Does time spent online with course material result in student success? A study for the online and face-to-face courses

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ABSTRACT

An age-old question among instructors and administrators is whether time spent studying course material results in the student success. This study analyzes this relationship for two online and two face-to-face business finance courses using the Canvas Learning Management System (LMS). The relationship between the average exam scores and the "total activity" measuring time spent online in hours is statistically significant for the online courses, and insignificant for the face-to-face courses. Additionally, the results indicate that the hard work may not pay off for the students who spent too many hours online with the course material.

JEL Classification: A22, G00, G000

Keywords: online teaching, face-to-face teaching, total activity, Canvas, time spent studying, average exam scores, academic performance, student success.

INTRODUCTION

The Canvas learning management system records "Total Activity" for each student in Hours:Minutes:Seconds to approximate time spent online with course material. According to the official Canvas definition, the "Total Activity" is defined as:

> Total Activity [7]—allows you to see how long students interact within a course and counts page navigation only. Total activity time is displayed in hours:minutes:seconds. If a user has not yet reached an hour of activity, total activity time is displayed as minutes:seconds. Total Activity records any time spent viewing course content that exceeds two minutes. If the time between a new activity and the last completed activity is under ten minutes, all time between these two events will also be included. Total Activity does not include group activity or page views for videos that do not include intermediate page requests, such as a half-hour recorded lecture.

This paper use "total activity" measured in study hours to predict average exam scores during the semester. Currently, there are no other research paper published analyzing the effectiveness of Canvas's total activity measure. However, two other research papers are in line with this study. First paper is by Calafiore & Damianov (2011) who use the online tracking feature of Blackboard, record the students' time spent in the course for the entire semester, and analyze the impact of time spent online for the final grades. They find that longer times spent online are associated with higher grades. The second research by Mo & King (2015) use McGraw-Hill's Connect homework management system to record the starting and submission times of online assignments to find out if the submission delays of assignments affect the academic performance. However, both papers use different methodologies and applications to measure the relationship between the time spent studying and academic performance.

The literature on the relationship of the time spent studying and academic success shows mixed results while some studies find no positive association, the others claim either positive or negative association. For example, Noonis and Hudson (2006) find that study time does not correlate with the academic performance. Also, Dickinson & O'Connell (1990) find a weak correlation between the test scores and total study time. However, they find a stronger relationship between test scores and time spent organizing the course content. Further, Gleason and Walstad (1988) does not support the hypothesis that student achievement is a function of study time.

Further, some studies investigate what determines the academic performance beside time spent studying. For example, English & Mladenovic (2004) find that when the accounting students adopted a deep learning approach by improving students' written communication skills, the overall course results has improved. Additionally, Davidson, R. A. (2002) finds that the cumulative GPA and motivation for taking the course are the best predictors of examination performance. Also, Elias (2005) finds that accounting and nonbusiness majors often use deep studying approaches as the active learners with a genuine curiosity and enjoyment in the subject matter compared with other business majors. Similarly, he finds that the women and mature senior students use the deep studying approach more often. In another study, Johnson et. al (2002) measure effort by the number of attempts made and the amount of time spent by students on repeatable computerized quizzes and find that student effort and student performance are positively correlated. Additionally, Noonis and Hudson (2010) find that some study habits such as access to notes and ability to concentrate affect the student performance positively. Also,

Nofsinger & Petry (1999) study the relationship between student attributes and class performance in the introductory finance course and find that the grade point average is the best determinant for the exam performance. Furthermore, some research papers emphasize the learning disabilities, especially about the attention deficit hyperactivity disorder (ADHD), among college students and its role (Jones et al. (1997), Heiligenstein et al. (1999), Lee et al. (2008), and Heiligenstein & Keeling (2010)). In addition, Curtis & Lucas (2001), Sarath A. Nonis & Gail I. Hudson (2006), and Lingard (2007) investigate if part-time work or financial difficulties affect academic performance.

RESEARCH METHOD AND ANALYSIS

In this study, a quantitative research methodology based on historical data is employed. The historical data are actual student exam scores obtained from two online and two face-to-face courses during the summer and fall semesters of 2019 taught by a single faculty. The time spent studying is approximated by the Canvas's "total activity" measure in hours. Two online and two face-to-face undergraduate courses in finance are shown at Table 1.

Table 1: Business Courses and the Number of Students Enrolled*

COURSE NUMBER AND SEMESTER	COURSE NAME	NUMBER OF STUDENTS
ONLINE		
BUS 370 SUMMER 2019	Introduction to Managerial Finance	31
BUS 471 SUMMER 2019	Case Studies in Finance	15
FACE-TO-FACE		
BUS 474 FALL 2019	Computer Applications in Finance	37
BUS 476 FALL 2019	Insurance and Risk Management	56

*Summer (SU) online courses are for 4 weeks long of instruction and the fall (FA) courses are about for 4-months long of instruction.

Further, Table 2 provides a picture showing the details of online material posted for the BUS 370 Introduction to Managerial Finance course. The Canvas course material for each chapter includes an outline of topics, author notes, PowerPoint presentation slides, study guide, solutions to the chapter-end questions, multiple-choice and true-false practice quizzes (not graded), multiple-choice and true-false quizzes (graded), video cases (4 to 6 minutes long video clips) with the two questions followed. The only course material left outside the Canvas system is the required textbook. Therefore, the omission of the time spent on the textbook from the analysis may reduce the predictability power of Canvas's total activity measure. However, the students are expected to spend a significant portion of their time with the online course material posted on Canvas, the total activity measure can still capture the student effort.

Table 2: Contents of the Course Material for the Online Courses on Canvas*

Students' Wiew Course Material on Canvas

Course Material Posted on Canvas

- Chapter topic outlines
- Author notes (from the textbook)
- PowerPoint Slides
- Study-Guide (from the textbook)
- Chapter-End Questions/Answers
- Practice Quiz: Multiple-Choice Questions/Answers (not graded)
- Practice Quiz: True-False Questions/Answers (not graded)
- Practice Quiz: Correct-Incorrect Questions/Answers (not graded)
- Multiple-Choice Quiz (graded)
- True-False Quiz (graded)
- Correct-Incorrect Quiz (graded)
- Video Cases (graded)
- Exams (graded)

Course Material NOT on Canvas

- Textbook

*The picture above illustrates a Canvas online course page linking students to the course material.

Similarly, Table 3 provides a picture for BUS 476 Insurance and Risk Management course material posted on the Canvas system. For each chapter, the Canvas course material includes an outline of topics, PowerPoint presentation slides, solutions to the chapter-end questions, multiple-choice, true-false, and correct-incorrect practice quizzes (not graded), multiple-choice, true-false, and correct-incorrect quizzes (graded), video cases (4 to 6 minutes long) with two questions. The course material outside the Canvas system are the course lectures (face-to-face), exams, textbook, and group project presentations. Because a significant amount of the course material is left outside the Canvas system, the total activity measure is not expected to perform well for the face-to-face courses.

Table 3: Contents of the Course Material for the Face-to-Face Course Material on Canvas*

Students' View of the Course Material on Canvas

Course Material Posted on Canvas

- Chapter topic outlines
- PowerPoint Slides
- Chapter-End Questions/Answers
- Practice Quiz: Multiple-Choice Questions/Answers (not graded)
- Practice Quiz: True-False Questions/Answers (not graded)
- Practice Quiz: Correct-Incorrect Questions/Answers (not graded)
- Multiple-Choice Quiz (graded)
- True-False Quiz (graded)
- Correct-Incorrect Quiz (graded)

Course Material NOT on Canvas

- Lectures
- Exams
- Textbook
- Group project presentations

*The picture above illustrates a Canvas face-to-face course page linking students to the course material.

Further, Table 4 shows the results of the correlation and regression statistics for both online and face-to-face courses. The strength of the relationship between total activity and the average exam score is statistically significant for BUS 471 Case Studies in Finance course. The relationship has a strong correlation with P = 0.0058 at 1% significance level. Additionally, t-statistics for the coefficient of the total activity (independent variable) in the regression is equal to 3.2938 greater than 2.947 at 1% significance level. In addition, BUS 370 Introduction to Managerial Finance course with 31 students does not exhibit any statistical significance for total activity to determine the exam scores.

For the face-to-case courses, BUS 474 and BUS 476, the relationship is insignificant. This finding is in line with the expectations that a significant portion of the course material (lectures, exams, textbook, and group project presentations) are left out from the Canvas system, and therefore students are expected to spend less time online with the course material.

Table 4: Correlation and Regression between Average Exam Scores and Total Activity

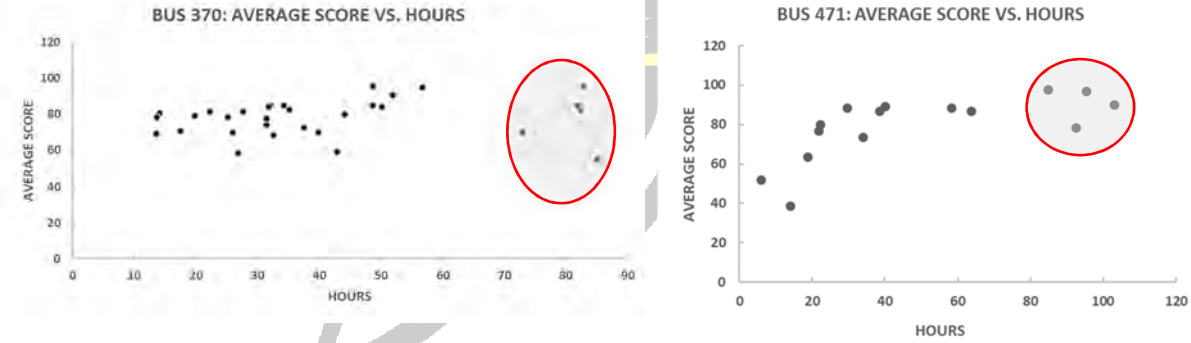
CLASSES	CORRELATION COEFFICIENT	COEFFICIENT FOR TOTAL ACTIVITIY	P-VALUE (Sig. P< 0.05)	t-STATISTICS	NUMBER OF STUDENTS
ONLINE					
BUS 370	0.17	0.0818	0.3625	0.9253	31
BUS 471	**0.67**	**0.3441**	**0.0058**	**3.2938**	**15**
FACE-TO-FACE					
BUS 474	0.03	0.0140	0.8572	0.1812	37
BUS 476	0.06	0.0209	0.6787	0.4165	56

*Total Activity is the independent variable in regression and measured in hours.
**If P < 0.05, the correlation coefficient or the coefficient of the dependent variable, total activity in hours, is statistically significant.

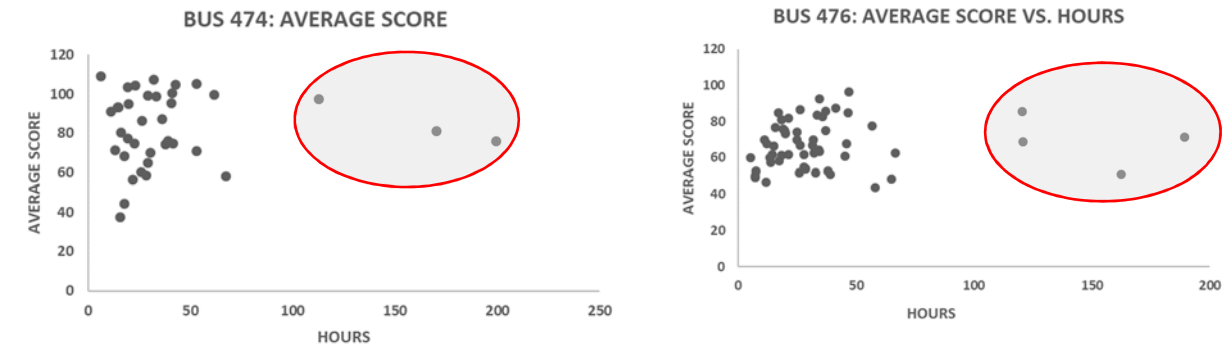
Table 5 is an extension of Table 4 with the exclusion of the students who spent maximum study hours for the online classes (70 plus hours in BUS 370, 80 plus hours in BUS 471) and for the face-to-face classes (100 plus hours in both BUS 474 and BUS 476) from the sample. Figure 1 is used visually to identify the clusters of the outlier students in all courses and can be seen in the oval shapes in each graph.

Figure 1: Outliers for Online and Face-to-Face Courses

ONLINE COURSES AND MAXIMUM OUTLIERS



FACE-TO-FACE COURSES MAXIMUM AND OUTLIERS



The goal of this exercise is to test whether the students with the most study hours spend their time effectively. After excluding the outlier students from the sample, it can observed on Table 5 that the correlation and regression statistics for BUS 370 online course are statistically

significant at 5% level. Further, the overall results for the face-to-face courses (BUS 474 and BUS 476), the statistical insignificance of the correlation coefficient and regression does not change by the exclusion of outliers from the sample.

The statistical improvement in BUS 370 by exclusion of the outlier students implies that the students who spend too many hours online with the course material did not improve their average score.

Table 5: Correlation and Regression for the Relationship between Total Activity and Average Exam Scores when the Students with Maximum Hours are excluded from the Sample

CLASSES	CORRELATION COEFFICIENT W/O MAX OUTLIERS	COEFFICIENT FOR TOTAL ACTIVITIY	P-VALUE (P < 0.05)	t-STATS	NUMBER OF STUDENTS	OUTLIERS/MAX HOURS
ONLINE						
BUS 370	**0.43**	**0.3242**	**0.0292**	**2.3192**	**26**	70+ hrs/85 hrs
BUS 471	**0.74**	**0.6988**	**0.0098**	**3.2611**	**11**	80+ hrs/103 hrs
FACE-TO-FACE						
BUS 474	0.08	0.1051	0.6500	0.4580	34	100+ hrs/200 hrs
BUS 476	0.11	0.0965	0.4404	0.7778	52	100+ hrs/189 hrs

*The outlier students who studied more than 70, 80, or 100 hours are excluded from the sample.

**If P < 0.05, the correlation coefficient or the coefficient of the dependent variable, total activity in hours, is statistically significant.

Even though Figure 1 does not show any outlier clusters of students in the lower-end of the time (hours) spectrum, a similar study is performed by excluding students who has less than 20 hours spent online (an ad hoc cutoff point) and the results are shown on Table 6. Table 6 shows when the students with less than 20 hours is dropped from the sample, the results become worse and there are no statistical significance for any of the courses. This result may imply that the relationship between the time spent online and average exam score is positively correlated for the students who puts less than 20 hours in their studies.

Table 6: Correlation and Regression for the Relationship between Total Activity and Average Exam Scores when the Students with Minimum Hours are Excluded from the Sample*

CLASSES	CORRELATION COEFFICIENT W/O MIN OUTLIERS	COEFFICIENT FOR TOTAL ACTIVITIY	P-VALUE (Sig. P < 0.05)	t-STATS	NUMBER OF STUDENTS	OUTLIERS/MIN HOURS
ONLINE						
BUS 370	0.13	0.0732	0.5198	0.6532	26	20- hrs/14 hrs
BUS 471	0.54	0.1343	0.0711	2.0190	12	20- hrs/6 hrs
FACE-TO-FACE						
BUS 474	**0.01**	0.0047	0.9534	0.0590	25	20- hrs/6 hrs
BUS 476	**-0.05**	-0.0192	0.7540	-0.3159	37	20- hrs/5 hrs

* The outlier students who studied less than 20 hours are excluded from the sample.
**If P < 0.05, the correlation coefficient or the coefficient of the dependent variable, total activity in hours, is statistically significant.

Therefore, Tables 4, 5, and 6 indicate that the "total activity" measure of Canvas is useful and captures the positive relationship between the time spent online with the course material and their average exam scores. However, higher total activity does not translate into higher average exam scores for the outlier students who spent too much time online.

Additionally, the existence of underperforming outlier students who spent too many hours with the online course material raises a question whether the relationship is logarithmic. Therefore, total activity hours is transformed in its natural logarithm forms as Ln(x) and the correlation and regression coefficients are re-estimated. The results of are shown at Table 7. The statistical significance is similar to the results of Table 4 for all courses.

Table 7: Correlation and Regression between Average Exam Scores and Total Activity Assuming the Relationship is Logarithmic

CLASSES	CORRELATION COEFFICIENT WITH LN(X)	COEFFICIENT FOR TOTAL ACTIVITIY IN LN(X) FORM	P-VALUE (Sig. P< 0.05)	t-STATISTICS	NUMBER OF STUDENTS
ONLINE					
BUS 370	0.20	3.8689	0.2856	1.0879	31
BUS 471	**0.80**	**16.2880**	**0.0003**	**4.7993**	**15**
FACE-TO-FACE					
BUS 474	0.04	1.0654	0.8100	0.2422	37
BUS 476	0.18	3.2767	0.1745	1.3759	56

*Total Activity is the independent variable in regression and measured in hours.
**If P < 0.05, the correlation coefficient or the coefficient of the dependent variable, total activity in hours, is statistically significant.
***X in LN(X) is the transformed student total activity hours.

Therefore, this study supports that the relationship between the total activity measured in hours and the average exam scores is positively correlated for the online courses. However, further research is needed to find out if the relationship is linear or logarithmic, or any other form.

CONCLUSION AND SUGGESTIONS

The relationship between total activity measured as hours spent online and average exam scores are positively correlated and statistically significant for two online courses. However, the relationship is insignificant for the two face-to-face courses because a significant portion of the course material (lectures, exams, textbook and group project presentations) are excluded from the Canvas LMS. Naturally, all the instructors around the world would like to hear that "the hard work of students pays off." This study finds that although the statement is true, the hard work may not pay off for outlier students who spend excessive hours with the online course material. This raises a question about the effectiveness of the students who spent too many hours online.

Finally, this study investigated the possibility that the relationship of total activity and average exam scores is logarithmic. However, the results did not support this hypothesis even though there is a cluster of students on the right tail of the distribution indicating some students spent too many hours online without receiving its rewards.

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