

Thesis Project Portfolio

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

(Technical Report)

Identifying the Flaws With Online Higher Education and Understanding Why They Remain Unsolved

(STS Research Paper)

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Sociotechnical Synthesis

My technical research centers around systems engineering education. Specifically, an analysis of how changes in the roles of current systems engineering professionals combined with a more virtual workplace due to COVID create a need for a new standard in systems engineering higher education – a modernized curriculum that reflects the needs of current professionals. Researching this topic necessitated an understanding of the future of content delivery within systems engineering education programs, and whether it should be fully virtual, in-person, or hybrid. This inspired me to look deeper into the current state of online higher education, as I was curious about the problems that online programs encounter. With this revealing a bevy of issues stemming from a greedy system, I decided to center my STS research on an Actor-Network Theory analysis on the problems with online higher education. Thus, my STS research topic stems from the preliminary research done for my capstone project.

The Current State and Future Needs of Systems Engineering: A Proposed Curriculum begins with a description of the field of systems engineering. Systems engineering is a transdisciplinary approach to problem solving that applies skills such as Model-Based Systems Engineering and the MITRE Systems Engineering Competency Model to arrive at solutions and analyze systems. Professionals who utilize systems engineering principles in their day-to-day include systems analysts, test engineers, and systems engineers. However, the education programs for these professionals are lacking. Current systems engineering education content is stuck in the past – most degree programs have a primary focus on systems analysis and design, a topic more pertinent in the 2000s. This is a contributing factor to the large gaps between academia and industry. Content delivery has similar flaws, with classrooms not digitizing fast enough. An analysis of current Mid-Atlantic programs reveals this - few are geared towards the needs or lifestyle of current working professions, emphasizing a need for modernization. The

modern systems engineer needs to act as an intermediary between technical and business roles, acting as a product manager as innovation is increasingly technical. Thus a modern curriculum needs to emphasize product innovation and an entrepreneurial mindset. A cohort-model and hybrid format are also identified as the optimal content delivery methods to emphasize social competence and teamwork while remaining flexible to the needs of a working professional. This research leads into a final proposed curriculum consisting of a focus on product innovation, a cohort-based hybrid learning environment, and a mixture of instruction from professors and industry professionals.

My STS research is an Actor-Network Theory based analysis of the current problems with online higher education and the reasons they persist. With online higher education programs existing to provide an alternative to those who cannot have a traditional college experience, their quality is of utmost importance to creating an even playing field for those looking for educational opportunities. An overview of the current research through a thorough literature review reveals that online higher education programs are primarily for-profit, online learning has intrinsic flaws, and that managers of these online programs use predatory marketing tactics in order to boost their enrollment numbers. To understand the root of these problems, an Actor-Network Theory Framework is utilized, leveraging connections found in primary and secondary sources to understand power dynamics and negative influences on online higher education programs. Analysis using this framework reveals that the profit-forward motives of online program managers is at the root of the problems persisting in these programs, including poor education quality, predatory marketing, and a failure to address the lack of interaction in an online space. This is exacerbated by a slow legislative response that enables online program managers to act unfettered. Opposition argues that these programs are taking advantage of the

free market, however with education standing as one of the most important factors of success in modern America, they must act with more care to prevent the growth of class inequity. Future research must be undertaken to understand the relationship between state legislators and program managers, with simultaneous activism needed to spur change by lawmakers.

Working on both projects simultaneously afforded me the opportunity to view the world of online higher education from multiple perspectives. Systems engineering degrees are rarely offered at community colleges or for-profit online universities, and the future of masters programs in systems engineering lies in hybrid programs that support working professionals to avoid taking a gap year from their job. The needs and challenges of setting up that curriculum and structure address a problem in a single industry. However, the problems facing online higher education programs are, ironically, much more systemic and speak to a deeper issue of class inequity and greed.