Thesis Project Portfolio

2024 ASCE Concrete Canoe Design Competition - Final Report

(Technical Report)

Engineers are Needed Now More Than Ever: How Can Design Competitions Help?

(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

Leon Crawford
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Department of Civil and Environmental Engineering

Table of Contents

Sociotechnical Synthesis

Infrastructure in the United States is failing and in dire need of attention. The 2.6 trillion-dollar gap in infrastructure investment could cost the nation 10 trillion dollars by 2039 (American Society of Civil Engineers, 2021). This gap hurts more than just the economy - it also affects the well-being of the country's citizens. Engineers are key players in solving this problem. They design and maintain the infrastructure the United States depends on. However, a gap of 133,000 engineers exists between new job openings and new engineers entering the market (Kodey et al., 2023). This gap cannot be allowed to increase, otherwise there might not be enough people to make impactful improvements to the state of U.S. infrastructure.

My STS research investigates how engineering design competitions affect this undesirable gap. I specifically looked to research how they affect the number of students who pursue engineering and how they prepare them for the job path. I analyzed my personal experience, other students' experiences, and existing literature to find supporting information on this. Overall, cases at the high school and college level showed that engineering design competitions created an interest for the field and made students more likely to pursue engineering. Interviews I held with current University of Virginia students provided explanatory evidence that students gain technical and professional skills from participating in engineering design competitions.

The technical portion of my thesis looked to solve the lack of clarity on what skills are developed by participating in engineering design competitions. To collect evidence, I competed in the American Society of Civil Engineers' Concrete Canoe Competition. My team and I were

focused on designing and constructing a full-scale concrete canoe and providing a fabrication plan that would allow 100 concrete canoes to be constructed sustainably. Throughout the course of the project, fundamentals of engineering I learned from my college coursework were integral to preparing engineering calculations for the hull and mix design for the concrete canoe. Project management, teamwork, and communication were key skills that I improved upon as a leader of the team. My personal and immersive experience with an engineering design competition alongside interviews from my teammates serve as strong evidence that design competitions can drive students to bring the same type of innovation to their future entry-level roles.

By creating interest in the field, developing technical and professional skills, and being an accessible resume-builder, engineering design competitions do make an effect on the number of engineers entering the workforce and the quality of the work they produce, thereby impacting the problem of U.S. infrastructure. While neither my technical or STS work directly solves the problem of failing U.S. infrastructure, this paper creates a case for experiential engineering learning to be well supported at all education levels. If time permitted, I would have liked to receive more perspectives from students through interviews on their experiences with engineering design competitions. Hearing from high school or first year college students who are still developing their career aspirations could provide more support for my claim. Future researchers should consider expanding their interviewee pool to strengthen the argument of this paper.

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how to prepare a strong STS thesis. I would also like to thank Mr. Ryan Henry, my capstone technical advisor, for his guidance on the concrete canoe project. While the students were leading the effort to a 2nd place overall regional finish, his constant vow to support the team made us always believe in ourselves. Finally, I would like to thank my fellow capstone team members, Ethan Ames, Melody Cao, Madison Cannon, Kenneth Reyes, and Jason Wong for being a great group of individuals to work with.