CS6460: Project Proposal

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1 INTRODUCTION

My journey into educational technology began during my undergraduate studies when I became involved in the Tapestry Tool project. Over time, this project has evolved into an open-source online learning platform that has captured my fascination. What intrigued me most was its innovative graph-based structure, which simplifies the concept of content relevance through edges and nodes, transforming traditional teaching into a multidimensional and engaging experience. This unique approach harnesses the human memory's capacity for making correlations, thus enhancing the overall quality of Education. This experience has fueled my desire to explore the relationship between human cognitive-level instincts and learning and the possible role of Educational Technology within this sector.

Now, as a part of the CS6460 Research track, I am embarking on a research endeavour to investigate the pivotal role of educational software in fostering student engagement within online learning. My research will investigate how technology can effectively stimulate students' curiosity and intrinsic motivation, ultimately leading to increased engagement and improved learning outcomes to what extent. To achieve this, my primary focus will be on graduate students, chosen due to their practical feasibility for surveys and data collection and leveraging Duolingo as the tool to conduct my research.

This proposal aims to propose the work that has been done on the related topic, the research I will be conducting in the following weeks and the deliverables I will submit by the end of this semester.

2 RELATED WORK

I had spent the previous four weeks reading a wide variety of literature related to my research subject. I gained a lot of interesting findings that triggered deeper thinking about the relationship between human curiosity and learning, provided

value to my further investigations, and prompted more questions worth exploring.

Interactivity in Online Learning - In a study conducted by Ha and Im (2020), the positive impact of interactive online learning tools on student engagement and learning outcomes was underscored. These tools increased students' attention, curiosity, and interest in various learning activities. Additionally, Orcutt and Dringus (2017) discovered that instructors who demonstrate active interest, a passion for teaching, and an ability to connect course topics to students' interests and responsibilities are more likely to effectively engage students, inspire curiosity, and foster authentic relationships. Such qualities contribute to the creation of a positive online learning environment.

The Reward-Learning Framework - Building upon the foundation of curiosity and interest, Murayama, FitzGibbon, and Sakaki (2019) have delved into the Reward-Learning Framework, providing a theoretical framework for understanding these cognitive processes. Oudeyer, Gottlieb, and Lopes (2016) have also found that novelty, complexity, and prediction errors can enhance memory retention, indicating that the brain has neural circuits that treat information as an intrinsic reward.

The Role of Educational Technology - Educational technology is a neutral conduit for delivering information. However, its value lies in its ability to offer unique affordances that align with practical learning principles, as Yeung, Carpenter, and Corral (2021) highlighted. In response to the sudden shift to remote learning brought about by the pandemic, Karcher, Koltes, Wenner, and Wells (2022) propose innovative approaches to overcome the challenges posed by online Education.

Relevant studies suggest that online learning may be a future direction for Education. While this raises many challenges for educators and students, Educational Technologies bring more possibilities for engaging students in learning. The Reward-Learning Framework provides theoretical support for how Educational Technologies can improve student engagement. Exploring the extent to which Educational Technology can improve learning outcomes by ensuring students' commitment has essential implications for the future development of the Education system.

3 PROPOSED WORK

Detailed Task list can be viewed in *the Appendix*.

3.1 Hypotheses

In the context of distance learning, Educational Technology can increase students' engagement in learning by offering unique affordances, which in turn vastly improves learning outcomes.

3.2 Data Gathering

Utilizing Duolingo for my research presents an excellent choice. As highlighted by Luis von Ahn in his interview with Lindsay (Luis & Lindsay, 2023), the traditional approach to language learning, which they initially attempted with the first version of Duolingo, was perceived as dull and challenging to sustain motivation. Consequently, they transformed Duolingo into a levels-based gamified platform rather than a robotic learning tool. This aligns seamlessly with my educational philosophy and research interests. Furthermore, the fact that Duolingo is a free application eliminates the need for a budget to conduct my research.

Specifically, my research will commence by inviting a minimum of twenty CS6460 students to participate. These participants will be randomly assigned to either a control or treatment group. They will then embark on a two-month journey to learn a new language that differs from their native tongue. For instance, if a participant's native language is Chinese, I may recommend learning Portuguese; for Spanish speakers, Japanese may be suggested, and so forth. The control group will adhere to traditional learning methods, while the experimental group will use Duolingo for language acquisition. Yeung, Carpenter, and Corral's (2021) research is an exemplary model for designing experimental settings, data collection, and subsequent analysis to derive meaningful findings.

As the study's initiator, I will ensure that all participants possess no prior knowledge of the language they are assigned before commencing the study. The learning period will span from the first day of week 9 to the conclusion of week 14, with each participant dedicating half an hour daily for five weeks. During the first three weeks, participants will receive daily reminders via email, while the subsequent two weeks will allow participants to follow their schedules.

Additionally, I will solicit feedback from participants weekly, culminating in collecting final levels, badges, and other pertinent data in week 15.

3.3 Analyze Methods

As previously mentioned, the data collected from participants' weekly feedback will play a pivotal role in assessing student engagement. At the same time, their final Duolingo levels and badges will serve as primary indicators of learning outcomes. To comprehensively analyze this data, I will employ both quantitative and qualitative approaches:

1. Quantitative Analysis
    - *Engagement Assessment* - I will quantitatively evaluate the engagement levels of both the experimental and control groups by examining the participants' weekly feedback. This will encompass tracking how many participants in each group reduced the frequency of their learning or discontinued learning in any given week.
    - *Learning Outcome Evaluation* - I will quantitatively assess the participants' final Duolingo levels to gauge the extent of their learning outcomes.

    I will visualize the analysis results in selected forms of charts so my audience can have an intuitive overview of the findings.

2. Qualitative Analysis
    - *Understanding Learning States* - by collecting weekly feedback from participants, I will delve into understanding the participants' evolving learning states. This qualitative aspect will focus on identifying the obstacles and challenges encountered by participants during their learning journey.
    - *Reflection and Discussion* - towards the culmination of the study in week 15, I will invite participants to reflect on their overall learning experience and encourage them to raise any noteworthy points they believe are worth discussing in the future. This qualitative input will enable me to gain deeper insights into their perspectives, potentially shedding light on the future direction of Educational Technology.

By combining quantitative and qualitative approaches, I aim to comprehensively analyze the data, offering a multifaceted understanding of student engagement, learning outcomes, and participants' learning experiences in remote learning.

3.4 Fall-back Plans

I am considering the possibility of encountering challenges in recruiting enough CS6460 students for my research project initiation. To address this potential issue, I have devised the following solutions:

- *Early Engagement on Ed Discussion* - I will commence by crafting a post and actively engaging participants in Ed Discussion at the earliest opportunity. Additionally, I will enhance the visibility of this post by sharing it within the comments sections of other related posts. This proactive approach attracts participants and generates initial interest in my research.
- *Mobilizing External Help if Needed* - if I do not manage to secure a minimum of 20 participants by the commencement of week 9, I will enlist the assistance of my network, including friends, to ensure the research trial proceeds smoothly. While this approach will likely yield the required number of participants swiftly, it may diversify the study group beyond graduate students. The advantage of this diversity is that it could enhance the generalizability of my findings; however, the downside is the potential introduction of strata bias.

To mitigate any potential disruptions, I am actively developing both my primary recruitment and contingency plans. This includes drafting the Participant Recruitment post, which will be essential in attracting participants. Linking research participation to incentives such as participation points will brace students' motivation to engage in the ongoing studies, additionally supporting my project's success.

4 DELIVERABLES

I will produce several significant deliverables throughout my research to effectively document and communicate my progress and findings. These key deliverables include:

1. *Eight weekly status reports* – those will comprehensively outline the weekly progress, highlighting challenges encountered and any adjustments or refinements to the project's initial expectations.
2. *Two intermediate video milestones* - these presentations will showcase the achievements attained thus far in the research process, serving as pivotal checkpoints for receiving input and guidance for the subsequent phases.
3. *The Final Project* - the culmination of my research will result in a comprehensive final project, which includes:
    - *A final written paper* - this document will meticulously document the research process, present the findings of the analysis, and highlight any intriguing discoveries made throughout the study.
    - *A presentation* - I will deliver a presentation summarizing the key aspects of the final project, offering a concise overview of the research methodology, significant results, and their implications.
    - *Data and Methodology* - this will encompass test results from experiments, distributed surveys, and other pertinent research tools and methodologies.

While these deliverables represent the essential components of my research project, additional items may be incorporated as the research progresses. However, the elements serve as the foundational requirements for documenting and disseminating the outcomes of my research endeavours.

5 REFERENCE

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6 APPENDIX: TASK LIST