Imperial College London

UROP: Undergraduate Research Opportunities Programme

A Personal Perspective by Nicholas Zuo Kai Low

Nicholas had just completed the first year of an undergraduate degree in Electrical Engineering, and embarked on an UROP research experience in the summer of 2015 under the supervision of Dr Christos Papavassiliou (Department of Electrical and Electronic Engineering).

Placement Title: Simulation of Memristor Crossbars

Pre-UROP

Throughout my first year in electrical engineering at Imperial, I have seen how powerful engineering was at solving problems.

Yet coursework was never satisfying enough as there always seemed to be a formulaic way of solving problems. I was never forced to think outside the box as problems and their solutions were constrained by the syllabus the coursework was based upon.

I wanted to test myself and approach problems in ingenious ways, and I believed that UROP would provide that chance and show me a different way of learning. Also, UROP would give me the first-hand experience in research for me to determine if I had the aptitude to pursue it as a career.

I secured my research experience by expressing interest in research to my personal tutor. I was given the task of doing a MATLAB assignment during term time, which evolved into a full-fledged UROP project to be tackled over the summer holidays. On hindsight, working on a scaled down version of the problem and familiarizing myself with MATLAB before my research experience enabled me to speed up my progress.

UROP

At the beginning of UROP, I was tasked to do a comprehensive literature review on the problem, which gave me a broader perspective on my research area. It also gave me the necessary knowledge required to discuss problems with my professor and to devise novel approaches to the problem.

My efforts in term time paid off and I was able to come up with a scalable MATLAB simulation to solve the circuit without much difficulty. However, as I began to delve deeper into the problem, I found that it was a much more profound issue than initially thought.

Thus one of the problems I faced was struggling with the feeling that I was too ill equipped to tackle the research problem, that I knew too little to understand or make a significant contribution to the vast field of research. The logical conclusion would be to view research as an inefficient way to spend one's efforts.

The best thing about my research experience was the presence of my mentor. Dr Papavassilou offered invaluable guidance and support throughout my research stint and pointed me in directions where I could make the most progress with my current skillset. He also treated me with respect and as a fellow collaborator, something that was highly motivating. I have no doubt that if left alone to my own devices, I would have concluded that research was not my cup of tea and was not worth suffering for.

Post-UROP

The thing about research is that there might not be any outcome after putting in so much effort. This can be a very difficult prospect for most people to accept, and to keep up the effort in face of such odds is something researchers struggle with each day. UROP has taught me that trying to solve problems that might not have answers is a grueling experience. However, the exhilaration of coming up with an ingenious solution to a worthy problem cannot be found elsewhere.

I began UROP with the belief that learning from coursework was not satisfying and sought to learn a different way through research.

Indeed, the attempt to solve an open problem has taught me how to approach problems in a way coursework can never provide. I was forced to tackle the problem with everything I had, and the result was unexpected. Seeing the disparate pieces of knowledge I had accumulated through coursework come together gave me a more coherent understanding on the art of engineering. It impressed upon me that despite how insular each coursework module seemed, they all shared the common goal of solving problems.

Not only did research teach me how to be more creative in solving problems, research also impressed upon me the importance of theoretical knowledge obtained from coursework. There were times when I wished I had taken a course on a certain subject, whose techniques and perspectives I could draw upon for research. It is ironic how the seemingly useless coursework became vital for research, and I also began to approach coursework differently, with a eye for picking out useful tools, models of thought and approaches to problems rather than berating how I would never use the content learnt.

UROP has definitely made me consider research to be part of my career as I have experienced the joys of tackling a profound and interesting problem as well as collaboration with fellow researchers. I now view the remainder of my years at Imperial with a newfound passion, eager to learn more and use the knowledge to solve important problems.