Thesis Project Portfolio

Educational Engine

(Technical Report)

The Development of Mechanical Engineering Education at the University of Virginia and Virginia Tech

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

Growing up, I always had the assumption that engineering would be very hands-on. I am not saying that this is not true, but I have found that it is much more than that. In engineering school, there seems to be a strong mix of hands-on opportunities, lecture-based learning, and laboratory classes. In my summer internships, I noticed a trend: U.Va. engineers seemed to be much different from Virginia Tech engineers. Virginia Tech engineers seemed to be more likely to be found working a technical job while U.Va. engineers were likely to be found working in higher-level management. This got me wondering, could these differences be tied back to the individual engineering programs and the learning methods they implement? If so, what caused these programs to develop this way?

The technical portion of my thesis produced two educational engine models that would provide a hands-on means of learning about four-stroke engines. We first created a 3-D printable four-stroke engine model that showed a four-stroke engine’s function. We uploaded this model to various websites so that anyone with a 3-D printer could create it. The final 3-D printed model is seen below in Figure 1.

Figure 1: Final 3-D printed four-stroke engine model

Second, we produced a more realistic cutaway model that made use of a small four-stroke engine. Our group intended for this model to be an interactive display, where passersby could use it to learn about four-stroke engines. The model has a display screen, as well as a keyboard where users can control the engine. This is made possible by a DC brushless motor that is attached to the engine, allowing it to spin when prompted by a microcontroller. This Propeller 2 microcontroller is what allows all of the model's electronic components to interface. A late stage of this model is seen below in Figure 2.

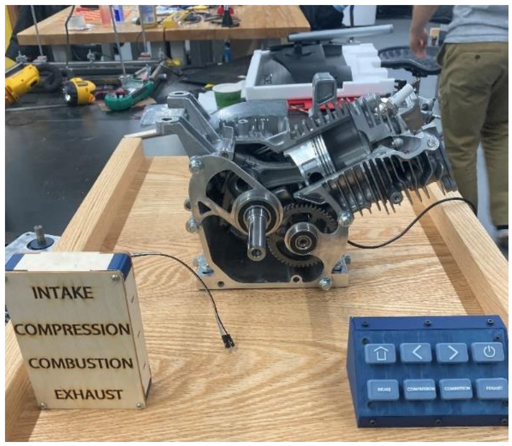

Figure 2: Late stage of interactive four-stroke engine model (not included are the display screen and DC brushless motor)

In my STS research, I performed a Social Construction of Technology (SCOT) analysis on U.Va. and Virginia Tech's undergraduate mechanical engineering programs. This looked at how students, faculty, employers, and accrediting bodies impacted the development of these two programs. I performed interviews and created surveys to reach these social groups. My goal for this research was to see if differing development of these programs might lead to differences among engineers like those that I had noticed in my internships. The analysis showed that Virginia Tech's program was more impacted by industry, while U.Va.'s was more influenced by accrediting bodies and students. However, the employer that I interviewed noted that U.Va. engineers might have a bit more of a theory-based background, while Virginia Tech engineers might have more of a hands-on background. Nonetheless, this wouldn't make a distinct difference on who he hired.

This project has given me greater appreciation for all of the individual elements that go into developing a technology. In this example, there is no one person that creates undergraduate engineering programs. Instead, it is a combination of many groups that will each factor into a program's development, allowing for such unique and different programs. As engineers, sometimes we might think that even the smallest task may go unnoticed, however, this is not true. From this SCOT analysis, we can see that every action in our work will have some sort of impact. With this being said, I believe engineers should treat all their work with the same level of care, as they don't know how much of a impact it will have on their final product.

I would also like to take the time to acknowledge and thank those who assisted with undergraduate thesis. Professor Scott Huxtable for taking the time to provide information regarding Virginia Tech's mechanical engineering program as well as answering questions I had regarding their program. Hannah Troutt for putting me in contact with Professor Huxtable. Professor Huxtable and Professor Joshua Sole for helping to distribute my survey to classes at Virginia Tech. Professor Natasha Smith for providing information about U.Va.'s program and answering questions I had regarding it. Ashley Williams, for her assistance in getting this project approved by the Institutional Review Board, allowing for this project to involve human subjects. Professor Gavin Garner for allowing me to distribute my survey to his undergraduate Mechatronics course and for being an amazing capstone advisor. Finally, Professor William Davis for all of his assistance with my STS thesis.