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

(Technical Paper)

The Impact of Online Learning on College Students

(STS Paper)

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Introduction

In early 2020, the whole world was dealing with a health crisis known as COVID-19 which has spread widely. With almost everything being shut down to prevent the spread of the virus, new protocols and ways of functioning were necessary. This pandemic pushed thousands of schools around the world to incorporate virtual learning as their main format of teaching. By Fall 2020, "75 percent of all undergraduate students were enrolled in at least one distance education course and 44 percent of all undergraduate students exclusively took distance education courses "(National Center for Education Statistics, 2022). Prior to the pandemic, online learning has now been prominent in graduate education for some time. However, now that society has adjusted well to online learning and being able to communicate well with others virtually, the idea of virtual learning is beginning to grow and extend beyond the graduate level. While everyone was forced to adapt to the virtual learning style, there has not been much discussion on how students have been performing and their ability to thoroughly understand materials delivered virtually. My STS project will assess the impact of online learning on college students, specifically looking at the negative and positive impacts, the impact on students academic performance, and barriers that college students are facing making it challenging for them to succeed in online learning.

Assessing the impact of online learning on college students stems from my technical project of designing the new Masters of Systems Engineering program for the University of Virginia campus location in Northern Virginia. My capstone group and I, along with our client and advisor, are responsible for designing the entire program from course curriculum and structure to tuition cost/academic expenses and so on. Given that this program will mainly be hybrid, being able to examine the impact of hybrid learning on students will be helpful in

enabling us to design an impactful program that caters to students needs and learning. It will also be essential in determining how content should be delivered so students are best able to get the most out of their graduate education.

Below I elaborate on my technical topic that will lay out steps we have taken and steps that will be taken to develop a new Masters in Systems Engineering program. I will also discuss in detail the process I will be using to analyze and answer my STS topic and the Science, Technology, and Society framework of Social Construction of Technology (SCOT) that will be incorporated into my research to analyze the impact of online learning on college students.

Technical Topic

In May of 2023, the University of Virginia will launch the new Accelerated Masters Program in Systems Engineering at their Northern Virginia location. To develop the program, my capstone team will be engaging in tasks such as extensive research on our competitors , budgeting, curriculum design, class structure and marketing for student acquisition. We began by having extensive discussions to understand the task as well as see how we can better the previous accelerated masters program. Thorough research was completed to assess who our competitors were in our region. We focused on a few elements such as tuition cost, course curriculum and structure of the programs offered by our competitors. We also paid close attention to their marketing techniques and aspects of their program that makes them stand out.

After completing research on our potential competitors, we determined that a cohort model of the program will be our distinguishing factor for marketing. Our cohort model structure allows for a community of students to bond during the course of the program, alleviating any concerns surrounding the a of prior social connection or unestablished academic support networks. This model differs from a typical graduate program because it encourages students to

engage with their peers as they continue their educational experiences whereas a typical graduate program might be fully online making it hard for students to connect or consist of a large classroom where it is difficult to form those close connections. The cohort model will enable students to build relationships with their classmates whether that's to help with studying for exams, school assignments, networking purposes, or just simple friendships. This model will be incorporated into the program from the very first day as we plan for the first and last week of the program to be a full week of completely in person classes and social activities. Students will be able to establish those relationships early on and can utilize them throughout the program. The bulk majority of the program will be hybrid with about 70 percent of the classes being taught in person at the Northern Virginia location and about 30 percent of them being virtual.

In addition to determining our differentiating factor, we will also brainstorm ways we can enhance the courses we will be offering. Our target audience are students looking to hold leadership positions in the technology industry. Our program will consist of providing them with technical hard skills as well as soft skills needed to succeed in engineering management as well as management positions in general. As we aim to build leaders, they will need more skills of overlooking and monitoring information as well as how to help derive new innovations and how to manage the lifecycle of the innovative product.

Once we determine our complete list of courses offered we will determine the financial constraints as well as beginning marketing campaigns for the program. We plan on utilizing our connections with previous alums who completed the previous Accelerated Masters in Systems Engineering program to gain exposure specifically for future recruits. We also plan on using a variety of social media platforms such as linkedin to advertise this new program with the goal of having around 40 students in the first class beginning May 2023.

This masters program was designed to align with the needs of the future systems engineering education and meet the demands of the developing workforce. The program is designed with a focus on enhancing skills needed in the emerging industry and workforce so that students can become technology leaders in their field. The technical research paper stands as our basis for the creation of the masters program. Systems engineering continues to evolve as the complexity of systems and the development of technology continues to increase. The technical paper first identifies the current state of systems engineering by recognizing systems engineering roles, responsibilities and expectations. It explores the future of systems education focusing on content, content delivery, cost, and student cooperation. Additionally, it discusses the changes needed in the systems education so that students acquire skill sets and knowledge that will be critical to the evolving industry. By assessing the evolution of systems engineering and systems engineering education, we created a masters program that would support the development of systems engineering and align with the needs of the workforce.

STS Topic

While my technical project focuses on designing a masters program that incorporates a hybrid learning format, I am interested in seeing how non-traditional ways of teaching such as virtually or a hybrid format impacts college students. It's also important to see what innovations have helped in improving online learning. Many companies for online course management systems have directed their focus on administrative support rather than innovation tools for the improvement of learning systems (Hiltz, 2005, pg 61). Given that online learning continues to grow, I'm interested in seeing what innovation tools are out there that can be helpful and add to the education of students. Being able to assess the true impact of online learning allows us to improve the methods that content is delivered by, remove techniques that are not impactful to

student learning as well as provide recommendations on new innovations that can be incorporated into online learning that will improve a students education experience.

The STS project will mainly be focused on college students as college is one of the most prominent factors and sets the precedent for advancing their academic careers. Also given that the content learned in college is more difficult than high school, it takes more out of a person to understand the material. With online learning, it's possible for college students to have more distractions as they are able to learn from anywhere. However, this can be difficult for them since the content might require extreme focus. Being able to do well in online learning requires a lot of self-discipline and initiative. “Students are not aware of how to look inward to examine how they learn and to judge which methods are effective especially when faced with new forms of learning online because they lack metacognitive skills” (Anthonysamy pg. 1), metacognitive skills allow a person to evaluate their thought process related to learning. Many students lack the skills to evaluate and reflect on their learning performances which puts them as a disadvantage. Being able to evaluate students' performances and learning will help determine the effectiveness of online education. In addition to students being able to assess how well they are learning, there are certain factors with online learning that are beyond their control. “Not every student has easy and convenient access to the internet and computers as they might have to share with other family members (Kearsley 2002). Also, college students with disabilities might have different impacts and views on online learning. It's important to assess a variety of college student social groups that can be impacted differently so I'm able to provide appropriate recommendations and conclusions.

The main STS framework I will use to analyze the impact of online learning on college students as well as how new innovations can be incorporated into online learning is SCOT. This

framework will be used to analyze technical changes in society as online learning begins to grow and also the relationship between society and different technologies that will be incorporated into online learning. SCOT framework is for those who seek to “understand the reasons for acceptance or rejection of a technology should look to the social world” (Klett, 2018). The framework will be used to examine how online learning has affected different relevant social groups (students, professors, and administration). By understanding this impact we are able to assess the successes/failures of online learning as well as improvements that need to be made.

Works Cited

Anthonysamy, L. The use of metacognitive strategies for undisrupted online learning: Preparing university students in the age of pandemic. *Educ Inf Technol* 26, 6881–6899 (2021). https://doi.org/10.1007/s10639-021-10518-y

Chen, Pu-Shih Daniel, et al. "Engaging Online Learners: The Impact of Web-Based Learning Technology on College Student Engagement." *Computers & Education*, Pergamon, 22 Nov. 2009, https://www.sciencedirect.com/science/article/pii/S0360131509003285?casa_token=ZhqEXHQhyjkAAAAA%3AGD56oRwiD55Mmn-WQCOCrRjjj74CSGCSc82tRXiIOUuntVHP65v90bkEv0UklKqVhePhVN7y-90.

Hiltz, Starr Roxanne, and Murray Turoff. "Education Goes Digital: The Evolution of Online Learning and the Revolution in Higher Education: Communications of the ACM: Vol 48, No 10." *Communications of the ACM*, 1 Oct. 2005, https://dl.acm.org/doi/pdf/10.1145/1089107.1089139.

Kearsley, Greg. "Is Online Learning for Everybody? - JSTOR." *Is Online Learning for Everybody?*, 2002, https://www.jstor.org/stable/44428721.

Klett, Joesph. "SCOT." *SCOT | STS Infrastructures*, 2018, https://stsinfrastructures.org/content/scot.

National Center for Education Statistics. (2022). Undergraduate Enrollment. *Condition of Education.* U.S. Department of Education, Institute of Education Sciences. Retrieved May 31, 2022, from https://nces.ed.gov/programs/coe/indicator/cha.