

Thesis Project Portfolio

Building a Graph-Based Database and API for Real Time Analysis of User Behavior

(Technical Report)

The Social and Ethical Effects of Gamifying Online Learning

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Existing systems may not always be perfect. Identifying these weaknesses and enhancing existing systems is important for optimizing user productivity and efficacy. My STS research explores the topic of decreased user engagement in online learning and how the gamification of online learning platforms can provide a solution. The technical topic focuses on a technological solution to efficiently analyze user behavior that was explored during my internship the summer of 2023.

My STS research focuses on how gamifying online learning platforms can increase user engagement. Online learning does not work for everyone - users are less engaged compared to traditional classroom learning. I examined how the gamification of online learning can provide a solution through the Octalysis framework, a human focused gamification design framework that lists out the eight core drives responsible for human motivation. The lack of studies tracking engagement when interacting with a gamified vs. non-gamified tool compelled me to conduct my own exploratory study. I created two web applications, a gamified and non-gamified version, and executed the study to determine how gamification affects user engagement. The results of the study supported the claim that gamification increases user engagement and led me to propose a working definition of engagement in online learning. I believe that a user's engagement when interacting with online learning tools is best represented by the behaviors of a user interacting with the tool, is correlated with user motivation and state of mind, and stems from having an appealing user interface. While gamification provides a promising solution to increasing user engagement, it also introduces some ethical implications. During my research, I analyzed the following ethical conflicts: (1) high engagement does not necessarily correlate with high learning, (2) high engagement vs. addiction, (3) social comparison can encourage some users while discouraging others, and (4) security and privacy of publicly accessible leaderboard data.

The technical topic focuses on a project I worked on as a software engineer intern at an unidentified company. My team and I were tasked with building a custom graph-based database and analytics API to examine user behavior. Although there was already a tool that addressed this topic, there was room for improvement to consume data faster. This project was valuable because it processed and retrieved data in real time, enhancing the latency of an existing solution. The project had two key components: the ingestion process to consume relevant data and API development to query and retrieve appropriate responses. At the end of our ten week internship program, our team delivered a working prototype that reduced the latency of consuming user data to real time.

While my STS research corroborates existing claims about how the gamification of online learning increases user motivation, there is still a lot of research that needs to be done. Some other interesting areas of research are (1) how intrinsic vs. extrinsic motivation correlate with engagement and (2) how gamifying online learning correlates with effective design of the user interface. While I am proud of developing two web applications and conducting an exploratory study, I think it would be valuable if more studies of this manner are performed to determine what specific gamification elements are most effective in increasing engagement. More research is also needed to carefully understand the ethical implications that could arise

with gamifying online learning to educate both the developers designing gamified online learning systems and individuals administering these systems. For the technical aspect, while my team and I were able to deliver a working prototype, there are still several next steps that need to be taken to complete the project and expand on it in the future. The first step would be to fully deploy all components of the project to production. In terms of future expansion, a few objectives we could focus on are creating a user interface for the API, deploying our API across multiple availability zones in AWS, and consuming from multiple data sources.

I would like to sincerely thank Professor Caitlin Wylie for helping me throughout my research. She guided me through the process of conducting the exploratory study and offered invaluable assistance. I would also like to thank the four individuals who agreed to be interviewed by me for the study. Their responses and interactions with the web applications provided meaningful insights.