Thesis Project Portfolio

The Current State and Future Needs of Systems Engineering Education: A Proposed Curriculum

(Technical Report)

Understanding the Function of a Science, Technology, Engineering and Mathematics Master's Degree

(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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In May of 2023, the University of Virginia will begin classes with the first cohort of the newly redesigned Accelerated Master's Program in Systems Engineering in Northern Virginia. In an effort to develop a stronger understanding of the educational landscape and relevant stakeholders, the following papers discuss the state of System's Engineering education and its associated alignment with industry needs, as discussed in the technical paper, and the function of STEM Master's degree's more holistically on society, as discussed in the STS thesis paper.

The technical paper, entitled *The Current State and Future Needs of Systems Engineering Education: A Proposed Curriculum*, surrounds the expanding utilization of systems engineering in industry and the related growing skillsets needed. With a greater understanding of the direction of Systems Engineering, it is determined that an alteration to both the content and pedagogy of Systems education is merited and needed. Through literature review of current papers, publications and System organizations material, combined with an analysis of current program offerings, the team was able to determine several conclusions around opportunities for improvement. These conclusions include, but are not limited to, tuition, course offerings, curriculum structure, and education delivery methods. With this in mind, the student team generated a proposed program structure and content outline that would satisfy these newly understood constraints and requirements. In an effort to inform and provide knowledge around the evolving state of the discipline, the team sees this work as foundational to the next phase of systems engineering education and application.

The STS thesis paper, entitled *Understanding the Function of a Science, Technology, Engineering and Mathematics Master's Degree*, discusses the way in which different students interact with advanced education and the outcomes and functionality of a degree in the work force. By examining the historical shift away from liberal arts education, the paper argues a growing American interest in technical or marketable disciplines.

Through a deep dive in several theoretical discussions around the value of education and degrees, the paper demonstrates the complex nature of degree signaling and the importance of pedigree. By explaining the differences in experience among minorities, both racial and gender based, it is shown that the purpose and outcome of a degree is not generalizable, and is very much tied to external factors around the student. Surrounding both issues of representation and the actual lived experiences achieving or earning degrees, these social groups experience an extremely difficult landscape to navigate, necessitating a greater effort on the part of administrations, institutions and educators to more aptly align university resources to these issues. With a discussion of frameworks and limitations, the paper also recognizes the shortcomings of the analysis done and an understanding that alternative perspectives may be valid and not considered within the contents of the piece. Concluding with commentary around the future, it is critical to recognize the growing seriousness in automation and artificial intelligence that poses a threat to the current structure of the working world. Understanding where education falls within this landscape will be critical and should be a massive consideration for institutions looking to adapt toward the future.

Both these papers aim to provide greater insight into the world of STEM education, on both the micro-level, as seen in the technical paper focusing on Systems Engineering, and on the macro-level, focusing on the greater technical Master's degree architecture. The goal of these portfolio of writing is to encourage those in important educational positions to take action and make an effort to educate themselves on how to approach these educational pursuits and eventually, provide an extremely robust program that offers great benefits and value to students.