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Exploring Learners' Video Interaction in edX Computer Science MOOCs

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Abstract In order to understand the interaction of a learner watching an online course video lecture, the learner's mouse clicks were logged. The clickstream data of video interactions from two edX online courses on '*Introduction to Computer Science and Programming*' in English and Japanese was analyzed. Results show that programming exercise related videos tend to have more learner interactions compared with lecture videos. Additionally, more video interactions based upon learner clicks were observed for videos with a shorter length. These trends were observed for both Japanese and English courses. In order to make online course videos more engaging to learners, shorter videos with programming exercises are preferred.

Keyword: Computer Science, Clickstream Data Mining, Data Analysis, MOOCs, Online Course, edX

1. Introduction

Massive Online Open Courses (MOOCs) have a great potential to enhance learning both academically and professionally [1]. Exploring MOOCs' learner interaction with the online course creates a bigdata set that is correlated with Learning Management System (LMS) content and allows a deeper understanding of learners' behavior and engagement which permits data extraction [2]. In this paper, we compare learner's video interactions data obtained from two computer science courses that were created at Tokyo Tech and hosted on edX. One goal of our analysis is to verify the existence of any differences in video interactions between lecture videos vs programming exercise videos. A second goal is to assess the impact of video length on video interactions. Finally, this analysis also allows an investigation as to whether there are differences in terms of video interaction between courses in Japanese in comparison to courses in taught in English.

2. Methodology

This study covers two edX MOOCs provided by Tokyo Institute of Technology (Tokyo Tech) entitled *'Introduction to Computer Science and Programming'*. Both courses are from the same instructor, one course is offered in English (CSE101X) and one course is taught in Japanese (CS101X). The English course is a revised version of the Japanese course. The number of enrolled students in each of these courses along with the total number of videos per course is shown in Table 1.

Table 1 Tokyo Tech edX Computer Science and Programming Courses

	Language	Videos	Students	LMS
CS101X	Japanese	44	2010	edX
CSE101X	English	60	3192	

Clickstream data generated on edX and stored in the form of daily logs was downloaded for each course. The data was anonymized to protect learners' privacy and then video interaction events were extracted. We distinguish 5 types of video interaction events: (i) *Play Video* (ii) *Pause Video* (iii) *Stop Video* (iv) *Show Transcript* (v) *Hide Transcript*. In this work we consider the total number of events for each video. The number of active learners and also the video length varies immensely. To get a better understanding of variation of video interaction across videos, interactions were normalized i.e., the total number of interactions for each video per active learners and per video length in seconds. An active learner is defined as a learner who interacted with the video at least once.

3. Results and Discussion

Figure 1 shows the normalized interactions per video for the Japanese course (CS101X). It can be noticed

that the normalized interactions for exercise videos is higher than that of lecture videos. For the Japanese exercise videos, the mean of normalized interactions is 0.029 event per student per second and for Japanese lecture videos the mean of normalized interactions is 0.020 event per student per second.
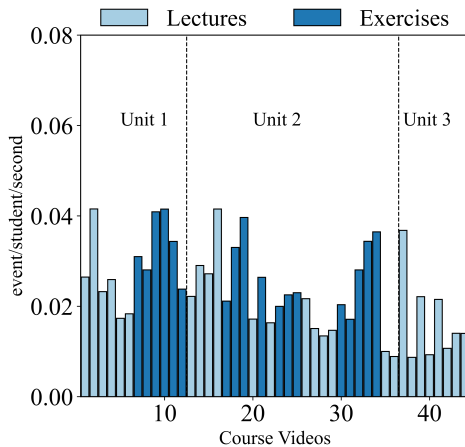

Figure 1 Video interaction in the Japanese Course CS101X

On average, in the Japanese course, exercises have 43% higher normalized interactions compared with the lecture videos. In a similar trend, we can notice in Figure 2 that exercise videos in the English course (CSE101X) show higher interactions. The mean of normalized interactions for exercises in English is 0.047 and for lectures it has a value of 0.032 interactions per student and per second.
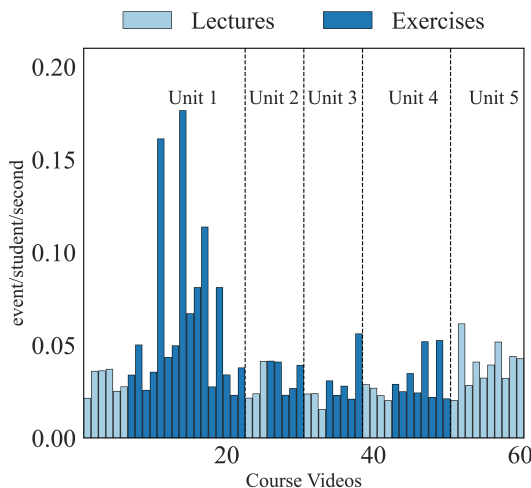

Figure 2 Video interactions in the English course CSE101X

On average, exercise videos have 51% more interactions compared to lecture videos in the English course. Figure 3 shows the normalized
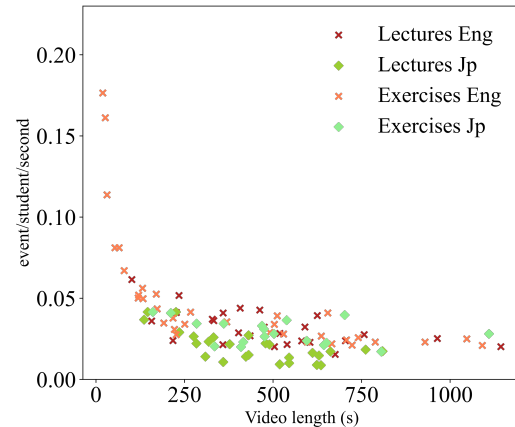

Figure 3 Interactions of all videos as a function of video length

interactions for all videos (lectures and exercises) in both courses (English and Japanese) as a function of the video length (in seconds). It can be clearly seen that the shorter the video length, the higher is the number of interactions per student and per second. This can mean that shorter videos are more engaging compared to longer videos.

4. Conclusions and Future Work

In this work, video interaction clickstream data of two course was preprocessed and analyzed. The data shows that exercise videos have more interactions compared to lecture videos in both English and Japanese courses. This could mean that, regardless of the instruction language, content with hands-on activities (programming exercises in this case) is more engaging in comparison to lectures. The video length appears to be an important factor affecting overall learner interactions with videos. In this work, however, we cannot conclude that higher interactions are certainly an indicator of a better content. More work on the different types of interactions in combination with content quality assessment e.g., text readability can provide more insights into students' behavior.

5. References

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