Thesis Project Portfolio

Optimization of a Formula SAE Vehicle Intake Manifold

(Technical Report)

Prioritizing Experiential Learning in the Classroom

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The goal of my senior design capstone project is to optimize the intake manifold of UVA's 2023 Formula SAE vehicle, allowing us to improve fuel efficiency, increase engine power output, and decrease the weight of the sub-system. Not only are these goals directly related to the performance of a vehicle, but in the grand scheme of things, this project and all others related to the vehicle, will provide more recognition to the University, more companies will recruit FSAE participants from UVA, and the team will gain more sponsors which will simply allow for more improvement.

This year's capstone team did extensive research on proper computational fluid dynamics procedures and random vibrational analysis and had the opportunity to work with high end additive and subtractive manufacturing machines including Stratasys Fortus 3D printers and YCM 5th axis CNC milling machines. While one might connect this work with the social aspect of fuel consumption and how it results in air pollutants like nitrogen oxides, particulate matter, and volatile organic compounds, or even the increased occurrence of oil spills which cause permanent damage to ecosystems, I connected this work to the opportunities experiential learning provides students with that cannot be found in traditional coursework. Most of the work my capstone team has done, does involve foundations in many courses required of mechanical engineering students, but very little of the actual design, simulation, and manufacturing was used based on classroom knowledge.

My STS research dives into the importance experiential learning has on undergraduate student satisfaction, post-graduation career success in terms of job sophistication and salary, and university recognition. My research uses Actor Network Theory to see the relationship that students, faculty, industry partners, equipment and facilities, and administrative policies and

procedures all have on experiential learning at the undergraduate level. There are a variety of methods used when conducting this research including student surveys and interviews, using research papers from online databases, some educational books focusing on progressive learning, and confined research on MIT mechanical engineering curriculum and professor/teaching style insight. I am hoping to validate my opinion that undergraduate students do indeed gain the most from having access to experiential learning as it will allow them to implement current technologies to solve complex engineering problems, which also allows more time for creative freedom.

This topic may come off as harsh to professors at the university, which is not my intention. There is something to say about the wants and needs of students which doesn't always get heard. In this day in age, many universities are focused on research, which is more accessible to graduate students. With engineering being such a rapidly growing field that is required of every industry in the world, undergraduate students need access to more current technology, and it should not be the norm for curriculum to stay almost identical for over 2 decades at a time.