Online Video Lectures: The Relationship Between Student Viewing Behaviors, Learning, and Engagement

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Online classes and degree programs have grown considerably in the past few years, and one of the most widely used methods of delivering content to online students is the video lecture. This article used an experimental design to examine if five different types of video lectures affected student learning, interest, or engagement. In addition, this article examined YouTube viewing statistics from real-world online classes/actual student viewing behaviors toward 33 video lectures. Findings indicate that the amount of the video lecture students watched positively affected student learning; however, this relationship is curvilinear in nature. In addition, students viewed roughly 60% of the total length of video lectures and thus may miss important content contained in the video lecture, only 34% of students likely watched the full video lecture.

Online video lectures: Examining student viewing behaviors in online classes

One of the largest trends in higher education is the increased push towards more college classes, and even degree programs, being held entirely online. For instance, in 2011 77% of college presidents reported that their institution offered online classes and 65% expect, in 10 years, that over half of their students will be taking at least one online class (Parker, Lenhart, & Moore, 2011). Allen and Seaman (2013) reported that, in 2002, 1.6 million college students were taking at least one online course, 3.9 million were doing so by 2007, and by 2011 this figure had reached 6.7 million. More recently, the National Center for Education Statistics (2014) reported that, out of the 23 million college students in the United States in 2012, roughly 32% were enrolled in an online class, while 6.5% were enrolled in a degree program that was entirely online. Roughly a decade ago, less than ten percent of college students were taking at least one online class (Allen & Seaman, 2013) and, today, that figure appears to be well over 30%, with every indication that this figure will continue to grow. In fact, by 2016 nearly 1 million students were taking a distance education

course in a different state than their postsecondary institution (National Center for Education Statistics, 2017).

For better or worse, online classes and online degree programs are here to stay and have become a staple of a 21st century college education. Thus, enhancing online learning is an important priority for faculty, administrators, and staff. As educators, we should actively seek opportunities for enhancing our online courses and continuing to advance best practices for developing and delivering online course content. Understanding online student behaviors, and the link between these behaviors and learning, will provide faculty and E-Learning administrators additional information to inform future development of online classes.

The present study focuses on one popular method for conveying course content to online students: the video lecture. As Thiede (2012) noted when discussing best practices in online courses, "A considerable number of students are primarily visual learners, so the incorporation of video tapes to aid in learning is advantageous" (p. 138). In a small exploratory study, Rose (2009) found that students reported positive attitudes when instructors included instructor-made videos in both online and face-to-face classes. Video lectures are a staple educational tool used in many online classes and, according to one study, "the bulk of content delivery in online learning is done through pre-recorded video" (Hansch, Hillers, McConachie, Newman, Schildhauer, & Schmidt, 2015, p. 10). Related to this last point, videos have become fairly easy to record, especially when most modern smart phones and laptop computers come equipped with HD cameras/webcams and multiple sites (e.g., YouTube, Vimeo) offer free video hosting. However, faculty may rightfully question if these video lectures positively affect student learning and if students actually watch these videos as instructors intend.

In order to examine student behaviors and learning from online videos, this article used data collected from (1) an experimental study and from (2) YouTube viewing statistics from actual online college courses. The experimental study compared five different types of video lecture, all based on the same content, to determine if student interest varies by video type and how that variable may affect student learning. The second data source focused on real world student viewing behaviors and analyzed viewing statistics from actual video lectures used in several online classes. Since video lectures, of various different types, are likely fairly common in online classes, understanding student viewing behaviors will be helpful for online

instructors. Taken together, these two data sources help to inform our broad understanding of video lectures in online classes and how we might work to enhance this important instructional tool.

Literature Review

College Students, Online Learning, and Perceptions of Online Degree Programs

As previously noted, millions of college students in the United States are currently enrolled in online classes and many of them are nontraditional students. The National Center for Education Statistics (2016) reports that, in fall 2015, the United States had nearly 20 million students enrolled in degree-granting postsecondary institutions. Of that, 11.6 million (58%) were 18 to 24 years of age, roughly the traditional age for college students, and 8.1 million (41%) were 25 years of age or older (i.e., nontraditional age). Even though traditional-age students still makeup over half of the college student population nationwide, nontraditional college students do represent a considerable portion of the overall student population. In particular for nontraditional students, online classes can represent an attractive alternative to traditional, face-to-face (FtF) classes. For example, online classes are often touted as options for students with busy schedules or who might be working and unable to attend traditional classes during the day. For these students, online classes offer a way to work towards the completion of their degree, without having to change their schedule or routine. Online classes likely appeal to traditional students by adding flexibility to course scheduling, as well as other benefits.

Although online classes offer a unique opportunity for students, faculty are often skeptical that online classes can achieve the same outcomes as FtF classes. Jaschik and Lederman (2017) surveyed over 2,000 faculty and digital learning leaders (i.e., those responsible for e-learning initiatives) to understand faculty and leaders' views of online learning. In general, they found that "faculty members divide evenly between strongly agreeing or agreeing (33 percent) and strongly disagreeing or disagreeing (34 percent) that online courses can achieve the same or better outcomes as in-person courses at any institution" (Jaschik & Lederman, 2017, p. 16). However, 78% of digital learning leaders agreed or strongly agreed with that statement. In addition, that research also found that faculty tended to disagree with the notion that online instruction is just as good as FtF

instruction, with 42% disagreeing or strongly disagreeing and 36% agreeing or strongly agreeing. Lastly, Jaschik and Lederman (2017) reported that faculty:

> Perceive online courses as inferior to in-person courses in terms of interaction with students in class (86 percent), ability to reach at-risk students (79 percent), ability to answer student questions (61 percent), ability to rigorously engage students in course material (60 percent), ability to maintain academic integrity (60 percent), interaction with students outside of class (53 percent) and ability to deliver the necessary content to meet learning objectives (51 percent). (p. 19)

Although the online classroom has certainly developed and grown over time, faculty do have legitimate concerns about online classes and how they compare against FtF classes.

Another major concern regarding online degree programs is how potential employers view these programs. Research has tended to show that hiring managers or those reviewing resumes of potential applicants regularly place FtF degree programs above online ones. For example, Adams and DeFleur (2006) studied the acceptability of online degrees as viewed by those who might make hiring decisions. Their research found that only 4% of surveyed hiring managers would recommend hiring someone who earned an online-only degree and only 27% would recommend hiring someone with a combination of FtF and online coursework. All told, Adams and DeFleur (2006) reported that "the findings suggest strongly that degrees earned online are by no means as acceptable as traditional degrees, and that they can be regarded as suspect when used as a credential in a hiring situation" (p. 43). More recently, Kaupins, Wanek, and Coco (2014) collected data from attendees of 10 monthly meetings of the Society for Human Resource Management in various major cities in Texas. Their overall finding was that online education or degree programs are "not perceived as equivalent to traditional education in college and universities. Only about half of the respondents in the human resources field believed that their organizations treat online graduates as equivalent to traditional program graduates for hiring purposes" (Kaupins et al., 2014, p. 227).

Even though online education is often espoused by digital learning leaders as being able to reach the same objectives as FtF programs, faculty often are not as convinced of the ability of online programs to reach the

same outcomes (Jaschik & Lederman, 2017). In addition, those in hiring positions do not appear to equate online degree programs or mixed degree programs as equivalent to FtF degrees (Adams & DeFleur, 2006; Kaupins et al., 2014). Thus, it would make sense to approach the educational outcomes of online courses and degree programs cautiously and avoid assuming that online classes/programs are automatically equivalent to FtF programs. With this in mind, examining particular aspects of online courses, particularly widely used instructional tools in online classes, should help instructors and digital learning leaders to address some of these concerns.

Online Video Lectures

In the context of this article, the term online video lecture is meant to encompass videos used in an online class in which instructors explain course content, either through their appearance on camera, their voice, or through a visual aid such as a Keynote or PowerPoint. This definition intentionally excludes "how to" or tutorial videos, since those are focused on demonstration and not typically focused on explaining a concept or idea. Instead, online video lectures typically explain course concepts and might serve as supplements to course readings, particularly in online courses.

Hansch et al. (2015) developed a typology for online educational videos and recognized 18 distinct video types: (1) talking head, (2) presentation slides with voice-over, (3) picture-in-picture, (4) text-overlay, (5) Khan-style tablet capture, (6) Udacity style tablet capture, (7) actual paper/whiteboard, (8) screencast, (9) animation, (10) classroom lecture, (11) recorded seminar, (12) interview, (13) conversation, (14) live video, (15) webcam capture, (16) demonstration, (17) on location, and (18) green screen. Although each type of video could be used in an online class, the present study is most interested in those videos that are within the capability of individual faculty to create; those that don't require a multi-camera setup, substantial editing, or hiring of talent to make (i.e., whiteboard videos), or the inclusion of a non-instructor in the video. This criteria limits the typology of online videos from Hansch et al. to five types of online videos: (a) webcam capture, (b) presentation slides with voice-over, (c) picture-in-picture (i.e., webcam and slides), (d) classroom lecture, and (e) recorded seminar (i.e., classroom lecture with slides). Each of these video types can be created by an instructor with limited resources or with those resources included with a standard Mac or PC.

As noted previously, visual learners may benefit from videos in their online classes (Thiede, 2012) and students may view those instructor made videos favorably (Rose, 2009). In addition, Hansch et al. (2015) report that much of the content delivered through online classes is done through online videos. Furthermore, recent scholarship examining video lectures found a relationship between student satisfaction with video lectures (VL) and overall learning experience (Scagnoli, Choo, & Tian, 2019). In particular "the more satisfied with VL students are in the online course, the more positive learning experience with the course they have" (Scagnoli et al., 2019, p. 407).

Student Engagement

While the present study takes a practical approach to examining online learning, theory still informs this process. Past work has noted that students are both emotionally and cognitively engaged in courses and that faculty should strive to tap into both types of engagement. As Mazer (2012) noted "heightened student interest and engagement can lead to significant improvements in their learning, satisfaction, and success in school" (p. 122). But fostering student engagement can be particularly difficult to do in online classes, since faculty and students are not regularly seeing each other in person (i.e., as in a traditional classroom), and 86% of faculty report online classes as being inferior to FtF classes for interacting with students (Jaschik & Lederman, 2017). However, proponents of online classes often note that an online classroom can be engaging for students or reach similar outcomes as FtF classes (Jaschik & Lederman, 2017). In addition, scholarship has found that "instructor-generated video content can have a positive and moderate influence on student satisfaction with and engagement in asynchronous online courses" (Draus, Curran, & Trempus, 2014, p. 250). However, when comparing in-class active learning sessions and online video lecture, Jensen (2011) reports that students "recognize that the regularly schedule class times and the more distraction-free environment in the classroom were beneficial to their learning and in the end reported preferring this more structured environment over the greater convenience provided by the online video lectures" (p. 302). This disconnect between mode of delivery and student engagement, and even student preference, is an area that would benefit from additional research.

One way to engage student interest in the online classroom, and hopefully promote learning, is through emotional and cognitive interest.

Mazer (2012; 2013) has examined both types of interest and developed scales to measure each. Emotional interest can be viewed as "entertaining details in textual material or in a lecture (e.g., engaging words, illustrations, or behaviors) that potentially excite and emotionally engage students" (Mazer, 2012, p. 102). By using content or delivery methods that build emotional excitement, educators might be able to generate emotional interest in the subject matter. Cognitive interest can be created "when clarity indicators such as explanative summaries influence students' cognition by promoting their structural understanding of content" (Mazer, 2012, p. 102). By using teacher clarity behaviors and presenting class content in clear ways, instructors can help build cognitive interest. This is accomplished by providing students a way to understand course content more easily and build mental connections between pieces of course content. Viewed together, "emotional and cognitive interest are both positive experiences that can lead to important benefits for students" (Mazer, 2013, p. 93). In the online classroom, tapping into both emotional and cognitive interest may even lead to improvements in learning and student success. In addition, examining if different types of online video lectures help to build emotional and/or cognitive interest would be helpful for faculty developing online classes.

Student engagement and online video lectures.

One way of potentially tapping into emotional and cognitive interest is for instructors to create and use instructor-made videos in their online classes. A study by Rose (2009) surveyed undergraduate and graduate students about instructor-made videos in their coursework. The author found that the vast majority of online students (nearly 80%) felt that instructor-made videos helped the student feel like they knew the instructor better (i.e., emotional interest) and nearly all of the online students felt that they learned better as a result of the instructor-made videos (i.e., cognitive interest). In addition, nearly 90% of students felt that the instructor videos enriched the course materials (Rose, 2009). Although initial research lends tentative support for online video lectures potentially tapping into emotional and cognitive interest, the type of online video lecture may also play a factor. In addition, a substantial limitation of the Rose (2009) study was that participants were students from several of the PI's courses. Thus, responses may suffer from social desirability bias as students may not

accurately report their behaviors for watching online videos to their actual instructor.

Guo, Kim, and Rubin (2014) examined the link between student engagement in Massive Open Online Courses (MOOC) and the production style of videos used in that course type by analyzing 6.9 million video watching sessions from edX courses. The authors measured engagement by "how long students are watching each video, and whether they attempt to answer post-video assessment problems" (Guo et al., 2014, p. 41). Guo et al. found that videos in which the instructor appears with lecture slides, which they call "talking head", appeared to be more engaging than a simple voice-over of slides and that classroom lecture videos did not appear to be as engaging as other video types. In addition, students watching lecture type videos tended to not watch the full video. For example, Guo et al. report that for a 9-12 minute lecture video the median engagement time (i.e., how long the student watched the video) was between 6-7 minutes, and the median time for a 12-40 minute video was between 3-4 minutes. Put simply, the average student tended to not watch the full video lecture and this tended to be the case across lecture videos of various different time lengths.

Although this research is helpful, Guo et al.'s (2014) measure of engagement is more focused on how long students watched the video and if they engaged in post-video assessments, which may not transfer well to non-MOOC type classes. In addition, MOOC classes are also problematic in that they typically have low completion rates. Jordan (2015) analyzed 221 MOOCs, and the average (median) completion percentage (i.e., percentage of students who enroll in the course and completed it) was 12.6%. Building from this research, measuring student cognitive and emotional interest should provide the scholarly community with a better understanding of the link between online video lectures and student learning.

Motivation to Process Instructional Material

In their research examining student motivation and instructor clarity Bolkan, Goodboy, and Kelsey (2016) noted that "simply providing information is not enough to ensure that students have engaged with the material in ways that promote deep learning and a lasting memory" (p. 130). These authors argued that individual student differences, particularly motivation to think about or deeply process course material, affect student outcomes. Ultimately, "students' ability to deeply process course material

and their subsequent learning may be conditioned upon their motivation to think elaborately about course concepts" (Bolkan et al., 2016, p. 134). Their study found a striking difference between levels of student motivation. Specifically, when exposed to a lecture with high clarity, students who were highly motivated to think deeply scored a 71% on an exam of lecture content compared to a score of 49% for those who were less motivated (Bolkan et al., 2016). Ultimately, the authors conclude that "students who scored highest on a test of knowledge after a short lecture were those exposed to a clear lecture and who were motivated to think deeply about the lecture content" (Bolkan et al., 2016, p. 144). Thus, it would appear that clarity is important but so is the student trait of motivation to deeply process course content. In the context of the online classroom, being able to present clear content through online video lectures, as well as potentially increasing student motivation to think about lecture content, should lead to improvements in student learning. Examining which types of online video lectures enable instructors to do this would provide valuable best practices for the development of online video lectures, helping both instructors and students.

Taken together, Mazer (2012; 2013) and Bolkan et al. (2016) identify key aspects of the classroom that can help engage students. In the context of the present article, examining student interest (cognitive and emotional) and student motivation in the online classroom can help enhance our understanding of the online learning environment. We also know that there are a variety of different types of online videos available for faculty to use in online classes and it would be helpful for faculty to know if particular types of video lectures help to enhance student interest, motivation, and ultimately lead to increased student learning.

> RQ1: Are there differences in student learning, motivation, or interest (cognitive and emotional) between different styles of video lectures?

However, even if results from RQ1 provide evidence that specific types of online videos are conducive to student engagement, motivation, and learning, that finding becomes irrelevant if most students are not actually watching that video content. Past research (Guo et al., 2014; Rose, 2009) has looked at whether students are watching online lecture videos; however, that research was fairly limited by either study design or type of

course used (i.e., MOOC). Anecdotally, a common question faculty have, both in online and traditional classes, is if students are reading course content or watching course videos. Examining student viewing behaviors, from real-world classes and using actual student viewing behaviors will shed additional light on the efficacy of this important instructional tool.

RQ2a: What are student viewing behaviors towards lecture videos?
RQ2b: How do these viewing behaviors relate to student learning?

Methods

Recruitment of Participants

After receiving IRB approval, the regional E-Learning office at a large Midwestern university was contacted via email with a request for their assistance in this study. The PI asked for a list of unduplicated email addresses of students currently enrolled in at least one online class through their office and the E-Learning office responded with a list of 2,704 unduplicated email addresses. Students were sent, via email, an invitation to participate in this study by clicking on a link to a Qualtrics survey. A reminder message was sent one week after the initial email and a second reminder was sent two weeks after the initial email.

Out of the 2,704 total students, 178 agreed to participate in the study. Study requirements were that participants needed to be 18 years of age or older, be currently enrolled in an online class, and had not taken either of the two classes that cover interpersonal communication. This requirement was needed since the lecture video in this study covers four interpersonal communication theories and prior exposure to this content might influence the results. A total of 151 participants met these requirements and were randomly assigned to one of the five study groups. Each study group watched a different lecture video format: voiceover (n = 26), webcam (n = 29), voiceover with webcam (n = 29), Mevo (n =36), and Mevo with slides (n = 31). Participants were nearly equally distributed in terms of class year, with roughly 23% of participants indicating they were first year students, 23% sophomore, 25% juniors, and 29% seniors. Roughly 80% of participants indicated that they are female and the remaining 20% were male. The average self-reported age of participants was 26. 88% of participants indicated that they were Caucasian, 3% Black or African American, 3% Asian, 3% multi-racial, and 2% other. The mean self-reported

GPA for participants was 3.30 (*SD* = 0.64), and the median number of online classes participants had taken for credit, from any college or university, was 4. When asked which mode of instructional delivery they prefer, 27% said they prefer online classes, 46% preferred face-to-face, and 27% indicated they had no preference.

Procedures and Manipulation

After agreeing to the informed consent form through Qualtrics, participants proceeded to an instructions page that noted that, on the following page, they would be asked to watch a video lecture from an online class and that they should watch this lecture as if they were watching it for one of their actual online classes. Following the lecture video, they would be asked to answer several questions, take a short test that covers content from that video, and answer some demographic questions. Upon proceeding to the next page, participants were randomly assigned, by Qualtrics, to one of the five groups used in this study. Each study group was provided with a YouTube video embedded in the Qualtrics survey. This allowed each group to watch the video lecture, while still staying in the online survey, mimicking the practice of embedding YouTube videos in online course LMS pages. Participants were instructed that, after they finished watching the video, to click the next button to continue. For each group, and only on the page of the survey containing the respective lecture video, Qualtrics recorded how many seconds elapsed between when that page loaded and when participants submitted the page (i.e., finished watching the video and clicked the next arrow). This metadata was recorded as a question type that would not be presented to participants. Following the page containing the assigned lecture video, participants were presented with questions from the Motivation to Deeply Process Course Information Scale (Balkan et al., 2016) and, on a new page, Student Interest Scale (Mazer, 2013). After completing these survey items, participants were presented with a 16-item multiple-choice test that covered content contained in the video lectures. The last page of the survey contained demographic questions. Upon completing the survey, participants were redirected to a Google Form page through which they could voluntarily submit their email address to be entered into the drawing for the Amazon Fire tablets.

Video Lectures

Although the experimental portion of this study used five distinct video lectures, each video was based off the same script and contained identical lecture content. The lecture script, which was previously used by Kuznekoff and Titsworth (2013) and Kuznekoff, Munz, and Titsworth (2015), covered four interpersonal communication theories and, respectively, contained content about the general explanation of each theory, assumptions about each theory, how the theory discusses relationship formation, and how the theory discusses relationship dissolution. The only differences between the lecture videos was the style of the video and how much visual content (i.e., slides and/or an instructor) was included. The voiceover video simply contained a Keynote presentation with a voice reading the lecture script and advancing to the next slide when moving to that content. The webcam video featured an instructor sitting in front of their computer reading from the lecture script and, as the name implies, was recorded using the computer's webcam. The audio portion of the webcam video was also used as audio in the voiceover video. The third lecture video was the voiceover with webcam, which primarily featured the Keynote presentation but also superimposed the webcam video in the top right corner of the screen (i.e., picture-in-picture). The webcam video was scaled down in size to prevent overlapping or hiding content of the Keynote presentation and the slide content was synchronized with audio content so that the verbal content matched the content displayed on the slide.

The fourth lecture video was captured using a Mevo live event camera and this approximated lecture video captured from a traditional classroom. The lecture video featured an instructor giving a simulated presentation to a class using the lecture script. The last video lecture was Mevo with slides, which cut between the classroom lecture and still images of the Keynote slides at appropriate parts. In other words, high quality images of the slides would take up the whole viewable area, for a brief period of time, while that content was being discussed. This lecture video also functioned to simulate an edited or higher production value lecture video; however, this editing does not require advanced training or highly specialized software. Each video was recorded using the same high-quality microphone, to ensure that audio quality was sufficient and equal across the videos. The voiceover, webcam, and voiceover with webcam lectures were each 671 seconds long, while the Mevo and Mevo with slides lectures were, respectively, 685 and 690 seconds long. The difference in video length

was simply due to minor differences in timing with the delivery of the lecture script and not due to differences in lecture content.

Multiple-Choice Test and Survey Instrument

The 16-item multiple-choice test contained questions that covered content in the lectures. Each theory had four questions that tested participants on content pertaining to that theory. Similar to the lecture script, this test has been used in prior studies. Those studies report KR-20 values of 0.524 (Kuznekoff & Titsworth, 2013) and 0.583 (Kuznekoff et al., 2015), and the present study reports KR-20 of 0.683. As was the case with past research, the design of the present study includes multiple groups that are exposed to different manipulations. This manipulation diverges from what we would expect in a typical classroom, in which all students are taking a test under the same, or similar, conditions. The multiple groups in this study likely introduce a degree of error into this calculation, which would not likely be present in non-experimental conditions.

Student interest scale.

Developed by Mazer (2012; 2013) the 16-item Student Interest Scale is broken down into two subscales, one measuring student cognitive interest and the other measuring student emotional interest. Items covering emotional interest are made up of 9 statements that typically ask participants the degree to which they may feel positive emotions surrounding their class experience. Items were slightly modified to focus on the study lecture instead of an overall course. This modification typically amounted to substituting the word “lecture” for “course.” Example items include “I feel enthused about watching this lecture”, “watching the lecture is enjoyable”, and “the lecture makes me feel good.” Scale items measuring cognitive interest focus were made up of 7 statements examining student understanding or processing of class content. Example items include “I feel like I am learning topics covered in the lecture”, “I understand the lecture material,” and “the information in the lecture is useful.” All items on this scale were measured using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Mazer (2013) reported reliability coefficients of .95 for emotional interest and .88 for cognitive interest. The present study reports alpha reliability estimates of .92 for emotional interest and .86 for cognitive interest.

Motivation to deeply process course information.

Bolkan et al. (2016) developed a measure that examines student learning motivation and "operationalized the construct as motivation to engage in deep thought regarding course concepts" (p. 135). The scale is made up of four items that ask participants to rate how true each statement is of them on a seven-point scale with scale anchors of (1) not at all true of me and (7) very true of me. Example items include "I was motivated to think deeply about what is being taught in this lesson" and "I cared about really learning the material in this lecture." Past research (Bolkan et al., 2016) reports alpha reliability of .94, and the present study reports alpha reliability of .91.

YouTube Viewing Statistics

Additional data was collected from YouTube statistics from 33 videos used by the PI in their online classes. The videos are used in two different online classes (advanced interpersonal communication and introduction to health communication), both of which have been offered for several semesters. The videos are integrated into the course LMS and emphasized by the instructor at the beginning of the term (i.e., it is important that you watch the videos in the class). The videos range from explanation of major assignments to lecture/module content (i.e., discussion of class content). The length of the online videos ranges from 2:11 to 42:27 (MM:SS). All of the videos were created by the instructor and uploaded to YouTube, and thus the instructor has access to YouTube viewing statistics for each video. These statistics include: total watch time, average view duration, and total number of views. Each video is unlisted, meaning the video is not included in search results, and a viewer would need the specific URL to the video in order to watch it. The only links to the videos are the ones embedded in the course LMS at the PI's institution. All told, the 33 videos combine to 1,630 views and represent real-world behavior of students in multiple sections of two online classes.

Results

The first research question asked if there are differences in student learning, motivation, or cognitive and emotional interest between different styles of video lectures. An ANOVA was conducted to determine if a statistically significant difference was present between scores on the

multiple-choice test (i.e., student learning), based on study group. No statistically significant difference was found, F (4, 146) = 1.408, p > .05, between the different study groups: voiceover lecture (M = 9.92, SD = 3.01), voiceover with webcam (M = 8.83, SD = 2.99), webcam (M = 8.24, SD = 3.33), Mevo (M = 8.69, SD = 2.77), or Mevo with slides (M = 8.23, SD = 3.14).

To examine student motivation, an ANOVA was conducted to determine if a statistically significant difference was present between scores on the motivation to deeply process course information scale and study group. No statistically significant difference was found, F (4, 146) = 1.001, p > .05, between the different study groups: voiceover lecture (M = 4.25, SD = 1.40), voiceover with webcam (M = 4.66, SD = 1.35), webcam (M = 4.10, SD = 1.25), Mevo (M = 4.02, SD = 1.48), or Mevo with slides (M = 4.37, SD = 1.44).

Next, an ANOVA was conducted to determine if there was a statistically significant difference for emotional interest based on the lecture video. The present study did not find a statistically significant difference on emotional interest, F (4, 146) = 1.653, p > .05, between the different study groups: voiceover lecture (M = 26.85, SD = 6.74), voiceover with webcam (M = 30.17, SD = 7.91), webcam (M = 26.38, SD = 6.83), Mevo (M = 25.75, SD = 7.82), or Mevo with slides (M = 28.03, SD = 7.89).

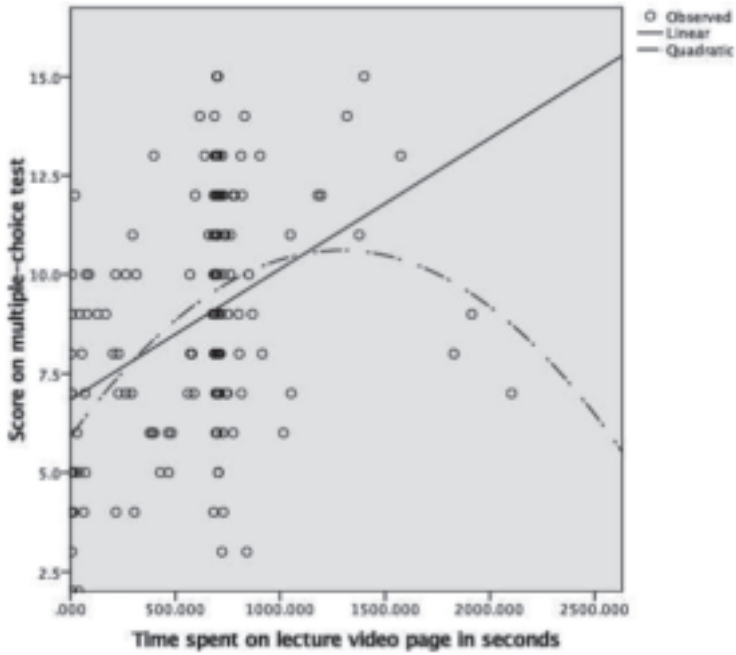
Finally, an ANOVA was conducted to determine if there was a statistically significant difference for cognitive interest based on the lecture video. The present study did not find a statistically significant difference on cognitive interest, F (4, 146) = 1.802, p > .05, between the different study groups: voiceover lecture (M = 27.04, SD = 3.77), voiceover with webcam (M =27.45, SD = 6.11), webcam (M = 25.38, SD = 4.30), Mevo (M = 24.47, SD = 5.02), or Mevo with slides (M = 25.61, SD = 5.73). At present, this study is unable to find statistically significant differences between type of lecture videos and how that may influence student learning, motivation, or cognitive and emotional interest.

The second research question was split into two parts. The first asked what student viewing behaviors are towards lecture videos, and the second asked how these behaviors relate to student learning. Time spent watching the video lecture was measured based on how many seconds the participant spent on the page containing the embedded video before clicking submit/next. In the experimental portion of this study, the mean view time for the five videos was 578 seconds, and the five video lectures ranged in length from 671 to 690 seconds.

It would appear that the average student, when measured with the mean, is not watching the full video and, at best, is only watching 84-86% of the video. When examining the frequency distribution of how long participants spent on the video page, roughly 40% of participants did not spend enough time on the video page to have watched the full video (i.e., < 671 seconds). Approximately 34% of participants were on the page long enough to have watched the full video and/or to have spent an additional 30 seconds on that page (i.e., 671 to 720 seconds). This leaves roughly 25% of participants who were on the page containing their lecture video for far longer than the actual video (i.e., 721+ seconds), with 10% of those participants spending an extra 2:38 to 23:32 (MM:SS) on the video page after enough time had elapsed for the video to have finished playing.

No statistically significant difference was found between the different types of lecture videos and how much time participants spent on video lecture page, F (4, 146) = 1.247, $p > .05$. A regression analysis was run to determine if variance in multiple-choice test score could be predicted by time spent on the video lecture page. First, a linear equation was calculated and that linear regression accounted for 17% of the variance, F = 31.967 (1, 150), $p < .001$, adjusted $R^2 = .171$. However, a quadratic equation was also statistically significant and accounted for 23% of the variance in multiple-choice test score, F = 23.847 (2, 148), $p < .001$, adjusted $R^2 = .233$. The quadratic equation provides a better explanation of the data, and it appears that as more time is spent on the video lecture page (B = 0.930 standardized coefficient, t = 5.894, $p < .001$), score on the multiple-choice test will go up; however, at a certain point this relationship reverses and more time spent on the video lecture page (B = -0.571 standardized coefficient, t = -3.623, $p <$ .001) predicted lower scores on the multiple-choice test (see Figure 1).

Figure 1: Regression Analysis for Time Spent on Lecture Video and Score on Multiple-Choice Test



Data from YouTube viewing statistics were used to complement data from the experimental portion of this study for addressing RQ2a. Viewing statistics from actual YouTube video lectures indicated that the median length of the 33 videos was 6:09; however, the median view time for the 33 videos was 4:07. Looking at the mean, the average length of the videos was 10:42 and the average view was 5:18. The average student viewed less than 60% of the length of each video used in their actual online classes.

Discussion

This study sought to examine online video lectures, a staple instructional tool in online classes, and if differences in student learning, motivation, or interest (cognitive and emotional) were present between five different styles of online video lectures. Past research notes that instructors can use a variety of different styles of online videos in their classes (Hansch et al., 2015) and that some of these different video styles might be more engaging for students than others (Guo et al., 2014). In addition, there is considerable disagreement, between faculty and digital learning leaders,

concerning online classes being able to reach the same educational outcomes as FtF classes (Jaschik & Lederman, 2017). Lastly, college presidents expect online course offerings to expand in the coming years (Parker et al., 2011), and the percentage of students taking online classes has also grown over the past decade and is expected to continue to grow (Allen & Seaman, 2013).

The findings from the present study provide important information for instructors. First, and perhaps a rather obvious finding, watching more of the online video (measured by how much time participants spent on the video lecture page) corresponded with increased student learning, to a degree. The results from the regression analysis demonstrate that 23% of the variance in multiple-choice test score can be accounted for by how much of the video the student watched; however, this relationship is curvilinear in nature. The model shows that, at a point after the video has completed, staying on the video page predicted decreased scores on the multiple-choice test. This is particularly concerning when nearly 25% of participants stayed on the video page for substantially longer than the videos actually lasted, and nearly 40% only partially watched the lecture videos. When looked at as a whole, the experimental portion of this study found that roughly 34% of participants likely watched the full lecture video, while roughly 66% either watched too little or stayed on the video page for substantially longer than the video actually lasted, and this appears to have hurt their learning. YouTube viewing statistics, which pulled data from a different sample, found that students typically viewed less than 60% of the average video lecture. Together, findings from the present research provide additional evidence of a problematic relationship regarding online students' viewing behaviors of online course content and student learning. In addition, the general findings from this study correspond with similar research. Specifically, Guo et al. (2014) report that, for MOOC type courses, the average (median) student view of a 9-12 minute lecture was 6-7 minutes or roughly 60-67%. It very well could be that this is a consistent student behavior that spans different types of online courses and thus warrants further scholarly attention.

In general, these findings are particularly troubling for faculty, who likely would argue that watching the full video is important to student learning in the course. For example, in an FtF class we would generally expect students to stay during the entire class session and not leave shortly after the midpoint of class. While this would be unlikely to occur in an FtF

class, this study provides evidence that this appears to be the case for online classes and supported by data from experimental and observational studies, as well as being further supported by additional research (Guo et al., 2014). In both the experimental portion of this study and the YouTube viewing statistics, the average student did not watch the entire online video and missed out on any content covered in later parts of the videos, particularly content presented in the last 40% of the video. In addition, the roughly 11% of participants in the experimental portion of the study spent substantially longer on the lecture video page than the video actually was. It very well could be that these students were engaged in some other activity while the lecture video was playing and may not have devoted their full attention to the lecture.

Examples from the YouTube viewing statistics helps to illustrate this finding further. For instance, one of the online videos is 29:16 long and covers content from that particular online module. Across the lifetime of the video, the average view duration is 11:25. In this example, the average student is missing nearly 18 minutes of course content. In another example, this time with a video explaining one of the major assignments in the class, the video itself is only 2:46 long but the average view duration is 1:53. On average, students watched just 68% of this video, and this video provides details for a graded paper and presentation that students would be turning in for credit.

One potential explanation is that students may feel that the video is starting to wind down and that no new content is going to be covered; however, the timeline present on nearly all online videos provides an easy indicator that more content is presented in the video. Students might also use the timeline to jump through the video faster or perhaps speed up course videos to 1.5 or 2 times speed. In addition, students may come back to videos to watch particular parts of the video at a later point in time, for example if they seek clarification or a reminder about a specific part of the video and do not need to watch the whole video again. Although these are possible explanations, additional research that examines student viewing behaviors towards online course videos is absolutely needed. This future research should carefully examine the way in which students are consuming and interacting with online lecture videos in their online classes.

Implications and Caveats

Instructors should be mindful of the findings from this study. One suggestion is to emphasize that students should watch the entire video and not drop out of the video at the midpoint or prior to the actual end of the video. Instructors may wish to keep the length of videos limited; however, that may be difficult with particularly challenging concepts that take time to explain and unpack. Student should also take note that faculty generally expect them to watch all of the content provided in online lectures. While it is certainly easy to close out of an online video, this functions similarly to missing large portions of a FtF class and, according to the present study, missing large portions of video content corresponded to decreases in student learning. Future research should examine student viewing behaviors in more depth.

One significant implication of this article is how student learning relates to the increasing pressure to develop and teach online classes. As previously noted, college presidents (Parker et al., 2011) and digital learning leaders (Jaschik & Lederman, 2017) either advocate for or, at the very least, expect significant portions of the student body to take online classes. However, the present article and additional past research (Guo et al., 2014; Jordan, 2015; Rose, 2009) highlights student behaviors that not only appear to be widespread, but also negatively affect student learning. Given these findings and widespread faculty concern about online courses (Jaschik & Lederman, 2017), educators should be cautious about the move to online coursework. We should also question the push from higher education administrators to make more classes online, especially when we have clear evidence that students are not engaging in behaviors that benefit their learning in online classes and may prefer the interactions of FtF courses over video lectures (Jensen, 2011). However, we should also examine ways in which we may further develop online content to overcome these shortcomings and improve online course offerings.

Perhaps the largest caveat of the current study is that participants were recruited from a single university. Expanding this study to include a broader student population will aid in providing more generalizable findings. In addition, increasing the sample size used in the experimental portion of the study may aid in the statistical analysis. At present, no statistically significant differences were present between the different types of online videos and student learning, interest, or motivation; however, a larger sample size should provide additional power to detect differences if they are present. The present study lacked the power needed to detect a

statistically significant difference. Lastly, the present study assumes that students were watching the lecture videos during the time they spent on their respective lecture video in the experiment. However, it is entirely possible that students may have simply let the video play and done some other activity. While the study instructions told participants to watch the videos as they would for their online classes, it is not possible to tell if they actually were watching the videos or simply playing the lectures and not paying attention to them.

Conclusion

The online classroom is continuing to expand, despite concern that faculty have about online classes reaching the same outcomes as FtF classes. Overall, results from this study note that the amount of an online lecture video that students watched had an influence on student learning, but at a certain point more time spent watching the video predicted decreased student learning. The experimental study also found that only 34% of participants likely watched the full lecture video, 40% partially watched the lecture video, and 25% remained on the video lecture page for far longer than the actual video lasted. In addition, the viewing statistics from the observational study demonstrate that the average viewer watched less than 60% of each video used in actual online classes. These conflicting findings, that watching course videos increased learning but students generally do not watch the full video, provide concern for faculty as online classes are continuing to be emphasized by administrators and E-Learning offices.

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