Synchronous at Scale: Investigation and Implementation of a Semi-Synchronous Online Lecture Platform

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ABSTRACT

Online classes and degree programs continue to grow in popularity, in part due to the increased convenience and accessibility of education that technology has provided in recent years. As online education scales upwards and outwards, there is an increased need to provide students with an engaging and collaborative learning experience. In some online learning environments, student collaboration is perceived to be more difficult than it is in a physical classroom setting due to cultural or geographic distance between students. In particular, online class lectures often lack the collaborative spirit seen in most in-person classroom lectures. To improve upon the online classroom experience, this project first examines the benefits and drawbacks of several in-person and online lecture delivery techniques, then proposes an online lecture platform that allows students to facilitate their own collaborative classrooms on-demand through a semi-synchronous viewing area and chatroom.

Author Keywords

Collaborative Learning; Social Learning; Distance Education; Online Degrees; Engagement

ACM Classification Keywords

K.3.1 Computer Uses in Education

INTRODUCTION

Online degree programs have evolved significantly in the past decade, but one aspect of the online learning experience has remained surprisingly resistant to change: online lecture platforms. Historically, over 90% of online lectures have been delivered asynchronously [10], with on-demand lecture content made available to students for maximum flexibility and convenience. Many online degree programs have adopted asynchronous lecture platforms with asynchronous, instructor-supported discussion forums for their strength in scaling upwards to larger class sizes. While the

asynchronous approach may work well for class forums that operate similarly to social media, asynchronous interactions detract from lectures, which have traditionally been delivered in-person and contain many synchronous, real-time interpersonal interactions between students and instructors alike. Research shows that class forums have been shown to correlate positively with student engagement while lecture videos correlate negatively [5], and online instructors sometimes perceive that class forums have replaced the lecture platform as a facilitator of student interactions within the online classroom [6], indicating that the asynchronous lecture methodology may need to be revamped to improve the collaborative learning process.

Critics of asynchronous platforms have argued that the online students using these platforms lack a sense of community, and that collaborative student interactions within these platforms seems forced [9]. In online learning communities, there is evidence that social learning contributes positively to student interactions and overall satisfaction in the class [8]. With social learning being especially challenging in an asynchronous environment, online students that learn primarily through asynchronous methods may be missing out on the social learning benefits that exist in traditional classrooms.

To address the perceived weaknesses within asynchronous lecture platforms, multiple researchers have investigated various lecture platforms that fit under the umbrella of synchronous learning: all users join a classroom at the same time and interact with each other in real time. Web conferencing systems are relatively widely adopted synchronous platforms which have been shown to increase interactivity compared to asynchronous lectures [2, 10], but some students encounter technical issues within these platforms which may discourage them from participating in the synchronous environment [7, 9]. A more niche form of the synchronous online classroom comes in the form of virtual reality: this technology provides a highly beneficial hands-on experience for kinesthetic learners, but students and teachers that adopt this platform must heavily invest into it with their own money and time [1].

This project introduces the concept of semi-synchronous lecture platform which attempts to combine the strengths and mitigate the weaknesses of the existing platforms that we observed. We envision that this platform will encompass the convenience and accessibility of an asynchronous platform

as well as the enhanced collaboration and interactions typically seen in a synchronous platform or a traditional classroom.

APPROACH

Needfinding

An initial needfinding survey was designed to learn about typical user engagement while watching educational videos. A majority of the 33 participants surveyed self-identified as multitaskers, which indicates that they might benefit from a social learning experience. Almost 3/4 of participants said that they regularly discuss educational videos that they watch, and only 1/4 of participants felt that online videos were more engaging than in-person discussions. These results indicated a potential need for a better solution than the existing asynchronous platforms.

Designing a Platform

With the feedback that we received during the needfinding cycle and additional assessments of Georgia Institute of Technology's specific needs, we set forth core values and design requirements for our platform. Decidedly, our most important requirement was to provide equity in accessibility to all of Georgia Institute of Technology's Online Master's in Computer Science (OMSCS) students, who reside in over 100 countries around the world and have varying levels of access to computers and stable, high-speed internet connections. This led us to design a lightweight platform that can perform smoothly on slow connections and be scaled across different device types.

The most important core value in the design of this platform was to provide the flexibility and convenience that students already experience within their existing asynchronous lecture platforms, and the resultant platform embodies our core values in several ways. During the needfinding process, some students mentioned that synchronous platforms did not provide them with enough time to watch lecture videos at their own pace, so the semi-synchronous platform aims to allow more flexibility for students to choose the pace of the lecture videos while still participating in the chat session. Class sessions reuse existing lecture videos and operate without a central presenter, which allows for students to facilitate their own sessions, for sessions to be available anytime, and for users with low-bandwidth internet connections to pre-download video content for a smoother experience. The text-based chatroom interface provides ease-of-use and avoids some of the audio-related technical issues seen in Reynolds's [9] study of synchronous conference platforms.

Figure 1 demonstrates the features of the platform, including its semi-synchronous capabilities, video area, and chatroom.

PRELIMINARY FINDINGS

The platform has been iteratively prototyped with our target demographic over the course of three stages: an initial prototype evaluation, beta testing of the platform, and an empirical evaluation of the platform against other collaborative lecture delivery methodologies.

Initial Prototype

The initial-stage prototype evaluation was performed with 36 students enrolled in Georgia Institute of Technology's OMSCS program. Participants were presented with three prototypes: a textual description of the platform, a video demonstrating the platform on a desktop computer, and a video demonstrating the platform on a mobile device.
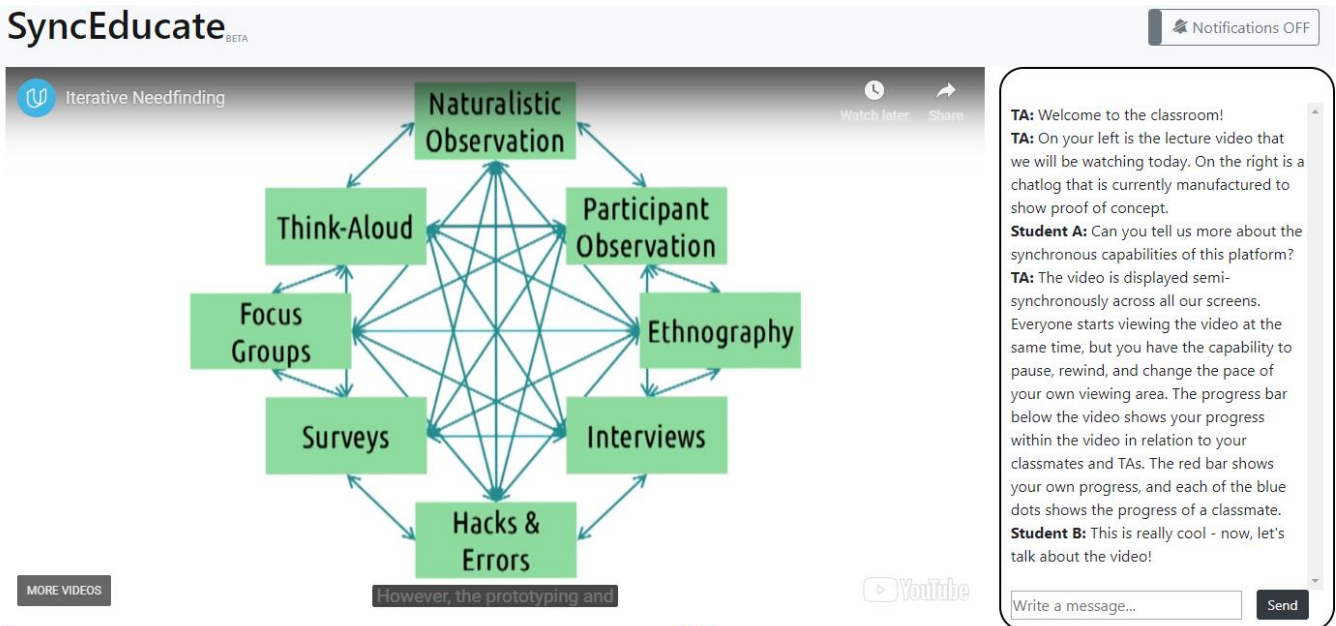
Figure 1. A classroom within the platform. The lecture is shown on the left side, with the student's individual progress displayed at the bottom and blue dots indicating each classmate's progress. The chatroom is on the right side, with a simulated conversation.

During the evaluation of the initial-stage prototype, 34 students (94%) indicated that they watched class lecture videos on at least a weekly basis. Reception towards the prototypes was mixed, with respondents having mixed-positive reactions to the textual and desktop prototypes and mixed-negative reactions to the mobile prototype.

When shown the desktop prototype, 25 respondents (69%) indicated that they would use the service on a regular basis. Participants like the ability to chat within the interface (12 mentions) and the live, real-time engagement that the interface provided (8 mentions). The most common complaint among participants (11 mentions) was that the chat feature was distracting and made it hard to concentrate on the video.

Several participants provided feedback asking for specific semi-synchronous features, such as the ability to pause and rewind the lecture video on their own screen. In contrast, only 12 respondents (33%) indicated that they would regularly use the mobile version of the platform based on the prototype shown. Most participants viewed the small screen size of a mobile device as a major detraction from both the video and chat content.

Beta Testing
The beta testing evaluation was performed with 17 students and 1 course instructor in Georgia Institute of Technology's OMSCS program. Students were shown an hour-long lecture video and were asked to complete a post-lecture qualitative survey at the conclusion of the video. 9 students (53%) completed the feedback survey. All 9 respondents found the platform at least somewhat engaging and indicated that they were willing to use the platform again.

Multiple respondents suggested that they especially enjoyed interacting live with the course instructor, which somewhat contradicts the ideal end-goal of an entirely student-facilitated platform. However, this feedback indicates that students value the opportunity to interact with instructors during a lecture, and this could potentially be facilitated by adding asynchronous instructor-discussions to further enhance student engagement within the platform.

Students generally enjoyed the collaborative aspect of the platform, but when asked for constructive feedback, some students asked for the platform to be made fully synchronous, while others asked for the platform to be made fully asynchronous. We hypothesize that the varied student sentiments towards the platform may potentially be due to differences in learning styles.

Students who self-identified as visual learners most vocally mentioned their desires to have an asynchronous platform where they could chat about the video. There is some existing evidence that one's learning styles may affect their participation in an online learning environment [3], but limited knowledge about the best lecture delivery method for students identifying with a particular learning style.

In the initial prototype evaluation, students indicated that they were not interested in a mobile interface for semi-synchronous lectures. However, in the beta testing phase, the mobile feature was largely requested, indicating that students may want to experience collaborative learning in more versatile contexts.

Empirical Evaluation
The data collected from our initial rapid prototyping phase indicated that a desktop version of the semi-synchronous learning platform could potentially enhance the online learning experiences of some students. As such, we decided to conduct an empirical evaluation comparing the semi-synchronous platform with a fully-synchronous virtual reality classroom and fully-asynchronous email threads. Previous research has shown that synchronous virtual reality lecture platforms are effective methods of content delivery, though many have noted that the collaboration between students within these synchronous environments is mostly text-based [7], raising the question of whether a fully synchronous platform is actually needed.

We have completed four hour-long collaborative sessions on our semi-synchronous lecture platform, with a total of 55 students enrolled in Georgia Institute of Technology's OMSCS program participating. The primary goal of these sessions has been to analyze organic student interactions within the semi-synchronous platform as they relate to interactions within the fully-synchronous and fully-asynchronous lecture delivery methods. We hypothesized that the presence of a course instructor within the semi-synchronous session had affected the ways that students interacted within the platform during our beta tests, so the course instructor disguised themselves as a student in each of the sessions that they attended.

Participation within the semi-synchronous platform was higher overall than participation within the fully-synchronous virtual reality platform, but some of the most substantive conversations were occurring through the fully-asynchronous email conversations. During each of the four semi-synchronous lecture sessions, students mainly discussed the technical details of the platform itself and their qualitative feedback towards the design of the platform, rather than the contents of the lecture video. This suggests that the semi-synchronous platform may need more directed conversation topics and heavier moderation so that the discussions can remain focused on the lecture material.

21 students (38%) opted to leave feedback for the platform at the conclusion of the lecture. 10 of those students voiced concerns about the pace of the lectures; however, these students were split between desiring a quicker pace and a slower pace for themselves. Some students felt like they were pressured to follow the pace of their classmates. Ideally, the semi-synchronous platform could be improved so that these students feel empowered to complete the lecture videos at their own pace.

FUTURE WORK

The empirical evaluation of our platform is ongoing; additionally, we are asking students to qualitatively evaluate the platform and provide us with feedback and feature requests. The larger goal of this research project is to determine how to viably increase student engagement, participation, and collaboration in online degree programs. Whether or not our empirical evaluations suggest that semi-synchronous lecture platforms are most helpful at facilitating these interactions, there are still plenty of learnings that can be obtained by comparing the platform to fully-synchronous and fully-asynchronous collaborative methodologies.

Another area for experimentation is the correlation between student learning styles and student perceptions and interactions in the platform. Our preliminary evidence suggests that students that identify with certain learning styles may prefer either synchronous or asynchronous learning, and more evidence could be collected to understand the quality of student contributions and engagement with these platforms as it relates to their learning style.

As we scale the platform to a larger audience, we plan to augment the chatrooms with top comments from other sessions and interactive mini-assignments within the lecture videos, so that students who attend sparsely-populated sessions will still have the opportunity to utilize the collaborative aspects of the platform. There is evidence that structured discussions and interactive thought-provoking questions can increase learning and comprehension in large-scale synchronous learning settings [4], so a feature that extracts and promotes substantive commentary in the chatroom could prove to be successful in our semi-synchronous learning environment as well.

CONCLUSION

The semi-synchronous lecture platform that we have developed has provided us with significant learnings relating to online student engagement and interactions based on learning styles. It has also received positive reception from students who participated in the beta testing and empirical evaluations, indicating that it may be a suitable replacement or supplement to an online student's traditional asynchronous lecture platform. We envision a future where semi-synchronous lecture sessions are entirely moderated by students themselves, with hourly lecture sessions and top-voted comments from each session appearing in all future sessions of the same lecture.

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