

## **Thesis Portfolio**

Modernizing College Courses: A Practical Application of Gamification  
(Technical Report)

The Modernization of the Framework of Learning  
(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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Spring 2020

Department of Computer Science

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## **Sociotechnical Synthesis**

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### **Introduction:**

In my technical report and STS thesis, I analyze the current processes of learning within the realm of collegiate courses. Through the STS frameworks, tacit knowledge and normalized deviance, I analyzed the current state of college courses and implemented the analysis in my technical report. Within the STS thesis, I focused more on the ethics of grade inflation, incentives, and motivations for students to learn more. The STS thesis aims to consider many different perspectives on increasing student satisfaction of courses. It also offers the idea that collegiate courses need to increase their value to keep up with alternative forms of learning through an analysis of tacit knowledge. The technical report expanded upon these perspectives by applying solutions to an implementation of the course, CS 4730: Computer Game Design. The technical report details the choices that were made in the implementation as well as an analysis of the results with a range of solutions provided for the issued that occurred. Together, they aim to create a “framework” of learning that formally creates a process for learning new topics while maximizing motivation and retention of knowledge.

### **Technical Report:**

The technical report details a proposed solution to creating a “framework” of learning. The proposed implementation changed the course logistics and some material of CS 4730: Computer Game Design. The implementation utilized the ideas of gamification to increase student’s motivation as well as knowledge obtained from the course. In this system, the students

received the foundations of Game Design for the first two weeks. Following that, the students grouped up into teams and were allowed to stay under a “sub-team” which were the Game Engine, Game Design, and Level Design. Each sub-team focused on a part of the objective of creating a video game from scratch. The assignments were set up in such a way that another sub-team would eventually utilize the solution that another sub-team implemented, creating this dependency chart to keep students accountable and improve their abstraction skills. Another new feature added to the implementation is that students were allowed to create their own assignments toward the end of the course depending on what feature they needed. It is important that the students have the freedom to choose, so they were allowed to choose another feature to implement that substituted the given assignment. By allowing the students to choose their sub-team, students were allowed to learn the course material and meet the objective in a style that most suits them. To ensure that a feedback loop system was in place, we required the students to create demos each week and present them to their peers. These presentations not only served as a way to show understanding but also allowed students to be competitive amongst their teams and receive praise when their demo was particularly good. In the report, I assert that the feedback loop system is essential to motivating students and outline different systems that implement it. Each assignment also required a small proof of concept that showcased that the implementation was understood by the students. This “personalization” is super important for storing the information into long-term memory and the report outlines several ways that it could be done. With this new implementation, there were some aspects of the course that could be improved. The technical report further analyzes some of those aspects and provides potential solutions that address those aspects. As a final piece, the report combines the analysis from the

data gathered on the course implementation and provides recommendations that address some of the improvements with a more refined implementation for the courses going forward.

### **STS Research Paper:**

The STS research paper aimed to analyze the motivation for the implementation in the technical report. Utilizing the STS frameworks of Tacit Knowledge and normalized deviance, the STS research paper proposes an argument of why college courses need a new structure to improve their value to the students. A few of the points mentioned were, that alternative forms of learning such as coding bootcamps provide better value, grade inflation, and a lack of incentive for the students to be motivated and retain the knowledge over long periods of time. The paper outlines how collegiate courses not just at the University of Virginia, but also other universities have a problem with grade inflation, cheating, and cost. In order to solve some of the problems, aspects of gamification were utilized in an implementation of a collegiate course. The paper claims that by applying gamification, many of the problems can be addressed and that the main objective was applying gamification in a correct way. The paper dives into previous iterations of gamified courses and why they failed as well as solutions that can avoid the issues that previously gamified courses had. For example, to address grade inflation and motivation, courses should utilize the feedback loop system and competitiveness in gamification in a way such that completing more assignments and learning more material determines the course grade. In this way, students receive a grade based on the mastery of the material in the course rather than on assessments or relative scores to other students in the course. Finally, the paper explains how important creating this framework of learning could be. The paper proposes that the framework

could be applied not only to collegiate courses but also industry, personal learning, and alternative forms of learning such as online content.

**Conclusion:**

The implementation of CS 4730: Computer Game Design heavily benefitted from the analysis done in the STS research paper. By analyzing STS frameworks and applying them to course implementation, I was able to see many different perspectives on applying gamification as well as justifying why I implemented certain features in the revamped course. The research paper provided me with an ethical analysis of student motivations and why courses are often unsatisfactory and applied them to my implementation. Furthermore, analyzing my implementation helped me experience many of the logistical struggles in implementing a college course and see perspectives that I had not considered before. Combining the experience from the course implementation and my analysis in the STS research paper, I was better able to create improvements not only logistically but also ethically.