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Reflection on URC RAP program – Research, Scholarly, & Creative Activity (Development)

It was one day during my first Fall semester, I was talking to my cousin Tsion, who is a graduate assistant at the URC, when she casually mentioned that I should apply to a program named RAP since it will help me with my college career. Without any hesitation, I completed the application that very night. After temporarily forgetting about it for about two weeks, I received an email saying that I had been accepted into the program and that they had found my application impressive. The email also mentions that I was assigned a mentor to work on a research topic that I haven't heard of.

Fortunately, my assigned mentor turned out to be Dr. Puteri Megat Hamari, a highly approachable, friendly, and knowledgeable professor. I was already familiar with her as she had been my professor for the Intro to Electrical and Computer Engineering (EE105) class during the same semester. Having a familiar face as my mentor added an extra layer of comfort and familiarity to the experience even though I had no prior research exposure. Initially, I perceived research as something exclusive to Ph.D. students and college professors. As these thoughts crossed my mind, I even started to regret my decision to apply to the program, imagining what the next 4 to 5 months might look like.

Our first meeting with my Mentor was right at the end of my EE105's that week class. I told her that the person named Nathnael is me and she was surprised that I was on her class too, considering the challenges of recognizing names in an introductory class with around 65 students. We then went to her office; we talked about the research idea for like thirty minutes. She told me to read research articles on the topic and write a report. She gave me some specific questions to work on for the next one and a half months, which covered the entire winter break. Despite feeling somewhat relaxed after the meeting, I remained concerned about whether I was capable of doing the research. After coming back from the

winter break, I had a better understanding of the topic. I went to her office with the report she had asked me to write.

I then got a green light to start working on our research topic titled "Development and Evaluation of a PDMS Microfluidic Biosensor with PVDF Sensing Polymer" aimed at advancing biomedical applications. The research anticipated developing a microfluidic device capable of detecting biomolecules and indicating the specific type of molecule tested.

Over the next 3 months, I worked in Labs working on the simulations and printing the device. The project was initially designed and simulated using Tinker CAD, Fusion 360, and COMSOL Multiphysics software. We used chemicals such as PDMS, Acetone, PVDF, ABS, and curing agents to fabricate the biosensor, which employs piezo resistive mechanism to detect the target molecule. Throughout the time we faced a lot of challenges, I would classify them into two categories: those directly related to the research problems and those indirectly related. Starting with challenges directly linked to the research, during the fabrication of the microfluidic device, we discovered that the chemical intended to cure the PDMS (Polydimethylsiloxane) polymer wasn't actually curing it. Even though we conducted thorough research and meticulously followed step-by-step guidelines, we faced difficulties, possibly due to the absence of a degassing tube. Alternative machine was used but didn't work. With the presentation deadline approaching, we decided to showcase the simulation work and postpone the fabrication aspect for a future conference. On the other hand, as an indirect challenge what we encountered was a schedule conflict and general time management issues. Every time I found a suitable time slot to work, my professor had a class to teach, causing delays in the fabrication process. Unlike simulations that I could handle independently, the fabrication work in the clean room involved multiple lab safety preparation steps, making solo work practically impossible. I recall my mentor highlighting how fortunate I was to work in this clean room, as many students, even graduates, never set foot in it. Typically, senior

students interested in ASIC design and fabrication took elective classes to access this lab. Despite these obstacles, as mentioned earlier, we decided to focus on presenting the simulations.

Simultaneously, I actively participated in the program's workshops, which aimed to equip participants with a diverse skill set. These workshops range from teaching the fundamental skills like approaching your mentors aka Professors, reading articles, building leadership skills to some technical skills like crafting a research posters and working on citations and so on. This aspect of the program has been invaluable in my learning journey. I've acquired the ability to communicate formally with professors and recruiters, enhanced my design skills through dedicated workshops on poster creation and resume crafting. These skills are essential for the career development of a freshman undergraduate student, and I've also gained valuable experience in tasks like reading and finding articles, even though I found the workshop on this subject less engaging due to my in-depth understanding gained from my previous ENG 101 class experience.

After such exhausting steps, trial and errors I finally crafted my Research poster, and presented it at the 2023 URC research symposium around May 2023. It was really great experience, it helped me build my confidence, I was feeling nervous at first since it was my first presentation in Public. There were judges that evaluated my presentation, they gave me their feedback and I used that on my next presentation at the ECET Faculty. Then after revising some of the concepts, I presented the research at the 23rd Annual IEEE International Conference on Electro/Information Technology (EIT2023) at Lewis University, Romeoville, Illinois. The conference provided me with a wonderful opportunity to connect with fellow students in my major, as well as professors and other professionals in the field. Additionally, I was honored to receive the 3rd place award for the best poster presentation, accompanied by a $250 monetary prize.

During my time in the URC RAP program, I gained a deep understanding of various research concepts and methodologies. This included conducting literature reviews, background research, and creating proposals, as well as participating in hands-on experimentation and simulations. These experiences have greatly enhanced my skills as a researcher. The challenges faced during the fabrication process, such as the ineffectiveness of the PDMS curing chemical, presented an opportunity to develop critical thinking and real-time problem-solving skills. This opportunity not only improved my technical abilities but also instilled in me resilience and adaptability when dealing with challenges. Participating in workshops about creating research posters, enhancing communication skills, and academic writing deepened my grasp of scholarly practices and enhanced my capability to explain complex concepts. Presenting my research at conferences not only boosted my confidence but also provided valuable opportunities for networking and professional development. During this journey, I've learned not only about research methods but also about myself - my ability to overcome challenges, adapt to new situations, and communicate effectively.

This program has significantly enhanced my resume and advanced my professional career. Thanks to this program, I achieved the MavPASS Leader position and the role of International Enrollment Assistant at KIC. Most notably, I secured a research assistant position at Thin Films Technology, facilitated by Dr. Wu, the dean of our department, who was impressed with my presentation to the ECET faculty and created this opportunity for me. I've been actively working as a research assistant since May 2023. Furthermore, during internship interviews, I consistently receive questions related to my research project, which I proudly address to recruiters. One of the experiences I had was when I had the opportunity to participate in the NSBE50 annual convention from May 20-24, 2024. I was able to attend career fairs, networking nights, and onsite interviews. During my onsite interview with HP, I discussed my undergraduate research project, which impressed the product manager, especially considering I was just a freshman.

In the future, I intend to complete the research, as we were forced to stop the fabrication due to time constraints and other circumstances. However, I will consider continuing working on it as soon as we get an ideal time. I have a plan of applying the skills I learned on my upcoming future junior and Senior design projects as they involve coming up with a project idea doing background research and actually making the thing and present it in front of class to the students and the professor, which is pretty much same as I did while I do my research.

I also have a plan to apply the soft skills I learned on my professional career including on my internship this upcoming summer. During my internship, I plan to use strong communication skills I developed through the program to clearly share ideas with other interns and managers, alongside applying critical thinking, troubleshooting and efficiency in the workplace. My enhanced critical thinking and troubleshooting will be extremely useful as I can now analyze problems from multiple angles, identify root causes, and develop creative solutions to overcome unexpected challenges. This will be particularly useful while working on project work and encountering unplanned technical difficulties. Additionally, effective time management will allow me to prioritize tasks efficiently, meet deadlines, and maintain a balanced workload– a skill gap I've observed in many engineering roles. Finally, my adaptability will be essential for navigating new challenges and the transition to Oregon, a completely different environment for me. I'm confident this combination will allow me to be flexible, resilient, and a valuable asset to the team.

The most important lesson I've learned from the program that I can apply in my personal life is the power of resilience. Regardless of the challenges or setbacks faced, it's the ability to persevere, adapt, and find strength within oneself that ultimately leads to growth and success.