Routledge
Taylor & Francis Group

Educational Media International

ISSN: 0952-3987 (Print) 1469-5790 (Online) Journal homepage: http://www.tandfonline.com/loi/remi20

Video lecture watching behaviors of learners in online courses

Ozlem Ozan & Yasin Ozarslan

To cite this article: Ozlem Ozan & Yasin Ozarslan (2016) Video lecture watching behaviors of learners in online courses, Educational Media International, 53:1, 27-41, DOI: 10.1080/09523987.2016.1189255

To link to this article: http://dx.doi.org/10.1080/09523987.2016.1189255

EDUCATIONAL MEDIA INTERNATIONAL, 2016
VOL. 53, NO. 1, 27-41
http://dx.doi.org/10.1080/09523987.2016.1189255

Routledge
Taylor & Francis Group

Video lecture watching behaviors of learners in online courses

Ozlem Ozan and Yasin Ozarslan

Communication Faculty, Department of New Media, Yasar University, İzmir, Turkey

ABSTRACT

This paper examines learners' behaviors while watching online video lectures to understand learner preferences. 2927 students' 18,144 video events across 13 courses on Sakai CLE LMS, which were integrated with Kaltura Video Platform and Google Analytics, were analyzed. For the analysis of the quantitative data, one-way ANOVA, Chi-square test of independence and descriptive statistics were utilized. The main results revealed that there was a tendency toward watching interview-style video lectures completely. In addition, the percentage rate of *Watching Completely* behavior was higher in shorter videos, and a tendency toward watching long video lectures by seeking was found. According to our results, watching patterns was also affected by lecturers' characteristics. *Watching Completely* rate of female lecturers was significantly different than those of male lectures in favor of females, as well as watching in *FullScreen* mode. Furthermore, learners, who watched online video lectures completely, had higher scores on the final exam than others. Our analysis could help those who plan to optimize online video lectures in e-learning programs.

ARTICLE HISTORY
Received 1 January 2016
Accepted 6 May 2016

KEYWORDS
Video lecture; watching behavior; online course; video event analysis

1. Introduction

The traditional role of video in education has changed as videos can be embedded in web pages (Caladine, 2008). In addition to web pages, content management systems and learning management systems (LMS), as distribution platforms of video, facilitated contextualization and the use of video as educational media. Developments in technology, lower production costs, easier technical requirements, and increasing access intrinsically make video a perpetual component of e-learning. In the last decade, open educational resources movement, massive open online courses, and a worldwide increase in the prevalence of open and distance education have created millions of learners, who watch video lectures from different platforms on a diverse number of terminals (desktop, phone, tablet). Online video lecture has emerged as one of the premier open educational resources (McGreal, Sampson, Chen, Krishnan, & Huang, 2012). They are used in many organizations, educational institutions, and open learning systems, such as Coursera, edX, Khan Academy, and TED.

Since well-designed video has been shown that can lead to high-level learning (Chen & Sun, 2012), improving the effectiveness of online video lectures has become a necessity as

CONTACT Ozlem Ozan ozlem.ozan@yasar.edu.tr

web-based video has gained more and more dominance in learning process. Despite the growing number and variety of online video lectures available, there is a limited understanding of the nature and quality of their effectiveness (Giannakos, Chorianopoulos, & Chrisochoides, 2015). Although many educational organizations create and share video lectures, the merits and limitations of each video lecture type for online learning have not yet been thoroughly investigated (Chen & Wu, 2015) and no conventional standard and guideline are available to create effective online video lecture (Ilioudi, Giannakos, & Chorianopoulos, 2013).

If we want to improve any aspect of students' learning from video, it is inevitable to typify and understand how they differ in their learning preferences (Yang & Tsai, 2008). The analysis, which is shared in this paper, was conducted to investigate how learners interact with video lectures in our system. We tried to find out how learners differed in their learning preferences and what patterns in viewing video could be detected in log files. Our research examines learners' behaviors while watching video lectures. We focused on the information (video data, video events, and learner profile), which we could acquire from log files. We parsed the raw video data as video lecture type, video lecture length, and lecturers' characteristics to define features of video lectures. After that, we asked the research questions below to detect the behaviors in viewing online video lectures and to see if final exam scores differ significantly with respect to those behaviors:

- Do the online video lecture watching behaviors differ significantly with respect to video lecture type, video lecture length, lecturers' characteristics, video events, and learner profile?
- Do final exam scores differ significantly with respect to the online video lecture watching behaviors?

The aim of this study was to understand learners' online video lecture watching behaviors in the system as the first phase of a research project that investigates how online video lectures can be designed optimally to enhance students' learning.

2. Background and related work

Using video in open and distance learning could be traced back, as early as the 1940s, to the introduction of television as an instructional medium (Delen, Liew, & Willson, 2014). Since then, there have been numerous improvements in video technology. As a result of increase in resolution quality, and delivery speed (Maniar, Bennett, Hand, & Allan, 2008), multimedia and communication (Wieling & Hofman, 2010; Zhang, Zhou, Briggs, & Nunamaker, 2006), and online video streaming (Hartsell & Yuen, 2006), video-based learning has advanced from passive linear broadcasting to an engaging interactive video experience for learners (Merkt, Weigand, Heier, & Schwan, 2011; Shephard, 2003).

Video is a powerful medium in education and video-based learning promotes the learning outcome (Yousef, Chatti, & Schroeder, 2014). It can be used for several purposes in educational settings such as showing authentic archive material and cases, simulating an event such as a lab experiment, engaging in a role-playing, demonstrating how to do something, lectures, and seminars (Asensio et al., 2006; Halls, 2012). Some researchers report that students find an instructional video attractive and take them to higher degrees of satisfaction (Kearney & Treagust, 2001); it increases learners' interest in a learning topic and motivation

to learn a new subject (Wetzel, Radtke, & Stern, 1994) and student's autonomy (Albó, Hernández-Leo, Barceló, & Sanabria, 2015). However, videos sometimes fail to satisfy individual learning needs, such as the user's inability to control the video's timing (Haas, Brown, Cao, & Wilbur, 2005), to extract the relevant information (Lowe, 1996), to emphasize the important part of the action (Catrambone & Seay, 2002), or to find and select the contents' key points (Despotakis, Palaigeorgiou, & Tsoukalas, 2007). Therefore, we found it necessary to investigate how online video lectures should be designed to optimally enhance students' learning. What should optimum length be? In which format should online video lectures be designed? Some of them are in talking head style, some in presentation or interview style. In technical courses, screen recording is frequently preferred, such as Khan Academy. Are lecturer's characteristics important for the learner? Although many researches investigate video in educational settings, few of them focus on video analytics of learners' video viewing in online courses as big data (Chen & Wu, 2015; Chorianopoulos & Giannakos, 2013; Danielson, Preast, Bender, & Hassall, 2013; Giannakos et al., 2015; Guo, Kim, & Rubin, 2014; Harrison, 2015; He, 2013; Ilioudi et al., 2013; Kim et al., 2014; Mongy, 2007). The question addressed in this study is whether the properties of online video lectures would form any differentiation in learning that we can detect from log files.

3. Methodology

Data were gathered from user sessions, which belong to 13 online courses. The courses were delivered via Sakai CLE LMS, which was integrated with Kaltura Video Platform and Google Analytics. Video watching sessions of learners were extracted from course data and analyzed. Video watching session represents a single instance of a student watching a particular video (Guo et al., 2014). Each session contains username, gender, department of learner, course code, video ID, video view duration, numbers of play, pause, and skip attempts. 18,144 video events of 2927 students were analyzed.

3.1. Course selection

University Foundation Courses, which are delivered online, were used as the case in this study. Foundation Courses are incorporated into the curriculum of the University to assist students in gaining essential skills. Foundation courses have been created with the goal of helping students build a strong base for their education and life. They are divided into three categories as Human Sciences, Cultural Awareness, and Social Responsibility. Students have to take at least one course in each category before they graduate from bachelor programs. The Philosophy and Activities courses are awarded two (2) and one (1) ECTS credit, respectively. There are a total of 16 lessons in the foundation course program. Thirteen of them were selected as the case in this study, since they contained video materials. The number of student enrollment in the selected courses in terms of faculty and vocational school program in Fall 2015 are shown in Table 1.

Each course consists of seven modules. Module materials are composed of a textbook chapter (or articles), a video lecture, and a self-evaluation test as shown in Figure 1. Students are free to study from either textbook (or articles) or video lecture. Watching video lectures are not obligatory. In self-evaluation tests, students come across 10 different random questions from a question pool at each attempt, attending this self-assessment activity is

Table 1. Enrollment numbers and final score averages with respect to departments, courses, and gender.

	Courses													Learners' gender		Total # of student	*Final score Average*
Departments	UFND10A	UFND10B EN	UFND10C EN	UFND20 EN	UFND20A	UFND30A	UFND30A EN	UFND40A	UFND40A EN	UFND50A	UFND50A EN	UFND60A	UFND60A EN	Female	Male		
Enrollment																	
Science & Letters		50	13	17			24		35		16		30	147	38	185	79
Law	57	14	21	32	120	87	18	55	12	70	15	88	2	345	246	591	77
Economics		89	58	156			132		112		57		54	332	326	658	67
Communication		14	11	27			41		26		16		15	76	74	150	73
Vocational School	84	1			83	57	3	19	2	45		14		129	179	308	73
Architecture		29	14	97			89		58		37		35	225	134	359	66
Engineering		44	27	107			116		88		57		60	167	332	499	78
Art and Design	36	6	2	2	28	29	3	27		19		25		77	100	177	71
Grand total	177	247	146	438	231	173	426	101	333	134	198	127	196	1498	1429	2927	73
Gender																	
Female	94	136	76	211	101	87	216	60	168	64	117	62	106			1498	73
Male	83	111	70	227	130	86	210	41	165	70	81	65	90			1429	72
Grand total	177	247	146	438	231	173	426	101	333	134	198	127	196			2927	73
Final score average																	
Female	79	76	57	47	84	83	78	57	81	75	79	70	87			1498	73
Male	79	80	59	43	80	81	82	49	81	76	80	73	87			1429	72
Average/grand total	79	78	58	45	82	82	80	54	81	75	79	72	87			2927	73

Notes: UFND 010A Behavioral Sciences, UFND 010B Semiology and Semantics, UFND 010C History and Philosophy of Science, UFND 020 Research Culture, UFND 030 Design Culture, UFND 040 Aesthetic Culture, UFND 050 Ethic Culture and UFND 060 Project Culture.

Source: Reproduced with permission from The Center for Open and Distance Learning of Yasar University, İzmir/Turkey.

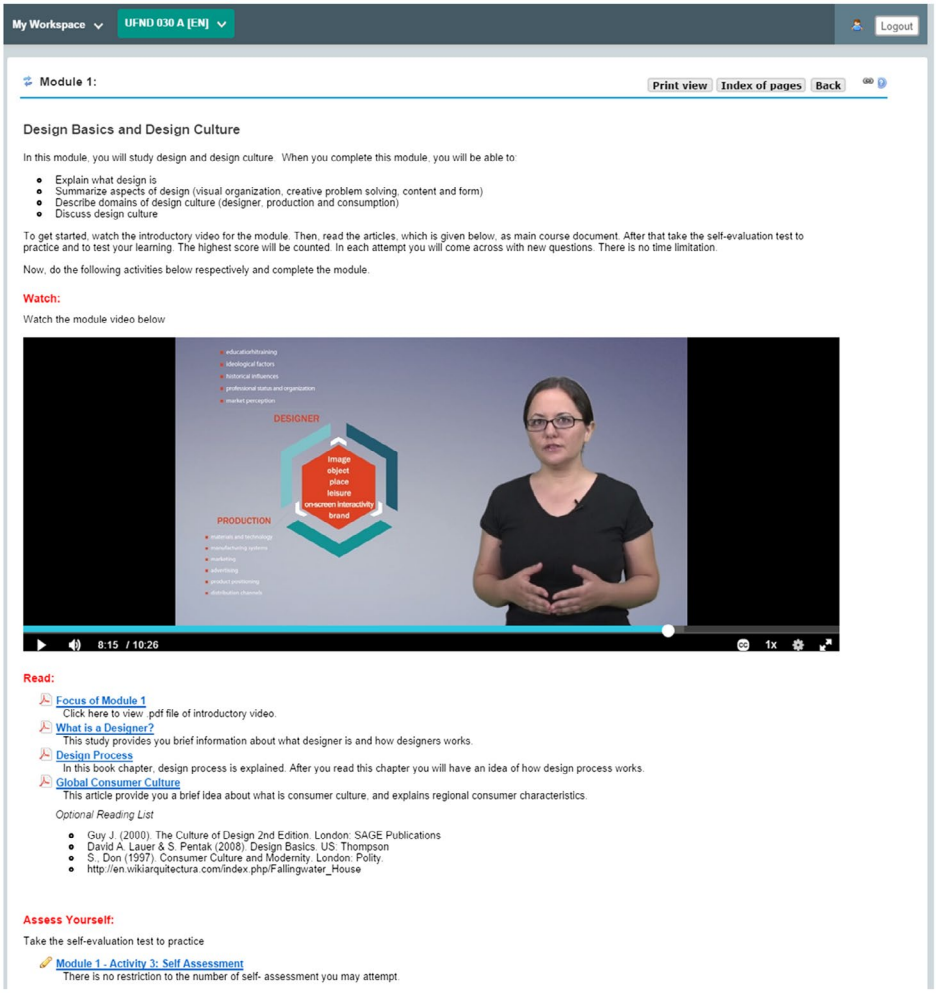

Figure 1. A screenshot of one of the course modules. The courses are all a combination of written instruction, textbook chapter (or articles), a video lecture, and a self-evaluation test.
Source: Reproduced with permission from The Center for Open and Distance Learning of Yasar University, İzmir/Turkey.

Figure 2. Interview-style video lecture. *Type 1 – Interview style:* This is a recording of dialog with a lecturer or domain expert as shown in Figure 2. It has a similar approach to bringing a guest speaker into the classroom to provide further discussion.
Source: Reproduced with permission from The Center for Open and Distance Learning of Yasar University, İzmir/Turkey.

Figure 3. Talking head-style video lecture. *Type 2 – Talking head style:* This is a recording of a lecture in which the main focus is the teacher who speaks directly to the camera as shown in Figure 3.
Source: Reproduced with permission from The Center for Open and Distance Learning of Yasar University, İzmir/Turkey.

Figure 4. Presentation-style video lecture. *Type 3 – Presentation style:* This is a recording of a lecture in which the lecture uses PowerPoint presentation, visuals, or audio to organize ideas to facilitate information processing as shown in Figure 4.
Source: Reproduced with permission from The Center for Open and Distance Learning of Yasar University, İzmir/Turkey.

voluntary. Course evaluation is based on summative assessment and, learners take a final examination at the end of the course.

3.2. Video data

Video data include video lecture type, video lecture length, and lecturers' characteristics and video events.

3.2.1. Video lecture type

Common online learning media include different types of video lectures such as talking-head style, presentation style, picture-in-picture style, voice-over presentation style, Khan style tutorial, video screencast of the instructor (Chorianopoulos & Giannakos, 2013; Danielson et al., 2013; Griffin, Mitchell, & Thompson, 2009; Guo et al., 2014; Ilioudi et al., 2013; Wiese & Newton, 2013) and interview style. There were 3 types of video lectures in 13 online courses, which were examined in this study, as follows:

Table 2. Video event numbers with respect to learners' gender, video lecture type, lecturers' age, lecturers' gender.

Video events	Total # of events	Learners' gender		Video lecture type			Video lecture length (min)			Lecturers' age		Lecturers' gender	
		F	M	Type 1	Type 2	Type 3	<10	10–30	>30	=<40	>41	F	M
Media ready	18,144	9344	8800	1512	6580	10,052	8318	8811	1015	10,287	7857	10,168	7976
Do play	10,282	5483	4799	782	3843	5657	4695	5140	447	5895	4387	5800	4482
Do pause	7852	4213	3639	591	2911	4350	3620	3936	296	4589	3263	4411	3441
Do seek	5700	2847	2853	414	2052	3257	2459	2945	296	3339	2361	3104	2596
Full screen	511	236	275	47	165	299	209	273	29	332	179	294	217

Table 3. Video lecture watching behaviors with respect to learners' gender, video lecture type, lecturers' age, and lecturers' gender.

Watching behavior	Total # of events	Learners' gender		Video lecture type			Video lecture length (min)			Lecturers' age		Lecturers' gender	
		F	M	Type 1	Type 2	Type 3	<10	10–30	>30	=<40	>41	F	M
Not watching	7862	3861	4001	730	2737	4395	3623	3671	568	4392	3470	4368	3494
Looking over	4881	2714	2167	337	1849	2695	2136	2522	223	2717	2164	2741	2140
Watching by zapping	3665	1773	1892	245	1308	2112	1552	1921	192	2190	1475	1984	1681
Watching completely	1736	996	740	200	686	850	1007	697	32	988	748	1075	661
Grand total	18,144	9344	8800	782	3843	5657	4695	5140	447	5895	4387	5800	4482

3.2.2. Video lecture length

There was no standardization in video lecture length in our case. Therefore, it was grouped into length categories as short (below 10 min), medium (10–30 min), and long (above 30 min).

3.2.3. Lecturers' characteristics

This includes gender (female and male) and age (40 and below and above 40).

3.2.4. Video events

A video, which is embedded in the course site, triggers various events. In this study, following video events were analyzed:

- *mediaReady*: This indicates that the loadable media has completed loading.
- *doPlay:* This event is triggered when the player enters a play state.
- *dopause*: This indicates that media playback is paused.
- *doseek*: This indicates a seek operation in video has occurred.
- *FullScreen*: This occurs when the player enters full screen mode. We assumed it indicates more interest.

Descriptive statistics of video data are given in Table 2.

3.3. Learner data

Learner data include profile data and video lecture watching behavior of learners.

3.3.1. Profile data of learners

This is the data about characteristics of learners, who enrolled the online courses. Profile data cover final exam scores, departments, grades, and genders of learners.

3.3.2. Video lecture watching behavior

Video lecture viewing behavior of learners was categorized as four types based on watching patterns as follows (Mongy, 2007):

- *Not watching:* This is the case when learners do not watch the video lecture of a module.
- *Looking over:* This is the case when a quick closure of the video lecture occurs.
- *Watching by zapping:* This is the case when learners skim the video lecture of a module. It includes watching by skipping, partially but consequently viewing the video.
- *Watching completely:* This is the case when learners almost completely view the video lecture of module.

Descriptive statistics of video lecture watching behavior are given in Table 3.

3.4. Data analysis

For the analysis of the quantitative data, one-way ANOVA, Chi-square test of independence and descriptive statistics were applied. For the normal distribution of data, the skewness and kurtosis coefficients were examined. For the normality test, skewness coefficient of a distribution was taken in the range of −1.5–+1.5 and the kurtosis coefficient of a distribution was taken in the range of −1.5–+1.5 according to Tabachnick and Fidell (2013). For ordinal data, Chi-square test of independence was performed. Besides ANOVA and Chi-square test of independence, descriptive statistics such as percentages (%), mean scores (X), and frequencies (f) were used as well.

3.5. Limitations

Participants of this study were college students. They perhaps processed information differently than those without college experience would. Therefore, this study should also be repeated with different participant groups.

4. Findings

In this section, the findings obtained in the study are presented under two headings based on the research questions.

4.1. Do video lecture watching behaviors of learners differ significantly with respect to video lecture length, video lecture type, lecturers' characteristics, video events, and learner profile?

4.1.1. Video lecture watching behaviors of learners with respect to video lecture length

A Chi-square test of independence was performed to examine the relation between the watching video lecture behaviors of learners and video lecture length. The relation between these variables was statistically significant ($X^2 = 143.60$, $N = 10{,}282$, $p < .001$). Higher *Watching Completely* behavior rate was associated with short video lecture length. 58% of Watching Completely behavior belonged to short (<10 min) videos, 40% of them belonged to medium (10–30 min) videos, and 2% of them belonged to long (> 30 min) videos.

4.1.2. Video lecture watching behaviors with respect to video lecture type

A Chi-square test of independence was calculated to compare the video lecture watching behaviors of learners and video type in "Type 1," "Type 2," and "Type 3," There was a statistically significant relationship between viewing behaviors of learners and video type, ($X^2 = 63.61$, $N = 10{,}282$, $p < .001$). A tendency toward watching interview videos completely was found. 25.6% of interview-style video lectures, 17.9% of talking head-style video lectures, and 15.0% of presentation-style video lectures were watched completely.

4.1.3. Video lecture watching behaviors with respect to lecturers' characteristics

In order to determine whether the video lecture watching behaviors of learners differed significantly depending on lecturers' age and gender, Chi-square test of independence test was applied. A statistically significant relationship between video lecture watching behaviors of learners and lecturers' gender was found ($X^2 = 29.31$, $N = 10{,}282$, $p < .001$). 62% of completely watched behavior belonged to female lecturers' videos.

A Chi-square test of independence was calculated to compare the viewing behaviors of learners and lecturers' age in "40 and below" and "below 40." There was a statistically significant relationship between viewing behaviors of learners and lecturers' age, ($X^2 = 14.46$, $N = 10{,}282$, $p < .001$). 57% of completely watched behavior belonged to videos of lecturers who were *40 years old and below*.

4.1.4. Video events with respect to learner profile

In order to determine whether the video events of learners differed significantly depending on learner profile, Chi-square test of independence was applied. A statistically significant relationship between *doSeek* event and learners' gender was found ($X^2 = 58.67$, $N = 10{,}282$, $p < .001$). Female students (58%) preferred to watch video lectures without seeking rather than male learners (42%). A significant relationship was also found between *FullScreen* event and gender ($X^2 = 11.02$, $N = 10{,}282$, $p < .001$). 54% of *FullScreen* watch made by male learners.

4.1.5. Video events with respect to video data

In order to determine whether the video events of learners differed significantly depending on video data, Chi-square test of independence was applied. A statistically significant relationship between *doSeek* event and video lecture length was found ($X^2 = 46.04$, $N = 10{,}282$,

Table 4. One-way analysis of variance of final exam score.

Source	df	SS	MS	*F*	*P*
Between groups	3	17,457.43	5819.14	8.17	.000
Within groups	2919	2,078,038.93	711.90		
Total	2922	2,095,496.36			

*$p < .05$.

$p < .001$). A tendency toward watching long video lectures by seeking was found. In 66% of long video lectures, a seek operation video occurred. A significant relationship between *doSeek* event and video type was found ($X^2 = 15.31$, $N = 10,282$, $p < .001$) as well. Interview style (Type 1) video lectures have the lowest seeking rate (53%). In addition, a significant relationship between *doSeek* event and lecturers' gender was found ($X^2 = 19.84$, $N = 10,282$, $p < .001$). Video lectures which were recorded by female lecturers have lower percentage rate of seeking (54%) than those of recorded by male lecturers (57%). There was a significant relationship between *doSeek and* lecturers' age ($X^2 = 8.11$, $N = 10,282$, $p < .005$). 58.6% of seek events occurred in the lecture videos, which was recorded by 40 year and below aged lecturers.

A statistically significant relationship between *FullScreen* event and video lecture length was also found ($X^2 = 6.12$, $N = 10,282$, $p < .047$). Percentage rate of *FullScreen* events is higher in long video length (6.5%) than short (4.5%) and medium (5.3%) video lengths. Also, a statistically significant relationship between *FullScreen* event and lecturers' age was found ($X^2 = 12.82$, $N = 10,282$, $p < .001$). Percentage rate of *FullScreen* events was higher in female lecturers' videos (7%) than those of in male lecturers' videos (4%).

4.2. Do final exam scores differ significantly with respect to video lecture viewing behaviors of learners?

A one-way between subject's ANOVA was conducted to compare the effect of *Video Lecture Watching Behavior* on final exam score in *not watching*, *looking over*, *watching by zapping*, *and watching completely* conditions. Table 4 presents the one-way ANOVA results, which demonstrate that the significant effect of video lecture watching behavior on final exam score at the $p < .05$ level for the four conditions [$F(3, 2919) = 8.17$, $p < 0001$].

Post hoc comparisons using the Tamhane T2 test indicated that the mean score for the watching completely condition ($M = 79.73$, SD = 17.83) was significantly different from the *not watching* condition ($M = 69.97$, SD = 30.38), *looking over* condition ($M = 72.58$, SD = 26.27), and the *watching by zapping* condition ($M = 72.99$, SD = 26.17). However, the *looking over* and *watching by zapping* condition did not significantly differ from the *not watching* condition. Taken together, these results suggest that watching video lectures really has an effect on final exam score. Learners, who watched video lectures completely, were more successful on final exam than others were.

5. Discussion and conclusion

The number of papers published every year regarding video-based learning research is increasing and research in the field of video-based learning is becoming more and more important (Giannakos, 2013). Although many corporations and academic institutions are

making lecture videos and seminars available online, there have been few and scattered research efforts to understand and leverage actual learner experience (Kim et al., 2014; Traphagan, Kusera, & Kishi, 2010) It is important to understand how students respond to video materials (Donkor, 2011). In this regard, this paper analyzed online video lecture watching behaviors of learners in 13 online courses, which were delivered by one of the biggest and oldest foundation university in western Turkey in fall of 2015, as the first phase of a research project that investigates how online video lectures can be designed optimally to enhance students' learning. We investigated two research questions. First, whether video lecture watching behaviors differ with respect to video lecture type, video lecture length, lecturers' characteristics, learner profile, and video events. Second, whether a student's achievement, in terms of final exam scores, differs with respect to video lecture watching behavior.

In the online learning system, which was examined in this study, watching video lectures is voluntary. Students were free to study either from textbook or from video lecture. Although Harley et al. (2003) reported that "'When video lectures are available, students typically use them, all students (95–97%) viewed video lectures at least once" in their study. We found different results. In contrast to their findings, 43% of total video events (18,144) were not watching (7862) in our case as reported in Table 3. According to Alexander (2013), users were more satisfied with the print medium over the video when instructions were long. To understand the topic, learners had to watch the entire video. As an advantage, watching the entire video led users to have a stronger grasp of the overall context. On the other hand, watching the entire video was also a disadvantage in terms of speed and locating the particular information. Therefore, learners in this study might prefer text materials to video lectures.

Ilioudi et al. (2013) reported that they found significant statistical differences between the tested video lecture styles, and the highest learning performance for the most complex topic occurred in talking head video lecture. On the other hand, Asensio et al. (2006) stated that even though talking head was a relatively passive use of video, if well designed and/or featuring a good performance, it could be engaging. However, finding of this study was not parallel to those researches. According to our findings, there was a tendency toward watching interview-style video lectures completely. In addition, those video lectures had the lowest seeking rate. Although different video lecture types resulted in different video navigations (Giannakos et al., 2015), our results could be related to that learners could not locate information and select key points due to interactive information flow in interviews, which was not linear as in talking head- or presentation-style video lectures. Another reason could be nonverbal information transfer, which occurred through body language of people who were having conversation. Learners might prefer those lectures because of the nonverbal information they included. Linear information flow in talking head-style lectures could be boring, and interactive information flow in interview-style video lecture could be more engaging. Besides, nonverbal information, which is provided through body language, could be more important in social science-focused online courses than science-focused ones. Video lecture type affects video lecture watching behavior. Further research is necessary in this topic.

The results obtained from Chi-square tests revealed that the short video lectures had higher percentage rate of *Watching Completely* behavior. In addition, a tendency toward watching long video lectures by seeking was found. The less seeking event occurred in shorter video length. This finding was parallel the finding observed by (Harrison, 2015), who reported that almost all learners preferred the videos less than 10 min. Video lecture length

affects video lecture watching behavior. Short (less than 10 min) and focused video lectures could be more understandable and easier to follow. Therefore, they could be more preferable.

The strength of the rapport between an instructor and his or her students influences each learner's affective experiences and achievements (Kim & Thayne, 2015). When learner–instructor relationships are strong, students better engage in the task and enhance their learning (Micari & Pazos, 2012; Sakiz, 2012; Xiao, 2012). Therefore, we investigated if online video lecture watching behavior differs with respect to characteristics of lecturers. Although our data are limited with just gender and age, our results showed that characteristics of lecturers resulted in statistically significant difference between video lecture watching behaviors and video events. 62% of *Completely Watched* events belonged to female lecturers' videos. Percentage rate of *FullScreen* events was higher in female lecturers' videos than those of in male lecturers' videos. In addition, video lectures which were recorded by female lecturers had lower percentage rate of seeking than those of recorded by male lecturers. However, this topic needs further research. Gladwell (2005) reported that students could rate the quality of a teacher after watching only a few minutes of videotaped performance. His and our findings together suggest that properties of lecturers could affect learning performance. Nevertheless, we need deeper research to figure out why female lecturers were preferred more than the male ones in our case. Similarly, there was a statistically significant relationship between *Watching Completely* behavior, *doSeek* event, and lecturers' age. In the videos of lecturers, who were 40 years old and below, both percentage rate of watching completely and *doSeek* events were higher than those aged above 40. This could be related to our participants' age range, which is between 18 and 25. However, this topic needs further research as well.

Results of Chi-square test of independence, which was utilized to compare the video lecture watching behaviors of learners and gender of learners, demonstrated that *FullScreen* and *seeking* events in video lectures differed with respect to the gender of learner. The percentage rate of preferring video lecture in *FullScreen* was higher for male learners, whereas the percentage rate of those viewing video lectures without seeking was higher for female learners.

The findings indicated that watching video lectures has a statistically significant effect on final exam score. Learners who watched video lectures completely had higher scores on final exam than those who did not. This finding was parallel to the finding obtained by Choi and Johnson (2005), Giannakos et al. (2015), Kay and Kletskin (2012), Ljubojevic, Vaskovic, Stankovic, and Vaskovic (2014), Meij and Meij (2014), who reported that video lectures increased learning performance and student engagement (Sherer & Shea, 2011). Therefore, video lectures should be well designed to enhance student learning.

These findings could be references for those who plan to optimize online video lectures in e-learning programs. In addition, the results of our analysis could be helpful to policy decision-makers in order to support their educational development. To improve external validity, it is planned to replicate the analysis in next semesters.

Disclosure statement

No potential conflict of interest was reported by the authors.

References

Albó, L., Hernández-Leo, D., Barceló, L., & Sanabria, L. (2015). *Video-based learning in higher education: The flipped or the hands-on classroom?* EDEN Annual Conference, Barcelona: EDEN.

Alexander, K. P. (2013). The usability of print and online video instructions. *Technical Communication Quarterly, 22*(3), 237–259. doi:http://dx.doi.org/10.1080/10572252.2013.775628

Asensio, M., Brown, F., Cuttle, M., Young, C., Little, R., Bijnens, M., & G. J. Verheij. (2006). *Handbook on digital video and audio in education creating and using audio and video material for educational purposes*. VideoAktiv. Retrieved from http://www.videoaktiv.org/fileadmin/template/main/resources/handbook/VideoAktiv_Handbook_fin.pdf

Caladine, R. (2008). *Enhancing e-learning with media-rich content and interactions*. Hershey, PA: IGI Global. doi:http://dx.doi.org/10.4018/978-1-59904-732-4

Catrambone, R., & Seay, A. F. (2002). Using animation to help students learn computer algorithms. *Human Factors, 44*, 495–511.

Chen, C. M., & Sun, Y. C. (2012). Assessing the effects of different multimedia materials on emotions and learning performance for visual and verbal learning style learners. *Computers and Education, 59*, 1273–1285.

Chen, C. M., & Wu, C. H. (2015). Effects of different video lecture types on sustained attention, emotion, cognitive load, and learning performance. *Computers & Education, 80*, 108–121. doi:http://dx.doi.org/10.1016/j.compedu.2014.08.015

Choi, H. J., & Johnson, S. D. (2005). The effect of context-based video instruction on learning and motivation in online courses. *American Journal of Distance Education, 19*, 215–227. doi:http://dx.doi.org/10.1207/s15389286ajde1904_3

Chorianopoulos, K., & Giannakos, M. N. (2013). *Usability design for video lectures*. In The 11th European Conference on interactive TV and video (pp. 163–164). Como.

Danielson, J., Preast, V., Bender, H., & Hassall, L. (2013). Is the effectiveness of lecture capture related to teaching approach or content type? *Computers & Education, 72*, 121–131.

Delen, E., Liew, J., & Willson, V. (2014). Effects of interactivity and instructional scaffolding on learning: Self-regulation in online video-based environments. *Computers & Education, 78*, 312–320. doi:http://dx.doi.org/10.1016/j.compedu.2014.06.018

Despotakis, T. C., Palaigeorgiou, G. E., & Tsoukalas, I. A. (2007). Students' attitudes towards animated demonstrations as computer learning tools. *Educational Technology & Society, 10*, 196–205.

Donkor, F. (2011). Assessment of learner acceptance and satisfaction with video-based instructional materials for teaching practical skills at a distance. *The International Review of Research in Open and Distributed Learning, 12(5), 74–92*.

Yousef, A. M. F., Chatti, M. A., & Schroeder, U. (2014). *Video-based learning: A critical analysis of the research published in 2003–2013 and future visions*. eLmL 2014: The Sixth International Conference on Mobile, Hybrid, and On-line Learning (pp. 112–119). Barcelona: IARIA.

Giannakos, M. N. (2013). Exploring the video-based learning research: A review of the literature. *British Journal of Educational Technology, 44*, 191–195. doi:http://dx.doi.org/10.1111/bjet.12070

Giannakos, M. N., Chorianopoulos, K., & Chrisochoides, N. (2015). Making sense of video analytics: Lessons learned from clickstream interactions, attitudes, and learning outcome in a video-assisted course. *The International Review of Research in Open and Distributed Learning, 16*, 260–283.

Gladwell, M. (2005). *Blink: The power of thinking without thinking*. London: Allan Lane.

Griffin, D. K., Mitchell, D., & Thompson, S. J. (2009). Podcasting by synchronizing powerpoint and voice: What are the pedagogical benefits? *Computers & Education, 53*, 532–539.

Guo, P. J., Kim, J., & Rubin, R. (2014). *How video production affects student engagement: An empirical study of MOOC videos*. L@S '14 Proceedings of the first ACM conference on Learning (pp. 41–50). New York, NY: ACM. doi:http://dx.doi.org/10.1145/2556325.2566239

Haas, S. W., Brown, R. T., Cao, L., & J. D. Wilbur. (2005). Evaluation of the GovStat statistical interactive glossary: Implications for just-in-time help. In L. M. L. Delcambre & G. Giuliano (Eds.), Proceedings of the 2005 National Conference on Digital Government Research. *ACM International Conference Proceeding Series*, 89,291–292. Atlanta, GA. doi:http://dx.doi.org/10.1145/1065226.1065326

Halls, J. (2012). *Rapid video development for trainers: How to create learning videos fast and affordably*. Virginia, VA: American Society for Training & Development.

Harley, D., Henke, J., Lawrence, S., McMartin, F., Maher, M., Gawlik, M., & Muller, P. (2003). *Costs, culture, and complexity: An analysis of technology enhancements in a large lecture course at UC Berkeley*. UC Berkeley: Center for Studies in Higher Education. Retrieved from http://escholarship.org/uc/item/68d9t1rm

Harrison, D. J. (2015). Assessing experiences with online educational videos: Converting multiple constructed responses to quantifiable data. *International Review of Research in Open and Distributed Learning, 16*(1), 168–192.

Hartsell, T., & Yuen, S. (2006). Video streaming in online learning. *AACE Journal, 14*, 31–43.

He, W. (2013). Examining students' online interaction in a live video streaming environment using data mining and text mining. *Computers in Human Behavior, 29*, 90–102.

Ilioudi, C., Giannakos, M. N., & Chorianopoulos, K. (2013). *Investigating differences among the commonly used video lecture styles*. WAVe 2013 workshop at LAK'13 (pp. 21–26). Leuven. Retrieved from http://ceur-ws.org/Vol-983/paper5.pdf

Kay, R., & Kletskin, I. (2012). Evaluating the use of problem-based video podcasts to teach mathematics in higher education. *Computers & Education, 59*, 619–627. doi:http://dx.doi.org/10.1016/j.compedu.2012.03.007

Kearney, M., & Treagust, D. F. (2001). Constructivism as a referent in the design and development of a computer program using interactive digital video to enhance learning in physics. *Australian Journal of Educational Technology, 17*, 64–79.

Kim, J., Guo, P. J., Seaton, D. T., Mitros, P., Gajos, K. Z., & Miller, R. C. (2014). Understanding in-video dropouts and interaction peaks in online lecture videos. In A. c. '14 (Ed.). (pp. 31–40). ACM. Retrieved from http://www.eecs.harvard.edu/~kgajos/papers/2014/kim14video.pdf

Kim, Y., & Thayne, J. (2015). Effects of learner–instructor relationship-building strategies in online video instruction. *Distance Education, 36*, 100–114. doi:http://dx.doi.org/10.1080/01587919.2015.1019965

Ljubojevic, M., Vaskovic, V., Stankovic, S., & Vaskovic, J. (2014). Using supplementary video in multimedia instruction as a teaching tool to increase efficiency of learning and quality of experience. *The International Review of Research in Open and Distance Learning, 15*, 275–291.

Lowe, R. K. (1996). Background knowledge and the construction of a situational representation from a diagram. *European Journal of Psychology of Education, 11*(4), 377–397.

Maniar, N., Bennett, E., Hand, S., & Allan, G. (2008). The effect of mobile phone screen size on video based learning. *Journal of Software, 3*, 51–61.

McGreal, R., Sampson, D. G., Chen, N. S., Krishnan, M. S., & Huang, R. (2012). *The open educational resources (OER) movement: Free learning for all students*. IEEE Conf. on Advanced Learning Technologies (ICALT 2012) (pp. 748–751). Rome: IEEE. doi:http://dx.doi.org/10.1109/ICALT.2012.227

Meij, H. V. D., & Meij, J. V. D. (2014). A comparison of paper-based and video tutorials for software learning. *Computers & Education, 78*, 150–159. doi:http://dx.doi.org/10.1016/j.compedu.2014.06.003

Merkt, M., Weigand, S., Heier, A., & Schwan, S. (2011). Learning with videos vs. learning with print: The role of interactive features. *Learning and Instruction, 21*, 687–704. doi:http://dx.doi.org/10.1016/j.learninstruc.2011.03.004

Micari, M., & Pazos, P. (2012). Connecting to the professor: Impact of the student – Faculty relationship in a highly challenging course. *College Teaching*, 60, 41–47. doi:http://dx.doi.org/10.1080/87567555.2011.627576

Mongy, S. (2007). A study on video viewing behavior: Application to movie trailer miner. *International Journal of Parallel, Emergent and Distributed Systems: IJPEDS, 22*, 163–172. doi:http://dx.doi.org/10.1080/17445760601125376

Sakiz, G. (2012). Perceived instructor affective support in relation to academic emotions and motivation in college. *Educational Psychology, 32*, 63–79. doi:http://dx.doi.org/10.1080/01443410.2011.625611

Shephard, K. (2003). Questioning, promoting and evaluating the use of streaming video to support student learning. *British Journal of Educational Technology, 34*, 295–308. doi:http://dx.doi.org/10.1111/1467-8535.00328

Sherer, P., & Shea, T. (2011). Using online video to support student learning and engagement. *College Teaching, 59*, 56–59. doi:http://dx.doi.org/10.1080/87567555.2010.511313

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Boston, MA: Pearson.
Traphagan, T., Kusera, J. V., & Kishi, K. (2010). Impact of class lecture webcasting on attendance and learning. *Educational Technology Research and Development, 58*, 19–37.
Wetzel, C. D., Radtke, R. H., & Stern, H. W. (1994). *Instructional effectiveness of video media*. Hillsdale, NJ: Lawrence Erlbaum Associates.
Wieling, M. B., & Hofman, W. H. A. (2010). The impact of online video lecture recordings and automated feedback of student performance. *Computers & Education, 54*, 992–998. doi:http://dx.doi.org/10.1016/j.compedu.2009.10.002
Wiese, C., & Newton, G. (2013). Use of lecture capture in undergraduate biological science education. *The Canadian Journal for the Scholarship of Teaching and Learning, 4*(2), 1–24.
Xiao, J. (2012). Tutors' influence on distance language students' learning motivation: Voices from learners and tutors. *Distance Education, 33*, 365–380. doi:http://dx.doi.org/10.1080/01587919.2012.723167
Yang, F. Y., & Tsai, C. C. (2008). Investigating university student preferences and beliefs about learning in the web-based context. *Computers & Education, 50*, 1284–1303.
Zhang, D., Zhou, L., Briggs, R. O., & Nunamaker, J. F. (2006). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. *Information & Management, 43*, 15–27. doi:http://dx.doi.org/10.1016/j.im.2005.01.004