

# **Undergraduate Thesis Prospectus**

## **Bridging Industry Disparity and Engineering Education Paradigms**

(technical research project in Computer Science)

## **The Struggle for Reform in U.S. Engineering Education**

(sociotechnical research project)

by

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technical project collaborators not  
applicable

On my honour as a University student, I have neither given nor received unauthorised aid on this assignment as defined by the Honour Guidelines for Thesis-Related Assignments.

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*Technical advisor:* Brianna Morrison, Rosanne Vrugtman, Department of  
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*STS advisor:* Peter Norton, Department of Engineering and Society

## **General research problem**

*What deficiencies exist in US engineering higher education for industry career readiness?*

Many recent graduates from two-year or four-year engineering colleges in the United States often feel unprepared for the demands of industry. In a recent Cengage survey, it was found that “nearly one in five (19%) of new graduates reported that their engineering education did not provide them with the skills needed to perform well in industry” (Hansen, 2021). The outcome of this survey highlights the significant problem: That engineering education frequently fails to adequately prepare students for the practical realities of working.

The gap between what students learn in academic settings versus the actual requirements of professional roles is quite substantial (Galloway, 2008). Many engineering programs heavily emphasize theoretical knowledge and mathematical skills, often they are in core subjects such as physics, calculus, and chemistry as well. While these general education requirements competencies are very important, they overshadow the development of practical skills, hands-on and real-world application of the knowledge necessary for success in industry settings. Among a few, some of these key developments are communication, business, and teamwork skills (Baukal, Stokeld, Thurman, 2022). There are profound repercussions to this discrepancy because the new graduates will find themselves ill-equipped to handle the industry requirements without having any of these skills.

Addressing this problem is imperative because the alignment of educational content more closely with industry needs ensures that graduates possess not only theoretical knowledge, but also the practical hands-on skills required for professional day to day. This would be able to ensure that graduates are job-ready, and it'll improve the overall quality and efficiency of the workplace for everyone involved.

## **Bridging Industry Disparity and Engineering Education Paradigms**

### *Industry Vs. Higher Education: An Eye-Opening Experience*

The project department is Computer Science. The technical advisors are Professor Brianna Morrison and Professor Rosanne Vrugtman. This project is associated with CS 4991, the zero credit Capstone Technical Report course required for graduation. There are no collaborators.

The disparity between what engineering students learn in academic settings and what they need to succeed in the professional sphere is the pressing issue. Research has shown that a significant proportion “approximately 50 percent of engineering graduates feel unprepared for the workforce upon completing their studies” (Sponsor, 2022). This alarming statistic highlights a concerning disparity between the skills and knowledge acquired the process of attaining a degree and the actual demands of the workplace.

This gap between academics and industry needs signifies potential inefficiencies in current educational approaches. It suggests that the curriculum might not fully address the practical skills, emerging technologies, or industry-relevant experiences that are vital for graduates' success in their professional careers. The product of this is potentially a group of engineering graduates who might face challenges transitioning into the workforce and meeting the expectations of their employers.

These findings emphasize the necessity for a reevaluation of engineering education to better align with the current and future needs of the industry. Addressing this disparity is crucial not only for the success and satisfaction of individual graduates but also for the overall competitiveness and advancement of the engineering field. Some efforts to bridge

this gap would involve revising current curriculum to integrate more practical experiences, to foster hands-on learning that will ensure alignment with industry needs (Baukal, 2022).

The primary goal of this project is to address the significant disparity between the skills and knowledge obtained during an engineering education and the actual real-world requirements. Some unusual constraints involve reshaping the traditional educational approaches to integrate more practical experiences and industry-aligned learning. It will involve overcoming the traditional methods and the resistance that comes with wanting to change within academic structures.

The existing state of the engineering education has often fall short in equipping new graduates with practical skills and industry-related experiences needed for professional roles. The current curriculums across many different institutions may not full address the skills necessary to succeed in a work environment. Hence, addressing this issue will have to involve a reevaluation and revision of the traditional approaches to make sure graduates are fully equipped.

This project will employ a two-fold methodological approach to address the identified problem. Firstly, it will conduct a comprehensive review of existing educational systems to understand their structure, content, and how they align with industry demands. This review will involve examining curriculums at different institutions, the types of different teaching methodologies, and learning outcomes to identify any gaps between the skills taught and those required in professional settings.

In addition, some meta-studies will be conducted involving surveys, interviews, or questionnaires with past graduates. These meta-studies will aim to gather insights into graduates' experiences, their perspectives on the adequacy of their education in meeting professional demands, and the practical skills they felt were lacking upon entering the

workforce. The focus will be on understanding their challenges and identifying areas where improvements could be made in the educational system.

Upon successful conclusion, the project will offer guidance for aligning engineering education with industry requisites. These proposed measures seek to narrow the divide between academic teachings and practical skills essential in the professional sphere. The execution phase will entail modifying curricula to include more hands-on experiences, ensuring improved readiness of future graduates for professional positions. The subsequent actions will involve implementing and overseeing these educational adjustments to uphold graduates' preparedness for the ever-evolving demands of the industry.

## **Examining the Critics' View on Status and Modern Technological Advances for Reform**

### *The Struggle for Reform in U.S. Engineering Education*

This explores the critical viewpoints regarding the relationship between the existing status quo and contemporary technological advancements for potential reform. Understanding these perspectives is crucial because it sheds light on the need for potential improvements or changes within societal and technological systems. The examination of critics' views on the status and contemporary technology is fundamental in highlighting the existing challenges and the necessity for potential restructuring, evolution, or innovation within these domains. For instance, in evaluating the struggle for reform in U.S. engineering education, comprehending the criticisms and challenges within the system is essential for fostering better alignment between educational approaches and the demands of the industry. The significance lies in recognizing the discrepancies and implementing strategies that enhance the preparation of future professionals for real-world demands.

Recent studies in engineering education, notably Patricia Galloway's work "The 21st Century Engineer," have emphasized the critical need for modernizing engineering education to better align with industry demands. Galloway's insights emphasize the necessity of adapting engineering curriculum to encompass emerging technologies and practical skills crucial for professional success (Galloway, 2008). Moreover, organizations such as Girls Who Code and the Society of Women Engineers actively advocate for gender diversity in engineering fields, promoting inclusivity and representation. In a similar vein, ABET sets standards for engineering programs, recognizing the importance of hands-on experiences and professional skill development. While these initiatives and research emphasize the urgency of educational reform, the specific methods and the extent of changes required to effectively

bridge the gap between academia and industry demands remain areas requiring further exploration (Baukal, Stokeld, Thurman, 2022). The existing body of research serves as a foundational understanding of the problem but leaves unanswered the precise strategies and adaptations needed within engineering education to harmonize with evolving industry prerequisites.

In this realm of engineering education reform, various stakeholders play pivotal roles. Students, as primary participants, seek inclusive and engaging learning environments. Their aspirations revolve around acquiring modern, industry-relevant skills and gaining practical experiences to prepare for professional careers. Teachers and educators are influential participants, with responsibilities encompassing the implementation of innovative teaching approaches that aim to bridge the gap between academic learning and industry demands. Their efforts are essential in reshaping curricula and classroom practices.

Additionally, industry experts significantly impact the education sphere by offering insights into the skills and proficiencies needed in the professional world. They advocate for educational reforms that better align with industry standards. Policymakers contribute significantly by influencing and shaping the educational landscape through regulations, funding decisions, and policies that can impact curricular changes and accessibility.

Furthermore, the rising costs of tuition emerge as a critical issue affecting all participants. The financial burden impacts students and families, potentially restricting access to engineering programs and impeding diversity and inclusivity within the field. This financial challenge not only affects the students' choices but also influences educational institutions' decisions regarding program structure and accessibility (Woodridge, 2023). Understanding the multifaceted concerns and perspectives of these stakeholders is fundamental in shaping effective strategies for engineering education reform.

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