin culture.

We knew that group runs and workout groups would not work for such a unique community so we set out on finding a more eccentric set of physical activities. We organized 80's dance aerobics sessions (in full costume) and a Halloween costume race, and late night ab workouts in the design studios. These events, strange as they might seem to an outsider, motivated over 70% of the student body to participate in physical activities organized by Phoenix Fitness.

This experience taught me a lot about entrepreneurship. At the beginning of the semester I was confident that since I was so active I would know exactly how to motivate others how to be active. I was quite wrong. I had neglected to realize that I was not representative of my user base. Second, my teammates and I refused at first to be effectual. We kept trying the same thing over and over, never stopping to consider trying a completely different path.

Eventually, we switched gears and tried the new approach that I outlined above with physical activities tailored more to the interests of the student body. Had we made this realization earlier, we could have made a much greater and lasting impact on the student body. Regardless the learning from those failed attempts was priceless. Learning to reflect on failure and steer towards success has made me a better engineer and leader and will come in use no matter where I end up down the road.



Figure 3: The Start of the Halloween Fun Run

## **Global Awareness**

Olin students typically study abroad in their Fall or Spring semester of their Junior year. I had planned to study away but ultimately decided to instead take a semester off to work at Synapse, a product development firm in Seattle.

While at Synapse I worked as a Project Manager Intern on a project involving a company called Intelligent Energy which is located in the United Kingdom. The project also involved several other companies located in other parts of the United States and Asia. This project was my first experience working with a global engineering team and I found the process of distributed design to be quite interesting. Facilitating phone calls with teams based in three different countries and three different time zones required organization and planning I had never had to use on a project before. There were also cultural differences that had to be taken into consideration when communicating with our team members abroad.

One of the key lessons I took away from working on this project was how important face to face communication is. Whenever possible teams should make an effort to communicate face to face instead of just over the phone or email. Video conferencing or face-to-face meetings allow teammates to become people rather than just digital presences. This was definitely a factor on this project. Prior to the first team meeting tensions would occasionally run high during phone calls but once everyone had met in person people were much more friendly and easy going as the individuals on the other side of the phone seemed more like real people.

Another key takeaway from this project was the value of having unique perspectives on a project. Much like on my SCOPE project, the variety of backgrounds of team members allowed us to come up with novel solutions to problems we encountered. We had an incredible mixture of technical backgrounds as well as cultural background that allowed us to think up problems we not have otherwise noticed until it was much too late. This saved us considerable time and money and resulted in a better product.



## Service Learning

I have been involved with several service oriented activities while at Olin but the one experience that has truly allowed me to really demonstrate my caring and compassion has been working as a Resident Resource at Olin. Olin's Resident Resources (or R2s as they are known) are similar to RAs at other schools but unlike a typical RA we have no authority to police or "write-up students." R2s exist as a resource for students who are going through personal, social, or academic difficulties or simply need someone to talk to. As a team, the R2s work to facilitate the development of a diverse community at Olin and interact with the Office of Student Life as representatives of the student body.

The situations I have handled as an R2 have been truly humbling. In working in service to my community I have been able to help students going through some of the most difficult moments of their lives. Even if all I am able to do is lend an ear or contact a teacher for a student, I have been truly humbled that students have felt comfortable coming to me through hard times (the death of a parent, the aftermath of a suicide attempt) and great times (getting the perfect job offer, asking someone on a date). As a student I have leveraged the support of the R2s many times as I have gone through trying times and it is an honor to have the opportunity to serve as an R2 myself this academic year.

There are many particular experiences that stick out as significant moments in my time as an R2. One time in particular was when I reached out to a student that seemed to be depressed. At first the student was very reluctant to let me in but as time passed I was able to earn the students trust and help them interact with student life officials at the school and outside mental counseling services to help this student get the help they needed. I was so grateful that this student was able to trust me to help them work through a very difficult situation that had been impacting their academic and social life at Olin.

Though serving as an R2 is not necessarily the same as a typical service opportunity at Olin such as SERV, I believe that the R2 team is critical to promoting the health, well-being, and happiness of the Olin community. My experience working on the team has given me an overwhelming appreciation for the support and strength of the Olin community and the compassion that each member of the community shows on a daily basis.



Figure 4: The 2012-2013 R2 Team