

## To stream or not to stream in a quantitative business course

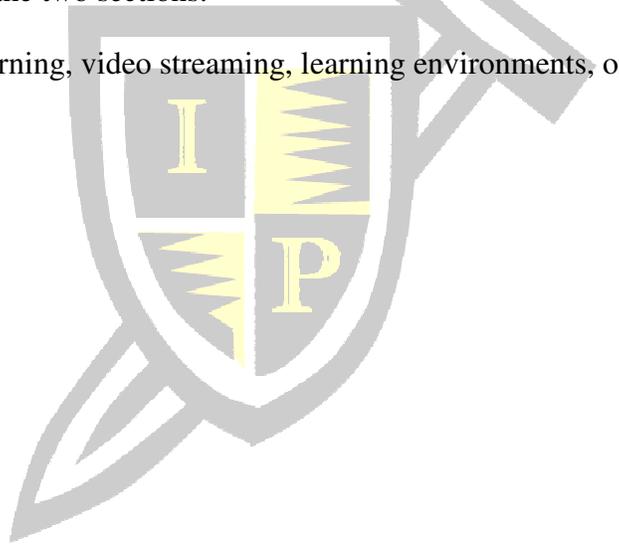
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### Abstract

This paper investigates whether there is a difference in student learning in a quantitative business course taught through video streaming with the option of going to a face-to-face lecture, compared to the same course taught only through face-to-face lecture. This topic has been the subject of research in recent years because of the importance of this new tool in the delivery of information to students in many high schools and universities. The study focuses on students in the College of Business Administration in a large (50,000 plus students) urban university, enrolled in a core quantitative business tools course. There was no statistical difference on overall grades between the two sections.

Keywords: distance learning, video streaming, learning environments, on-line courses.



## Introduction

This paper explores the contribution of streaming video in the learning of college students. This subject has been under research now for many years because of the importance of this new tool in the delivery of information to students adopted now by many high schools and universities. According to Boster, Meyer, Roberto, Inge and Strom (2006), "Video streaming refers to the process of viewing video over the Internet." The Joint Information Systems Committee webpage (JISC, 2009, Para 2) defines video streaming as the "Transmission of moving images over the internet in compressed form as a continuous stream. A recipient equipped with suitable 'player' software can decompress and view the images in real time." According to a study conducted by Fill and Ottewill (2006), video streaming "increases student's control" and allows "students flexibility with respect to accessing, starting, stopping and searching the video." Students are able to play back the lecture as many times as they want.

Streaming video is also a cost effective method to reach students. In 2009, the economic condition in The United States forced many states to slash the budgets of schools. However, the enrollments remain the same and schools are asked to deliver the same quality education despite the reduced funds. This problem is not new, Brown (2004) was reporting that "school budgets are constantly being stretched to meet more demands without necessarily being increased."

To meet their budget reductions, universities are employing the use of more video streaming classes. A study by Clark and Stewart (2007) suggested that streaming "videos are created easily and at low cost." Sheppard (2003) also described some of the advantages over other media. "Streamed video is also different from CD-based or DVD (Digital Versatile Disc)-based video. Individual CDs or DVDs need to be produced and distributed to each user; not so for the streamed video." Furthermore, Dupagne, Stacks and Giroux (2007) indicated that "most students appear enthusiastic about the use of video streaming technology." Streaming video might be very important in a quantitative class. As reported by Bolster et al. (2007) "technology is most powerful when used as a tool to teach important aspects of mathematics, such as problem solving, conceptual development, computation skills, and critical thinking." However, a study conducted on statistics students enrolled at Washington State University (Johnson et al. 2009) shows that students prefer to have a face to face class for a statistics class.

One of the courses at the University of Central Florida (UCF) that is available as a video-streamed section as well as a face-to-face section is ECO 3401, Quantitative Business Tools I. ECO 3401 is a 3-credit hour course that is part of the core curriculum required of all students in the College of Business Administration at UCF. The 2008-2009 Undergraduate catalog describes the course as an, "introduction to mathematical and statistical analysis of economics and business problems." The two prerequisites for the course are ECO 2023 (Principles of Microeconomics) and MAC 1140 (Pre-Calculus Algebra). The course covers a broad range of topics including matrix algebra, financial mathematics, business calculus, descriptive statistics, and an introduction to probability. Gagne and Shepherd (2001) found that student performance in a distance course is similar to the performance of students in a face to face course. The distance course is a web-based course where all material is delivered over the Internet and students and instructor mainly communicate using a chat function. Boster, Meyer, Roberto, Inge and Strom (2006) conducted a study on the effectiveness of video streaming in high school student performance. Streaming video is another method to deliver distance education. They found that most of the high school students performed on average better. However, for some of them there was no difference in performance between students exposed to video streaming and those not

exposed. The study conducted by Neuhauser (2002) showed no statistical difference between face-to-face students and distance learning students. A more recent study conducted by Allen et al. (2004) showed that students in distance education classes perform on average better than students in traditional classes. A study conducted by Argon and Shaik (2002) found that the student's learning style does not influence the success between online learning and face to face learning. However, Battalio (2009) found that there is a relationship between a student's success and his/her learning style in distance education classes. The study suggested that reflective learners were doing better than any other groups in online classes.

The University of Central Florida is offering more and more classes via video streaming. It is important for everyone involved in the education of students to understand the consequences of moving away from the traditional, face-to-face learning model. Specifically, this study measures the final exam test scores of two sections of ECO 3401, taught at the University of Central Florida: one section taught only face-to-face, the other taught via video streaming (with an option to attend a live class). Technology has advanced to the point where proximity is becoming obsolete. People no longer need to be in the same room in order to have meaningful discussions and exchange of ideas. The purpose of this study is to determine the efficacy of video-streamed classes and show there is no difference in learning outcomes for students in a traditional classroom setting and those learning through video-streamed methods.

## Method

This paper focuses on two sections of ECO 3401 that were offered during the 2009 spring semester. Section 0004 was delivered through traditional face-to-face lecture. The section consisted of 190 students, and met twice each week on Mondays and Wednesdays from 4:30 pm until 5:45 pm for 16 weeks. This study asked permission from all students to use their data according to IRB (Institutional Review Board) specifications. Of these 190 students 137 gave us permission to use their data. Section 0L01 was delivered through video streaming. The section consisted of 198 students and 140 gave us permission to use their data in the study. The students in this section had the option of viewing the lecture live through a high-speed internet connection as it was being given, or later by accessing the video at a password-protected course management web page. The students in the video-streamed section also had the option of attending the live presentations that took place on Tuesdays and Thursdays from 4:30 pm until 5:45 pm for 16 weeks. Both sections were taught by the same instructor. According to Toni (2003) "It is not the location of education that determines the effectiveness, but the amount of transaction between the learner and the instructor". The students of both sections could communicate during office hours, via telephone, e-mail and threaded bulletin board discussions (via Webcourses). Students of both sections were required to do online homework assignments. Students were required to either buy the book or buy access to the online version of the book. In a study conducted by Heerema and Rogers (2001), "high-quality instruction is best achieved when students received an educational experience customized to their individual learning abilities." For this particular class we made available to students a help desk with tutors available 4 days a week for a total of 30 hours. The notes used in both sections were available on Webcourses. The instructor has over 8 years experience teaching Economics at UCF. Students were required to take 3 exams plus a cumulative final and to do a set of online homework assignments. The exams were taken in a computer lab and questions were delivered via a computer. According to a study conducted by Reuter (2009) there is no difference in overall grade between on-line students and on campus

students. Yates and Beaudrie, (2009) found that there is no difference between test grades earned by students taking mathematic courses when the exam is taken in a proctored environment or in an environment not proctored. The computer lab at UCF has always at least one proctor and there are cameras covering the students taking the tests.

The class has a set of 38 learning outcomes. Each learning outcome has a corresponding question on the final to assess mastery of the concept. The performance comparison was based on these 38 questions which were identical for the two groups.

SAS was the statistical software used for this study. The TTEST procedure was used. This procedure provides two types of tests: one under the assumption that the variances are equal, and one under the assumption that the variances are not equal. The software automatically performs the test of equality of the variances (F test).

## Results

Of the 38 TTESTS conducted using a level of significance of 0.05 only two did not have a statistically identical mean: Question 28 (Assign probabilities to experimental outcomes) where the video streaming plus face to face students had a mean of 92% and the face to face only class had a mean of only 83%, Question 15 (Calculate the amount of time it would take for a sum of money (principal) to equal a future value, given principal, annual interest rate, frequency of compounding, and future value) where the video streaming plus face to face had a mean of 67% and the face to face only had a mean of 78%. Face to face performed better on one and video streaming performed better on the other. The overall final exam average was for face to face 81.4% and for video streaming 81.9%, with no statistical difference ( $\alpha = .05$ ). The study also did not find that there was a statistical difference in GPA between the two groups. However, the average age of the two groups was statistically significant. The face-to-face students had an average age of 20.9 and the video streaming students had an average age of 20 (see Table 1). While the difference between the average ages of the two groups is statistically significant, we don't believe this difference had a profound effect upon the overall outcome of our study. Reuters (2009) found the opposite: average age of online students was 34 and 25 for the on-campus class. One of the major conveniences of taking an on-line or video-streamed class is the fact that the class can be watched from any computer with internet connection and for the most part, at any time. This convenience would appeal to students that have full time jobs (typically older individuals). In this study, the age difference could be attributed to the possibility that younger students are more comfortable with the technology involved in taking a course through video-streaming, and are therefore more likely to enroll in a video-streamed class. In any case, this is an interesting difference, and may be a topic for future research.

## Conclusions

Under the current economic condition where universities are asked to deliver the same quality education with fewer funds, it is important to maximize student achievement. The current study showed that there is no statistical difference in the success of students taking a video streamed class with an option of face to face, and students taking a face-to-face class. This is important not only for universities, less cost same benefits, but also for students and the environment. Students will have more options for taking classes anytime of the day from any internet connection. The environment would benefit as well because less driving will bring on

less fossil fuel consumption and reduce carbon emissions. With exams, books, notes and assignments in digital format there would be a reduction of paper consumption and land fill waste. The focus of universities might have to be on designing courses taught by good instructors whom are available to their students outside of the lecture or streamed class, good supporting material, and tutors since the study shows that the delivery method does not have a statistically significant effect on learning.

**Table 1.** Demographic and GPA comparison

Characteristic	F2F	VS
Gender	62.4% male	54.35% male
Age <sup>(1)</sup>	Mean = 20.9 years	Mean = 20 years
Final Exam <sup>(2)</sup>	81.4%	81.9%
GPA <sup>(3)</sup>	Mean= 3.10	Mean = 3.16

(1) Significant difference in age ( $\alpha = .05$ )

(2) No significant difference in Final Exam Score ( $\alpha = .05$ )

(3) No significant difference in GPA ( $\alpha = .05$ )

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