Understanding How Video Interaction Data Predicts Academic Performance: A Preliminary Study

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Abstract

Video lecture is one of the most preferred learning resources in e- learning environments. Limited studies have investigated how video interaction data had an impact on learning performances. There is a gap in research pertaining to the relation between video interaction data and learning performance in real learning context. The purpose of this preliminary study is to explore how video interaction data of learners predict their learning performance. It has been founded that all variables reflecting video navigation behaviours of learners show a statistically significant relation to academic performance but not strong correlation. doSeek and viewing after feedback were significant in predicting the learning performances of the students. The regression model accounted for 35.2% of the variance in the learning performance. Our preliminary study could make contribute to a better understanding the relationship between video interaction data and learning performance.

Keywords: video based learning; video lecture; learning behaviours; learning performance

Introductıon

In recent years, millions of learners have attended open courses offered by different universities and have participated in online communities for the courses along with thousands of international learners with time and place flexibility. In these courses, various electronic content and multimedia have been used any time from anywhere such as e-book, video lecture, content packages, pictures, animation, and simulation. Especially, video lectures are the most prominent learning resources since they have been widely used multimedia in open and distance learning environments (Giannakos, 2013). Online video lectures often provide learners to enrich learning experience with content combining visual and verbal and to allow using them repeatedly (Chen & Wu, 2015; Mayer, 2009). E-learners can interact with video lectures at their own pace whenever they want to view in open online learning environments. Interaction and pacing that improve the educational added value of video lectures are the main essential features of video lectures (Kokoç & Altun, 2014; Sadik, 2015).

In addition to video-based learning environments such as MOOCs and Khan Academy, video platforms like YouTube and Vimeo can be used individually or collaboratively for educational purposes (Kleftodimos & Evangelidis, 2016). Widely using video in learning has led to emerging a research field named as video-assisted learning and video-based learning. In this study, it has been preferred to use video-based learning as a concept. Numerous studies in video-based learning field indicated that using video lectures in the learning process increased learners' involvement, course satisfaction, motivation and interest in learning (Giannakos, Chorianopoulos, &

Chrisochoides, 2015; Donkor, 2011; Hsin & Cigas, 2011; Kurtz, Tsimerman, & Steiner-Lavi, 2011; Traphagan, Kusera, & Kishi, 2010) and the students regarded video lectures as useful and enjoyment (Boateng et al., 2016; Fee & Budde-Sung, 2014). On the other hand, a number of studies claim that using video lectures lead to absenteeism and procrastination (Griffin, Mitchell, & Thompson, 2009; Traphagan, Kusera, & Kishi, 2010) and had no significant effect on attendance and academic performance of learners (Leadbeater, Shuttleworthb, Couperthwaitec, & Nightingale, 2013; Wieling & Hofman, 2010). These different results show that there was mixed evidence about the efficacy of video lectures on learning outcomes (Bos, 2016). Thus, new studies should be made to investigate the efficacy of video lectures in learning considering learning outcomes and new data sources from learners.

Together with the importance of studies on using video lectures, this study may shed light on understanding the learning process with video lectures by analyzing video interaction data of learners. During viewing video lectures, the interaction between learner and video lectures occur due to the progress bar on the video interface. Learners interact with video lectures performing various actions such as playing, pausing, resuming, backward and forward jumps using the progress bar (Kleftodimos & Evangelidis, 2016). In this context, video learning analytics studies provide the opportunity to researchers deeper understanding interaction learners and video lectures. It is clear that how students learn via video lectures is still a critical question to gain insight into the efficacy of video lecture in learning (Giannakos, Chorianopoulos, & Chrisochoides, 2015). Thus, video learning analytics may contribute to answering the important question based on interaction data of learners as the objective data source.

As aforementioned, a large number of researchers have studied using video lectures for learning context based on self-report data in the last decade. A review study on video lectures showed that mixed results revealed regarding the impact of video lectures on learning outcomes in the literature (O'Callaghan, Neumann, Jones, & Creed, 2017).

Additionally, limited studies have investigated how video interaction data or video navigation behavior of learners impact on learning performance. There is a gap in research pertaining to the relation between video interaction data and learning performance in a real learning context. The purpose of this preliminary study is to explore how video interaction data of learners predict their learning performance. To do this, the correlation between video interaction data and learning performance has been calculated at first. Then, it has been explored which video interaction data predicts the learning performance of learners. This study as a part of our ongoing research aims to answer the following research questions:

Research Question – 1: What is the relationship between video interaction data and learning performance?

Research Question – 2: Which video interaction data predicts the learning performance of learners?

Method

The participants in this study were 101 undergraduate students enrolled in an undergraduate course recruited from a major state university in Turkey in 2016; 48 were female, and 53 were male among the volunteer participants. No participants had prior knowledge of the topic presented in the videos.

The Computer Networks and Communication course delivered online, in this study. The study took five weeks. The goal of the course was to understand conceptional and applied knowledge of OSI Model, TCP-IP, IPv4, IPv6. The course adopted an online learning context included 10 video lectures developed by the instructor during the study procedure. The students accessed the video lectures weekly via a video-based learning environment. The video lectures were designed associated with two video lecture types including talking head (half of all) and picture-in-picture. Figure 1 illustrates each example of the video lectures with two types.

The length of video lectures is ranging from six to 12 minutes. The students viewed the video lectures and participated in a quiz consisting of 12 questions relevant to the content of the video lectures, weekly. After completing the quiz, feedback was given to the students with information about their false answers in the quizzes. The students were directed to the related video lecture with feedback. For an example, when a student did not answer correctly the question about the function of the layer 3 in OSI Model, feedback directed him to view at the third minute seventh second of the relevant video lecture. That was not a mandatory feedback and student can view the video lecture given in the feedback if she wants.

The data sources of the study consisted of the video interaction data and learning performance of the students as provided by the exam results. The learning performance was evaluated by using the results of the second mid-term exam consisting of 15 multiple-choice questions and 10 open-ended questions. The video interaction data gathered from log data reflecting video viewing behavior of the students. Sample screenshots have been presented in Figure 1.

Figure 1. Illustrations of video lecture types

A detailed description of events indicating each video interaction data is provided in the Table 1.

Table 1. Description of events in video lectures

Event Type	Event Description
Viewing at once	Completely watching a video lecture at once
doSeek	Dragging a video lecture from one time point to another time point
doPlayPause	Clicking the play and pause button
Total Viewing Time	Total time of watching all video lectures
Viewing After Feedback	Playing the relevant video lecture shortly after received feedback

Results

Correlation Analysis

The results of the correlation analyses of the study variables are presented in Table 2. The correlation analysis was conducted prior to multiple regression analysis to find out correlations among the independent (video navigation behaviors) and the dependent variable (academic performance) (See Table 2).

Table 2. Correlation analysis (n=101)

Variables	1	2	3	4	5	6
Learning Performance	1.00					
Viewing at once	.378	1.00				
doSeek	.400	.541	1.00			
doPlayPause	.487	.718	.459	1.00		
Total Viewing Time	.389	.640	.348	.914	1.00	
Viewing After Feedback	.556	.497	.290	.672	.587	1.00

The correlations between video navigation behaviour of the students and and their learning performance are presented in Table 2. It has been founded that the all variables reflecting video navigation behaviours of learners show a statistically significant relation to academic performance but not strong correlation. These positive correlations suggest that the more frequently a student engaged with the videos the higher they tended to obtain.

Multiple Regression Model

To address the second research question, the four variables indicating video interaction data were selected as predictors, and a multiple regression analysis was conducted to examine the predictability of the learning performances of the students.

A series of tests were performed to examine the assumptions that may affect its reliability before performing the multiple regression analysis. The tolerance values were above 0.10 for all the variables confirming the absence of multicollinearity and also the VIF values were below 10. The Durbin-Watson statistic verified the absence of autocorrelation (Durbin-Watson = 1.67).

As presented in Table 3, doSeek (β=.628, p=.011) and viewing after feedback (β =.335, p=.003) were significant in predicting the learning performances of the students. The regression model accounted for 35% of the variance in the learning performance (R^2=.35, F (5,.95) = 11.84, p< 0.001).

Table 3. Results of multiple regression analysis

Predictors	**Academic Performance**			
	B	**SE**	***β***	**R^2**
Constant	33.71	2.989	-	.352
Viewing at once	-.105	.314	-.039	
doSeek	.628	.241	.251*	
doPlayPause	.009	.007	.197	
Total Viewing Time	-.015	.054	-.035	
Viewing After Feedback	.335	.109	.377**	

** p < .01. * p < .05

The remaining variables, viewing at once, doPlayPause, and total viewing time did not make significant predictions to the learning performances of the students.

Discussion and Conclusion

Recent studies have suggested that using video lecture in education can enhance learning outcomes and support the learning process with flexibility and pacing. For all that, the studies indicate that the impact of using video lectures on learning performance is not clear. To the best of our knowledge, currently, there are limited studies about this subject using video interaction data. In this preliminary study, it has been aimed to explore which video interaction data predict learning performance of learners.

The results of the study indicate that two indicators from the video interaction data significantly predicted the learning performance. However, watching the video lecture at once, clicking the play and pause button, and total viewing time was not significant. The regression model with two variables explained 35.2% of the variance in the learning performances. These findings support those of previous research (Ozan & Özarslan, 2016), which has emphasized that video lecture viewing behaviors of learners effect on exam score.

One interesting finding is that watching the video lecture depending on received feedback predicted the learning performance. This result may be explained by the fact that quiz feedback could increase learners' engagement in the video-based learning environment and might lead to goal-oriented viewing behavior that provides better learning with video lectures. Another important result was that dragging the videos from one-time point to another time point predicted the learning performance significantly. This result, while preliminary, suggests that seeking behavior may provide learner to gain a deeper understanding of course content in video lectures (Bos, 2016).

The study is a preliminary research that was limited in terms of one specific course with one group of students and not considering learners' characteristic. Further studies, which take the more video interaction data types and individual differences of learners into account, will need to be undertaken.

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