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Introductory Videos: An Analysis of Student Use Patterns

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Abstract

In a distance-learning environment, an introductory video allows students to see and hear their instructor, affording the instructor the ability to efficiently communicate course information to a large number of students. This study considers the use of these introductory videos and made use of the Blackboard course management system (Blackboard, 2008) during two consecutive academic semesters to track and evaluate student usage patterns. Results found students used the video throughout the semester, although an ARIMA (autoregressive integrated moving average) analysis found a significant negative trend. An additional exploratory analysis conducted with a linear regression and t-test found that student use of the video during the first half of the spring semester was significantly greater than during the second half of the semester. This finding may suggest that this type of video, a general course introduction, is much more useful to students early in a semester than it is in the latter half of a course. Additionally, this type of video may be viewed in the second half of a course to access more specific content information to assist with assignments but does not require frequent viewing.

Introduction

Due to budgetary constraints, university administrators began to question the value of providing multimedia services in online courses. An analysis of learner behavior was conducted for two separate sections of a single course over two semesters (spring & summer 2009) in an attempt to determine the value of providing multimedia services to students, specifically the use of an introductory course video. A separate video was developed for each course section. Each introductory video was a streaming Flash video of the instructor explaining the syllabus, assignments, and the course policies of a fully online course:

- Spring 2009 Introductory video: http://eta.health.usf.edu/publichealth/HSA4011/MaxIPH/max.html
- Summer 2009 Introductory video: http://eta.health.usf.edu/publichealth/HSA4011/Intro/default.htm

Streaming video is a very useful medium for delivering and presenting content. With that said, it should be kept in mind that the purpose of such video is to generate and support learning. While this paper seeks to explore how students use course materials, it is important to consider how these resources may be better designed to support student learning. Thus this paper provides a brief overview of the development of streaming video, considers the design of introductory videos for online courses, and then analyzes how introductory videos were used over two semesters.

A Brief History of Streaming Video

This section provides a brief overview of the development of streaming video online before addressing the design of online videos for instructional purposes. Soon after researchers began to transmit text via the web, they began to explore the possibility of transmitting other types of media like graphics, audio and video (e.g. Guimãries, Correia, & Carmo, 1992). By the time graphical web browsers were developed in the mid 1990s, Apple's QuickTime Player had already been developed for desktop based multimedia applications (Apple, 1991). In the early 1990s most multimedia was distributed via CDROM, but the Internet offered developers a much larger audience and so it was only natural that they would want to port their existing content to the web. So video distribution via the web was incorporated into the first commonly used web browser, NCSA's Mosaic (Lowe, Lomax , & Polonkey, 1996; NCSA, 1994).

NCSA's Mosaic used external or “helper applications” like QuickTime to provide services beyond HTML rendering (Lowe et al., 1996). Netscape Navigator and Internet Explorer soon followed this convention and also employed a similar model. In the mid 1990s, video clips needed to be downloaded and played back within the browser once all the data had been received. Consequently, audiences quickly realized that there was a need for files to be played as they were being viewed, thus streaming audio and video applications were developed.

In 2001, there were three main helper applications for presenting streaming video, RealMedia, QuickTime and Windows Media had all been developed to make streaming services available (Cunningham & Francis, 2001). At this point, RealMedia claimed to have 70% of the market share (Green & Thomas, 2008). However, their share quickly began to erode, and within a few years everything had changed with the introduction of Flash video. By 2006, Adobe’s Flash video had become the dominant format and had captured 97.3 % of the market. The introduction of YouTube was an important reason for this change, but also, market leaders in news distribution (e.g. The New York Times, the Washington Post, and Reuters) also contributed to the market shift to Flash Video. According to Green and Thomas (2008), this shift also occurred because of a combination of factors: the development of standard formats, bandwidth increases, and the need for an easy plug-in based installation process. While RealMedia, QuickTime and Windows Media are still in use today, the majority of streaming traffic on the Internet is sent via Flash-based video (Green & Thomas, 2008).

Streaming Video in Online Courses

With the development of computer-based instruction, many researchers began to consider the impact of multimedia as an instructional tool. However as Mayer (1997) indicated, this research was often based on what computers could do, rather than on how media affected learning. Since the publication of this seminal article, many researchers have considered how media affect learning, and now e-learning is an important new domain of research.

Clark and Mayer (2008) describe e-learning in different ways. From a general perspective they discuss how media may promote “two different e-learning goals.” In their terms, learning may be “how to do” something (perform), or learning about something (inform). This distinction comes from the psychological and physiological literature, and is also described as procedural and declarative learning (Squire & Zola, 1996). In addition to the above dichotomy, Clark and Mayer (2008) also provide a nomenclature of several different types of learning (facts, concepts, procedures, processes, and principles). Instructional designers may use streaming media to deliver multimedia-based instruction for any of these types of learning.

Declarative learning (fact, concept, or principle-based learning) is often presented as narrated PowerPoint presentations. Once narration is recorded, these types of presentations may be presented with both visuals and streaming audio. Techsmith Camtasia and Articulate are widely used products for producing these narrated materials (Articulate, 2009; Techsmith, 2009). Over the past twenty years a number of researchers have developed guidelines for developing presentations (Clark & Mayer, 2008). In the 1990s,

several researchers began to study multimodal instruction (Mayer, 2001) and to consider the cognitive load (concurrent memory load) of instructional materials (Sweller, 1999). In the past decade, these two forms of research have come together to consider the cognitive load of multimedia.

With the development of multimedia-based instruction, researchers began to progress from only comparing print-based visual conditions to considering combinations of audio, graphics, and text. In general, researchers found that learners performed better given multimedia (i.e. dual modality instruction – visual and verbal) because of its ability to present both auditory and visual modes simultaneously (Mayer, 2001; Mousavi, Low, & Sweller, 1995; Penney, 1989). This is known as the modality effect or modality principle (Moreno & Mayer, 1999; Mousavi, Low, & Sweller, 1995; Mayer, 2001; Penney, 1989). While much of this research focused on declarative learning, researchers have also considered multimedia for procedure-based learning.

Certainly procedure-based learning is also possible with streaming video. For the most part, studies concerning procedure-based learning via streaming media typically demonstrate computer-based procedures. These presentations are commonly referred to as animated demonstrations. In the past few years, there has been some discussion questioning the effectiveness of this type of instruction (Hegarty, Kriz, & Cate, 2003; Tversky, Morrison, & Betrancourt, 2002), but recent evidence has shown that if a learner is presented with multimodal animated demonstrations that include narration, that these materials are an effective, efficient form of instruction (Lewis & Barron, 2009).

The focus of the paper so far has been on the history and design of streaming media as content for a course. That is, it has looked at media from a general course content perspective. The next section considers streaming media in a specific context, as an introduction to a course.

Introductory Video

In a campus-based course, an instructor typically provides a brief introduction to the course during the first day of class. During this overview, most faculty members review the course syllabus, and discuss course assignments, exams, activities, and course policies. While a course overview is a common occurrence in most campus-based courses, distance learners are often at a disadvantage because they do not have this opportunity, and may never meet their instructors face-to-face.

The inclusion of a well-designed introductory video fills this need, providing structure and guidance to distance learners. Like a well-crafted syllabus, introductory videos provide a clear, concise course overview. Although an introductory video is the latest in a series of e-learning course components which are now being implemented in many online courses, the importance of these videos has only recently gained attention.

The course syllabus itself is a staple of modern courses and has become a requirement at most institutions, but all too often instructors complain that “students do not read the syllabus!” This is unfortunate, because without this guidance students are often left confused and may easily fall behind. Video offers a solution to this age-old problem, because it can focus attention on the importance of the syllabus and course structure. It also offers a means of communicating with students via a medium that they may actually use. Thus, the faculty and staff of our university began to wonder if students would use an introductory video.

Research Questions

This study has as its central focus the following two questions:

1) How often are students accessing and using the course introductory video throughout the semester?

2) What are the students' usage patterns of the introductory video relative to assignments and projects and the due dates of those items?

The intent was to determine if a hyperlink to an introductory video was useful to the students, and how those students would interact with this instructional tool. Two independent variables (day of the week and time of day) and one outcome variable (video views) were considered. It was assumed that the first week of classes would be important and probably the most active usage period. This assumption was examined in this study; however student usage patterns were also analyzed throughout the entire semester.

Methodology

Sample

The participants of this study were undergraduate students taking an "Introduction to Public Health" course at a large, public southeastern university. Student data was collected from a single course section in the spring and summer semesters of 2009. Based upon the students that finished the spring course the female to male ratio was approximately 55% to 45%. The total enrollment during the spring section was 398, and 54 for the summer section.

Materials

Two introductory videos were developed for an undergraduate course during the spring and summer semesters of 2009. The largest of the spring sections was chosen for analysis, because it was thought that this would be less variable, more generalizable, or both. The only section offered during the summer was also used for analysis.

The subject matter for these introductory videos was developed specifically for a large undergraduate public health course and included information about the syllabus, assignments, and quizzes that were conducted in the course. The videos were edited in Adobe Premiere Pro CS4 (Adobe, 2009) compressed, and posted as Flash video files on a university web server, and accessible to students via a hyperlink in Blackboard. A hyperlink was built to an external web page from within Blackboard. The link was labeled "Introductory Video" and placed on the same web page as the course syllabus.

The Blackboard course management system allows for content tracking making it relatively simple to gather data on student behavior in a web course environment. In our case it was as easy as enabling tracking for the hyperlink. The study's main data gathering method was the statistical reporting options provided within Blackboard's course management system (Blackboard, 2008). The course management system was able to track how often individuals clicked on a link in the course. This study concentrated on clicks or "hits" to the introductory video. "Video hits" are defined here as a click on the introductory video hyperlink; however, there is no way to determine the length of time the video was viewed per hit.

Study Design

The research design of this study is primarily descriptive rather than inferential. Although inferential statistics and methodologies were employed, they were used in an exploratory fashion, since the data are time-based and the assumptions of the inferential analytical techniques, such as linear regression, are technically violated. The main descriptive tools used were generated graphs and plots that examined the type of association between the independent and outcome variables. Figures 1-6 display these relationships and their results are further discussed in the Results section.

In the first six figures, video hits (y-axis) and time (days or hour on the x-axis) were analyzed for two time periods for each semester (spring & summer). The first time period in each semester includes the number

of video hits made in the first seven consecutive days (Monday-Sunday) of each course offering. The analysis of this first time period is further subdivided in two: 1) an analysis including the number of video hits per day over the first seven days (Figures1 and 2 for spring and summer respectively); and 2) an analysis measuring the time of day that the video was viewed per hour during the first week (Figures 3 & 4 for spring and summer, respectively). The second time period covers the total length of the semester (Figures 5 & 6 for spring and summer, respectively). The spring semester extended over a full 16 weeks, or 111 days (January 5, 2009-April 25, 2009) while the summer semester was a compressed section of the same course extended for only 6 weeks, or 39 days. Finally, the second time periods for each semester were analyzed for possible trends. A study intending to characterize patterns of response and change in a variable over time is, by definition, longitudinal research (Ware, 1985). Four ARIMA (autoregressive integrated moving average) models, two for each of the two terms (spring and summer), were applied using SAS to determine the significance of an overall trend line over the entire semester. Since interest was focused on examining trends over time, the ARIMA methodology was chosen because it is well suited over other time-series techniques to execute this type of analysis. For each section, an initial model was conducted using the absolute number of hits to the video (Line A in Figures 7 and 8). Similarly, for both terms a second model was run using the ratio between the number of hits to the video and the number of hits to the course (Line B in Figures 7 and 8). This ratio was used in an attempt to account for student withdrawals from the course and the subsequent decrease in student enrollment. This was done under the assumption that students registered would still be interested in the course and, thus actively accessing the introductory video.

Exploratory Use of Regression

Best-fit linear regression analysis may be a useful investigative tool for a preliminary analysis, especially if longitudinal tools are used to confirm findings. Use of linear regression in longitudinal studies has been reported in the literature (Liang & Zeger, 1986; Twisk, 2003). A preliminary analysis executed in Microsoft Excel, 2007 was conducted for each of the two terms with linear regression and Pearson correlations as investigative tools.

The spring section study period was partitioned into two “halves”: the period starting after the drop/add week (day 6 - day 76), and the period after the withdrawal date (day 84-day 111). The first five days were removed from the data set because the roster was constantly changing due to drop/add activity. In addition, the week prior to the withdrawal date (days 77- days 83) was also dropped to cleanly separate the two times periods. The rational for removing the weeks of dropping decisions by students is to account for possible differences in student behavior.

Two distinct analyses were conducted on the two time periods of the spring section: linear regression to determine trend potentials, and a t-test on the difference of means to determine whether students before the drop day were significantly different from those who completed the course. A significant difference from the t-test might imply that the students enrolled before the drop day could exhibit different viewing behavior as those students who completed the course. The summer section was not divided into two time periods because it was so short it did not have a withdrawal date that could be used to split the total term into two parts with enough data to analyze.

Results

As expected, the first week of class showed a very heavy usage pattern (Figures 1& 2), The plot of total number of video hits made per day over the first seven consecutive days shows decreasing usage, as the first week progressed, for both semesters with different distributions during the week .

The first day of the classes, Monday, received the most hits in both sections studied (145& 40 for spring and summer respectively), with an overall decline as the week progressed [Monday (145 and 40), Tuesday (96 and 33), Wednesday (118 and 17), Thursday (81 and 16), Friday (103 and 15), Saturday (86 and 8), Sunday (25 and 12); for spring and summer respectively]. The day with the least usage was

Saturday for the spring and Sunday for the summer. It is noteworthy that students were given instruction to watch the introductory video during the first week of classes, but were not expected or required to do so thereafter.

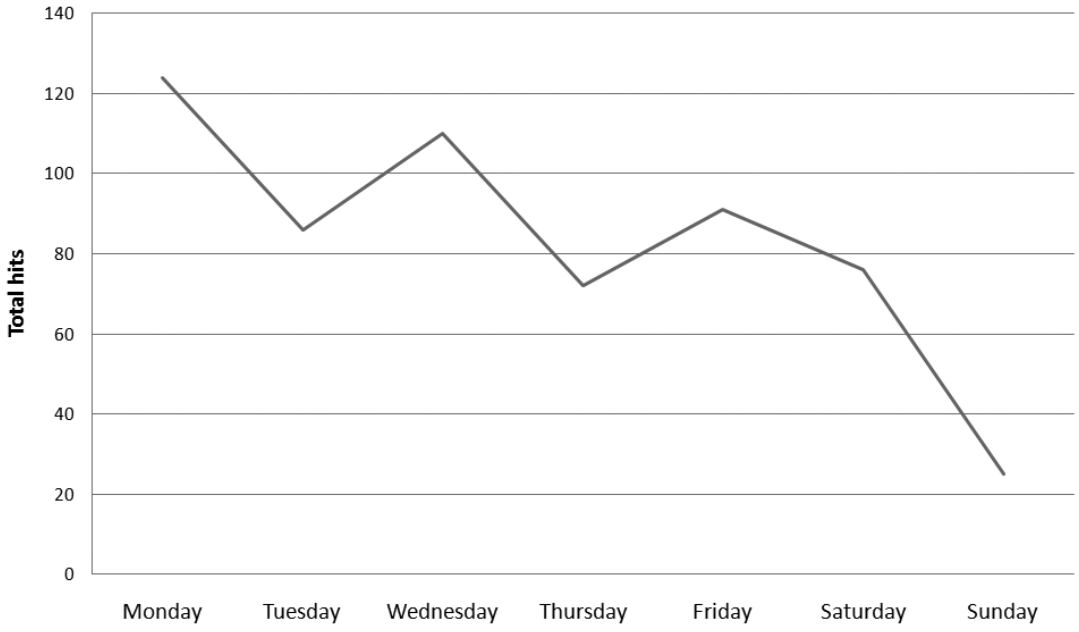

Figure 1: Spring Semester Hits per Day (Week 1)

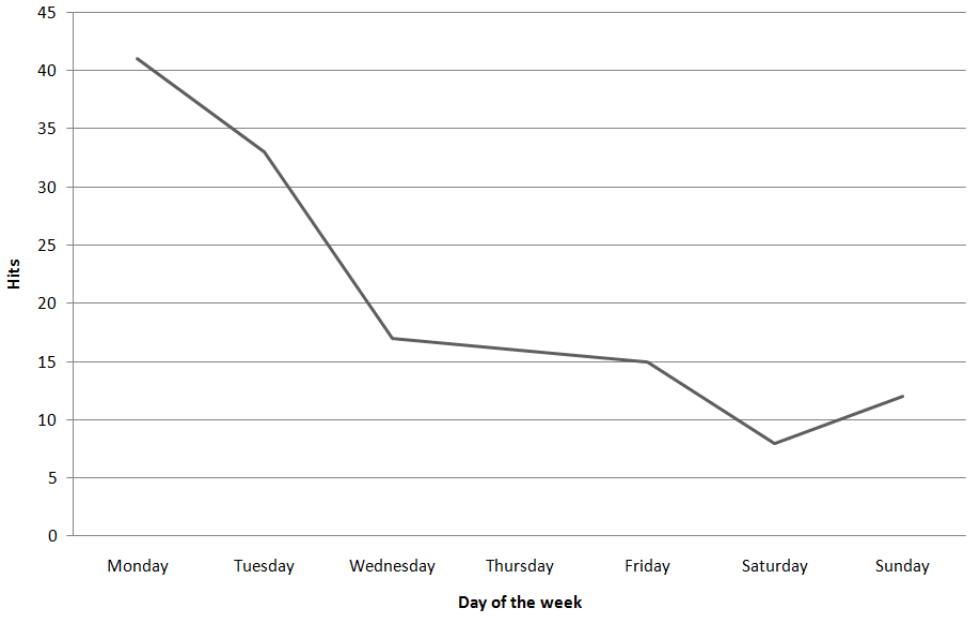

Figure 2: Summer Semester Hits per Day (Week 1)

The plot averaging the number of hits per hour during the 24 hours-day during the first week of classes shows similar results for both sections (Figures 3 & 4). These results suggest that the period between 3 AM and 9 AM correspond to the least usage of the video while that between 10 AM and 2 AM to the most usage. Plots of the number of video hits per day over the entire semester suggest that the video is viewed throughout the entire semester although with a slowly decreasing trend of usage (Figures 5 & 6).

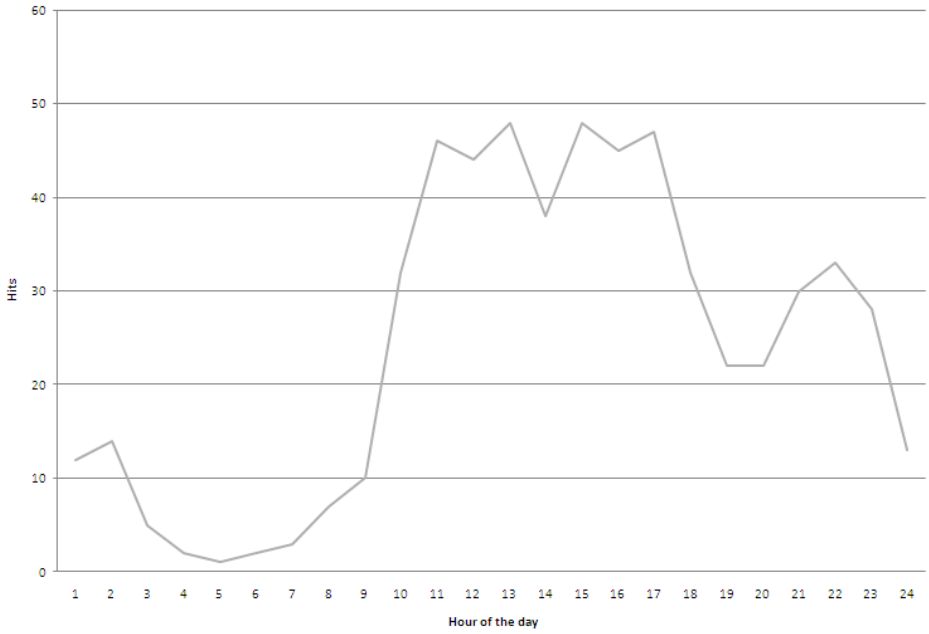

Figure 3: Spring Semester Hits per Hour of the Day (Week 1)

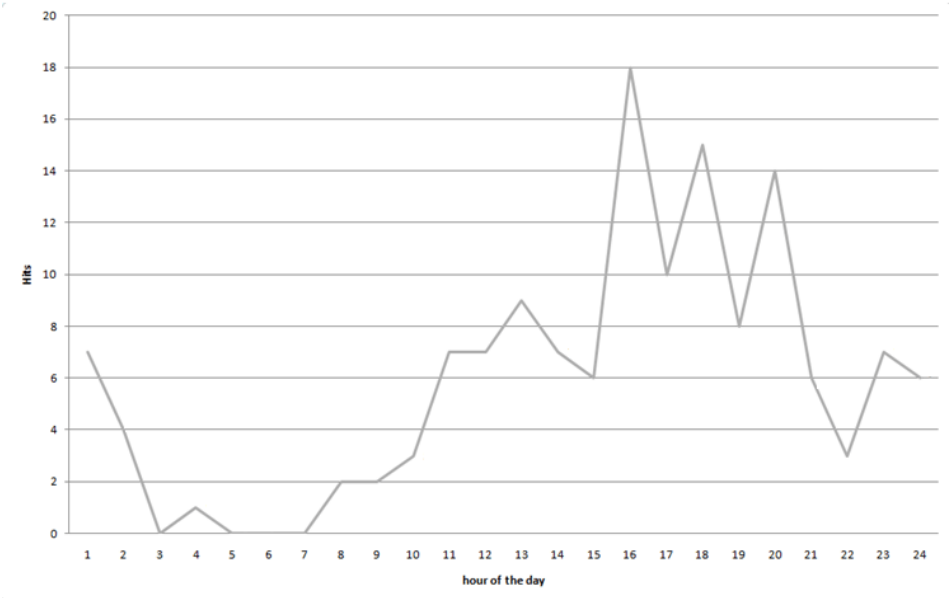

Figure 4: Summer Semester Hits per Hour of the Day (Week 1)

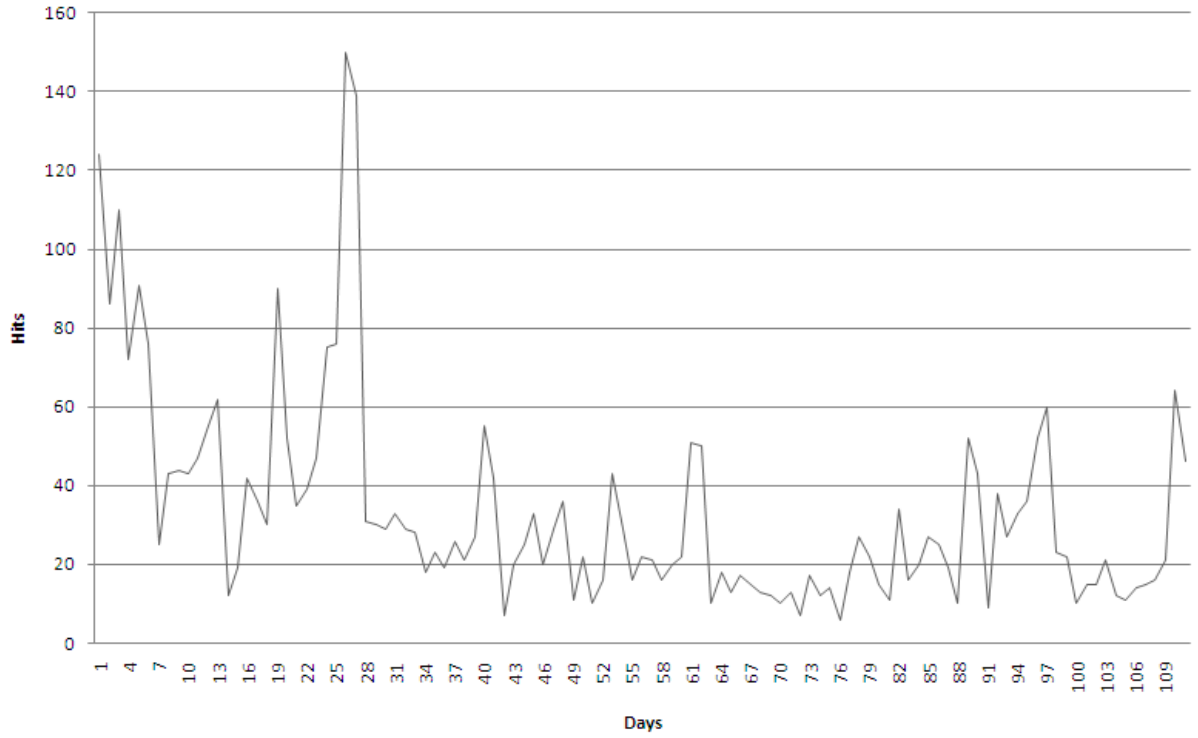

Figure 5: Spring Semester Hits per Day

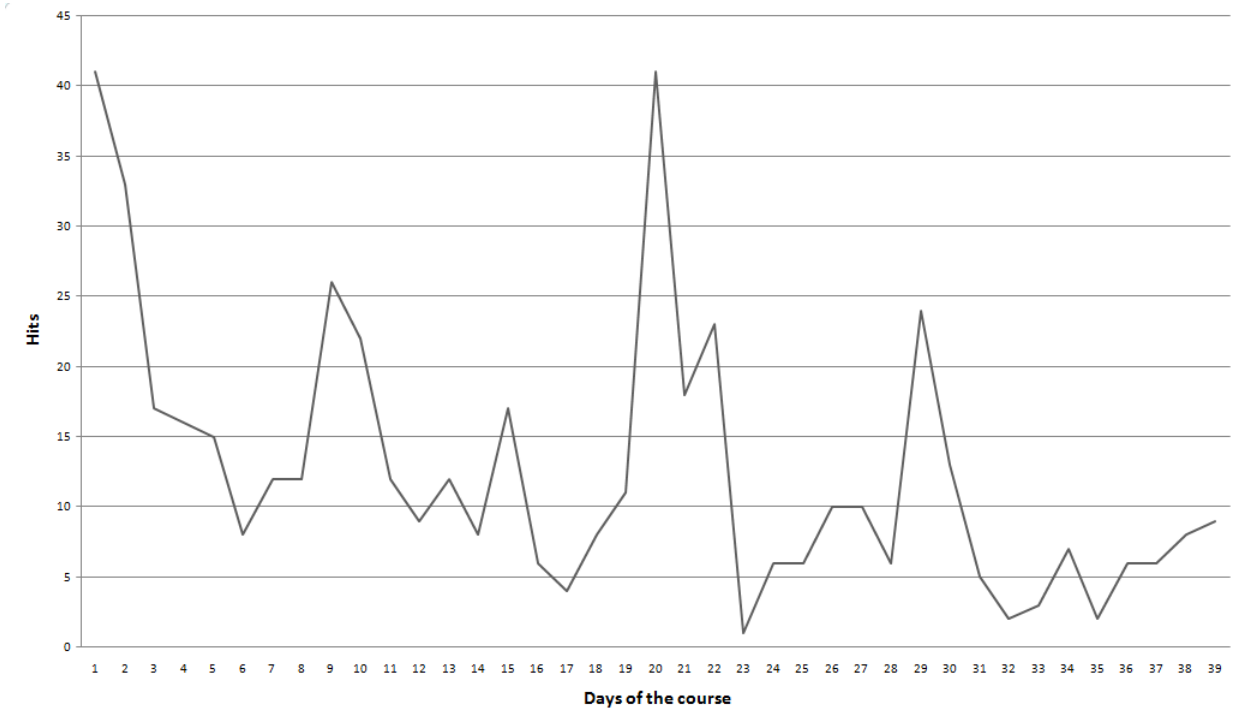

Figure 6: Summer Semester Hits per Day

Statistical analysis with an ARIMA model in SAS shows a significant trend line ($p < 0.01$) for the relationship between hits to the video and days over the entire academic semester for both sections considered. For the spring section, that usage of the introductory video gradually decreases, reaching its lowest point in the middle of March, coinciding with spring break, and then slightly increases toward the end of the academic semester (Figure 7). This confirms what had been suggested by a linear regression analysis (see methodology). A similar situation occurs for the summer semester where the lowest point is reached at the beginning of August with a slight increase toward the end (Figure 8). It is important to note the difference that the plot of hits to video during the summer has a peak by the middle of the term.

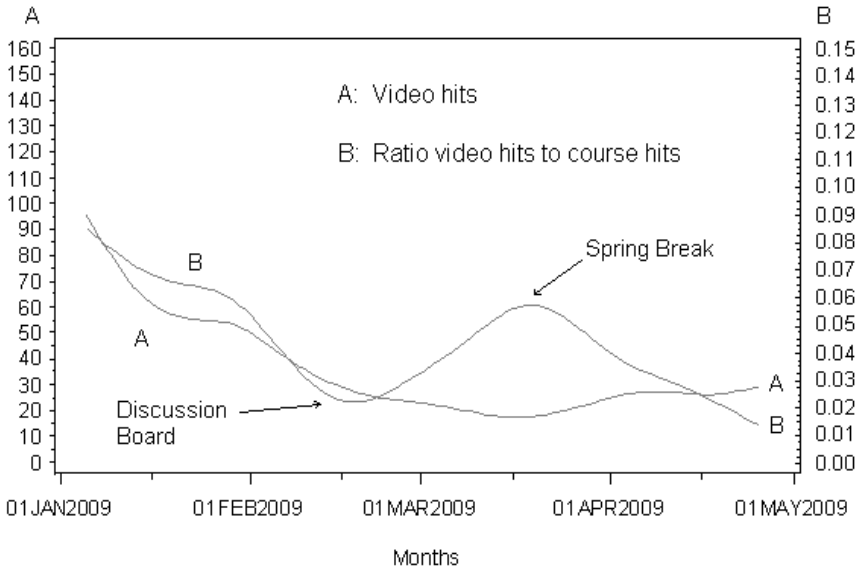

Figure 7: Plots of Video Hits and Ratio Video Hits to Course Hits over the Spring Semester

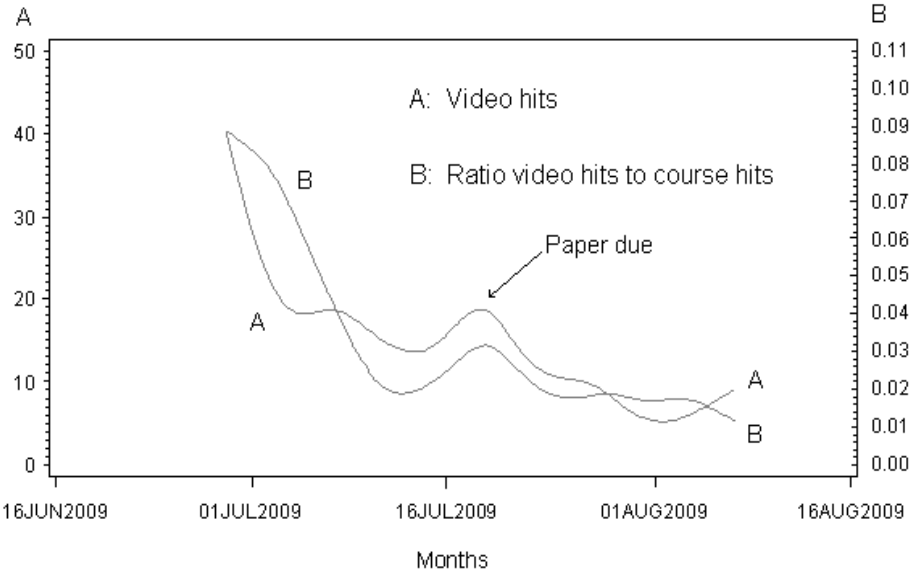

Figure 8: Plot of Video Hits and Ratio of Course Hits by Month over the Summer Semester

An ARIMA model was also significant when applied to the ratio of video hits to course hits ($p < 0.01$) for spring and summer. A graphic representation of this second relationship shows a different behavior for video hits for the spring section. The plot of the ratio of video hits to course hits has an accentuated dip during the middle of February and a strong peak during the middle of March. The dip in February coincided with a discussion board topic while the peak in March coincided with spring break (Figure 7).

Unlike the spring, there is no break during the summer section. This may explain the difference between the ratio trends in the summer and those of the ratio in the spring. There is still a peak in the ratio video hits to course hits during the summer (around July 18th), but this peak does not coincide with a break; it does with a paper due date. This peak coincided for both plots of the summer section: video hits and ratio of video hits to course hits (Figure 7).

Linear regression and Pearson correlations analysis found a significant inverse correlation between the number of video hits and days of the course ($r = -0.5$, $p < 0.05$, for spring; and $r = -0.56$, $p < 0.05$, for summer) as well as between the ratio of video hits to course hits and days of the course ($r = -0.42$, $p < 0.05$, for spring; and $r = -0.68$, $p < 0.05$, for summer). Results from the t-test analysis applied to the spring section of the ratio of video hits to course hits indicated that the second period is significantly different from the first period
($p < 0.01$). Since a direct comparison of the spring section to the summer section would be inappropriate, no t-test was performed for the summer section.

Discussion

While it is logical to assume a student would view an introductory video once, especially when they were instructed to do so, data indicates that students reviewed the video throughout the semester. Students tended to view the videos during regular business hours, rather than in the evening or late at night. It should also be noted that while there were quite a few hits during the first week of the course, higher relative rates were noted later in the spring semester but not in the summer. This coincided with spring break, which does not occur during the summer semester.

The plot of daily class video hits (in absolute terms) made for the spring course captured the effect of spring break (a one-week hiatus). It appeared that there was a decreasing trend, and when tested, proved to be statistically significant ($p < 0.001$). Total hits to the course dropped during spring break, which matches students' overall decrease in academic activity. However, what was unexpected was the relative increase in video hits toward the end of the course term after the spring break. To put this in perspective, a plot of the ratio of video hits to total course hits was overlaid on top of the video hits only curve (Figure 7). The curve of the ratio of video hits to total course hits decreases from the start of the course to level out at the beginning of March (before the start of spring break), increases during spring break, and then decreases steadily until the end of the term. The spring break peak is due to the decline in overall course hits relative to the video hits. Both video hits and overall course hits were declining, but overall hits declined faster, giving an illusion of a spike in the ratio of video hits to course hits. Similarly a dip in the curve in the middle of February can be explained by the use of a discussion board assignment. The discussion board assignment was the second project of the course but weighed heavily in the final grade. This assignment gave students a strong incentive to access the course, but no need to access the introductory video. Consequently, the relative ratio (video hits to total course hits) decreased as the value of the denominator (total course hits) increased.

During the summer semester, a different behavior was exhibited in Figure 8. The curves of the absolute number of video hits and the ratio of video hits to course hits are coincident around July 18th, the due date for an assigned paper, where both curve decrease and then peak near the due date. A possible explanations for the difference in behavior between the two terms include the shorter time period in the summer (6 weeks versus 16 weeks), the absence of a break in the summer, and the use of the discussion board assignment in the spring. The discussion board assignment encouraged students to visit the course site itself, but did not necessitate accessing the introductory video. Conversely, the paper

assignment in the summer seemed to favor accessing the video more than the discussion board did in the spring.

The t-test results suggest that the type of student who completed the spring course significantly differed from the type of student who began the course. Since students can withdraw from the course up to half way through the term, the behavior of the students that remain will be heavily represented by the end of the course. . This may indicate the need of future studies to incorporate survival analysis in the statistical investigation of student behavior. Alternatively, using students as the experimental unit, rather than the class as a whole, would allow the analysis of students who specifically start and complete the course, relative to those who drop before completion.

Conclusions

This study found that there is a tendency for students to use the introductory video throughout the semester. However usage patterns decreased as the semester progressed, with a slight increase at the end of the semester. In addition, findings indicate that students who completed the course exhibited different behaviors from those who initially enrolled in the course but dropped it at some point during the semester. It is also important to emphasize that the results from this analysis are mostly descriptive and not inferential.

The results of this study are thought-provoking, and show that students in both course terms (spring and summer) viewed the introductory video over the entire semester in the hope of extracting information that could be applied later in the semester. However, caution must be employed when comparing the results for the spring and summer sections of the course since they are not structured the same. First, the spring section of the course is 16 weeks long, whereas the summer section of the course is only scheduled for 6 weeks. Second, the assignments are not the same; for example, the spring section makes use of the discussion board but the summer section has a written paper assignment. Finally, the type of student that registers for a spring course may be different from the type of student that registers for a summer course. To compare sections of a course, it is preferred to use two or more sections within the same term.

Finally, while this study lays the groundwork for more detailed analyses, other researchers should consider variables such as location within the course, proximity to the syllabus, and correlations to key events within the course (e.g., due dates, etc.). In addition, future research should also consider students' perceptions of introductory videos. Such research could use a survey that specifically asks students for their perceptions of the value of the information contained in an introductory video. It was assumed in the current study that if students repeatedly accessed the video they found it valuable. Future research should address whether an introductory video would receive as much attention if other videos related to various lessons were used throughout the semester.

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