

A Correlation Between Non-Mandatory Attendance and Course Grades in a Fourth-Year Hybrid Industrial Engineering Course

Robert S. Keyser
Kennesaw State University

The purpose of this study is to 1) determine whether a correlation exists between non-mandatory attendance and course grades for a fourth-year hybrid industrial engineering course; and 2) to compare this conclusion with the conclusion from a previous study in determining whether a correlation exists between mandatory attendance and course grades for a third-year hybrid industrial engineering course. In sum, both studies provide evidence from their respective Pearson correlation coefficients that a negative correlation exists.

Keywords: Non-Mandatory Attendance, Course Grades, Negative Correlation, Industrial Engineering

INTRODUCTION

This study analyzes the course grades in a fourth-year hybrid Industrial Engineering course during the Fall 2018 semester utilizing the Blackboard Collaborate Ultra™ classroom technology and Brightspace Desire2Learn™ (D2L) learning management system. This study was conducted at Kennesaw State University, an R2 university in Georgia.

Unlike traditional courses that meet face-to-face two or three times per week, the hybrid section of this F2F course met one day per week on campus and had pre-recorded course lectures and materials, such as narrated PowerPoint slides, an Overview Page, videos, handouts, assignments, and exams, which were delivered via the Brightspace Desire2Learn™ (D2L) online learning environment. Although course materials could be accessed by students online via D2L, the Live Session of hybrid courses were not recorded and archived for later viewing. Therefore, students must come to class to listen to the lecture and take notes. By design for this research study, this particular course, ISYE 4250 – Manufacturing and Service Systems, did not require mandatory attendance although attendance was strongly encouraged by the professor throughout the semester. Students were informed on the first day of class, and in the Syllabus, that they would neither be penalized points for missing class nor would they receive bonus points for attending class. In short, students were informed that their course grade would be based on performance and would not impacted based on attendance.

During the Live Session, the professor reviewed key concepts and then worked through various problems in a step-by-step manner on the instructor's console by activating a pen with a choice of four different ink colors – black, red, blue, and green. Highlighting capabilities in different colors are also available. The work performed by the professor could be seen on the large projector screen in front of the classroom. Students were provided the problems to be worked in class in advance of the Live Session in

an Excel file that could be downloaded and printed before the Live Session began. Each problem was provided in a separate tab in that week's Excel file.

The two fundamental research questions in this study are:

RQ1: *Is there a correlation between non-mandatory attendance (i.e., days absent) and course grades? The null hypothesis postulates that no relationship exists between non-mandatory attendance and course grades.*

RQ2: *How does the conclusion from this study compare to the conclusion in a previous study (Keyser, 2019)? In other words, does a negative correlation exist between non-mandatory attendance (i.e., days absent) and course grades as was concluded between mandatory attendance (i.e., days absent) and course grades?*

The two research questions of this research are: 1) to discover whether a correlation exists between *non-mandatory* (i.e., voluntary) attendance (X) and course grades (Y) in a fourth-year hybrid industrial engineering course, and 2) to compare this conclusion with the findings of a previous study (Keyser, 2019), whereby a negative correlation was found to exist between *mandatory* attendance (X) and course grades (Y) in a third-year hybrid industrial engineering course at the same university and taught by the same professor as in this current study. The research questions will be addressed by analyzing a correlation matrix.

LITERATURE REVIEW

Hybrid courses combine instructional elements from traditional face-to-face (F2F) and online course formats (El Mansour & Mupinga, D. M., 2007). Hybrid courses, in many circles, is synonymous with a converged classroom and, therefore, the two terms may be used interchangeably. This type of learning environment differs from a traditional classroom teaching environment in two distinct ways: 1) students are first introduced to the substantive material and are required to read and understand the material before coming to class for the Live Session; and 2) during the Live Session, the instructor helps to clarify points of confusion or difficulty, work through problems, etc. (Houghton & Kelly, 2015). Because of changing student demographics and efforts to make courses more accessible to students, converged (or hybrid) course offerings have increased rapidly (Blier, 2008) due to many advantages it provides over traditional classroom courses. For example, converged courses not only decrease travel time for student who live in rural areas (Yudko, Hirokawa, & Chi, 2008), they also decrease travel time for students who live in metropolitan areas where traffic is heavily congested. The converged classroom also accommodates students' busy schedules away from school; principally, work and family obligations (Aslanian, 2001). Research also cites convenience, flexibility, currency of material, rapid feedback, and customized learning as key factors for online students (Harasim (1990); Hackbarth (1996); Kiser (1999); Matthews (1999); Swan et al. (2000); Wiles & Keyser (2016)). Therefore, it is likely that hybrid courses will continue to grow and stem the rising costs of higher education (Woodworth & Applin (2007); Allen & Seaman (2010)). In higher education, online enrollments have grown 21% vs. 2% enrollment growth for traditional classroom courses n s 2002 (Allen & Seaman, 2007).

Despite the many advantages of online learning, notable issues include a feeling of isolation by online students (Brown, 1996), students who may be confused about the instructions or where to find course elements (Hara & Kling, 2000), and a reduction in level of student interest and learning effectiveness (Maki, Maki, Patterson, & Whittaker, 2000).

Whereas Kolb's learning theory of pedagogical learning for instructional design (Kolb, 1984) combined with Knowles' learning theory of adult learning (Knowles, 1990; 1980) were instrumental in assessing the learning needs of both on-campus and online engineering students, the effectiveness of student attitudes, student satisfaction, and performance varies across the literature.

(Lam, 2009) analyzed the performance of traditional vs. online formats of an undergraduate computer programming course using regression analysis, concluding that delivery mode did not influence average course grades in a statistically significant sense; however, students' cumulative grade point average (GPA) was the only significant predictor. In analyzing the success rates of F2F vs. online students in two different business courses, (Wilson & Allen, 2014) also concluded that cumulative GPA was the most significant predictor of course grade, regardless of delivery mode. (Xu & Jaggars, 2014) conclude, in a study of over 51,000 students initially enrolled in one of Washington State's 34 community or technical colleges during Fall 2014, that the online format had a significantly negative relationship with standardized course grade, indicating that the typical student had more difficulty succeeding in online course vs. traditional F2F courses. (Driscoll, Jicha, & Hunt, 2012) concluded no significant difference in student performance and student satisfaction between traditional vs. online sections of an introductory sociology course taught by the same professor over multiple semesters with little change in course materials or assessment instruments. Reisetter et al., (2007) found no significant differences between traditional and online students in their course satisfaction and learning.

To stimulate both student performance and student satisfaction, Sauers and Walker (2004) state that there is a need to identify the best use of online instruction and how to implement the tools of online learning management systems. Further, undergraduate students suggested more instructor/student training in the use of technology as well as the recording of synchronous sessions for later review (Bonakdarian, Whittaker, & Yang, 2010); Wood, 2010). Effective instructors must play a far more prominent and interactive role by being a present and active participant if they hope to foster effective student thinking (Van Tassel & Schmitz, 2013; Schubert-Irastorza & Fabry, 2011).

A correlation study was conducted by (Gunn, 1993) between attendance and grades in a first-year psychology class. In another study, a correlation analysis was conducted between attendance and grades on pre-service teachers enrolled in methods classes (i.e., lesson planning, reflecting, and instructional strategies) over a three-semester period (Silvestri, 2003). (Lyubartseva & Mallik, 2012) conducted a study to identify whether attendance influences students' success in both high-level and low-level chemistry courses at two different universities.

There are mixed feelings about the merit of taking attendance. Some teachers take attendance even though they believe it is more laborious than it is worth (Marshall, 2017). A study conducted at the University of Albany in 2010 indicated little positive correlation between attendance and course grades (Marshall, 2017). (Hyde & Flournoy, 1986) studied a correlation of course grades by lecture attendance at the University of Oklahoma College of Medicine and made a startling discovery. Whereas students who attended 80-100% of the lectures appeared to be top performers, 21% of the students in the 0-19% lecture attendance category also were in the top 20% of their class, indicating that this portion of the low attendance students mastered the material without the aid of attending the lectures.

(Rendleman, 2017) discovered that there was a positive correlation between attendance and grade performance in an introductory agricultural economics course; however, the researcher could not conclude that having attendance policies influenced either course performance or class actual attendance. In a correlation study of attendance and course grades of undergraduate psychology students, (Jones, 1984)) concluded that increased absences cause lower grades but that low grades influence more frequent absences, suggesting an interaction effect between attendance and grades.

METHODOLOGY

The research design consists of obtaining students' course grades and recorded attendance for a F2F hybrid fourth-year industrial engineering course during Fall 2018 semester at Kennesaw State University. This course was taught by the same professor as in the previous study (Keyser, 2019) utilizing the same classroom technology, specifically, Desire2Learn™ and Blackboard Collaborate Ultra™.

The course included 16 Learning Modules (one Learning Module per week for 16 weeks). Included with each Learning Module is an Overview Page, the pre-recorded lecture videos, posted PowerPoint slides, homework assignments, and any ancillary materials accessed by links such as handouts, tables,

videos, Excel problems, etc. Students were required to submit their online quizzes or exams by clicking on the Quizzes tab in the D2L NavBar, then clicking on the appropriate assessment (quiz or exam), opening the file, and then completing the assessment. Online quizzes and exams were submitted automatically when the student selected 'Submit' when closing out the session. The professor offers alternate types of assessments each semester to counter the possibility of students using recycled quizzes or exams from prior semesters.

Students were expected to view the pre-recorded lecture videos, read the textbook, review the posted PowerPoint slides, and work problems on their own prior to the Live Session. During the Live Session, with the expectation of familiarity of concepts for the week, the professor used the Live Session to work through problems in the chapter and answer any questions that students may have.

This type of classroom learning differs from traditional classroom learning in that, with traditional classroom learning, the professor meets with students face-to-face on typically a M-W-F or T-R schedule, whereby the professor will discuss concepts and work examples through each chapter. With hybrid classroom learning, the expectation that students will view the pre-recorded lecture, read the textbook, review the posted PowerPoint slides, and work problems on their own takes the place of one day in traditional classroom learning environment prior to the Live Session. The Live Session serves as the second day of traditional classroom learning. The anticipated trade-off is that time is more efficiently utilized by the professor if students are already familiar with the chapter concepts prior to attending the Live Session. The Live Session is thus utilized for solving problems and answering questions. Hence, the same instruction and learning occurs as in a traditional classroom environment, albeit in a different format with hybrid courses.

Each of the assessments consisted of a mixture of 20-25 True/False and Multiple-Choice questions. Questions consisted of concepts, definitions, and problems to be solved. The professor would open the Submission View of the quiz or exam after the submission deadline had passed so that students would have complete access to their own exams. This prevented the possibility that a student who finished the quiz or exam early might share the answers with other students before time expired. Solutions to all questions were provided in the Feedback section for each question.

Grades for each assessment were recorded in D2L's Grades tab as well as the professor's Excel spreadsheet. Once all assessments were graded with appropriate weights assigned as outlined in the Syllabus, the final course grade for each student was determined and a letter grade was posted in the Grades tab for each student in the course.

RESEARCH FINDINGS

In this study, a simple linear regression model was developed using Days Absent as the independent variable (X) and Course Grade as the response variable (Y). Days Absent referred to the number of days absent during the semester and Course Grade referred to a numerical scale from 0-4 (i.e., A = 4, B = 3, C = 2, D = 1, and F = 0). There are no plus or minus grades, such as B+ or C-, at Kennesaw State University.

Coded details of the predictor and response variables in the model are shown below:

Response variable:

$$\hat{y} = \text{Course Grade}$$

Predictor variables:

$$x = \text{No. of Days Absent}$$

Following an examination of the simple linear regression model in Table 1 and a correlation matrix in Table 2 provided below, the researcher addressed the fundamental research question provided in the Introduction section.

TABLE 1
REGRESSION ANALYSIS: COURSE GRADE (Y) VERSUS DAYS ABSENT (X)

**SUMMARY
OUTPUT**

<i>Regression Statistics</i>	
Multiple R	0.283160129
R Square	0.080179658
Adjusted R Square	0.03637869
Standard Error	0.380438741
Observations	23

<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	0.26494148	0.264941	1.830545	0.190450887
Residual	21	3.039406346	0.144734		
Total	22	3.304347826			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>
Intercept	4.009723644	0.157209529	25.5056	2.76E-17	3.68278853
X Variable 1	-0.032241556	0.023830094	-1.35298	0.190451	-0.081798948

TABLE 2
CORRELATION MATRIX

<i>Correlation</i>	<i>Y</i>	<i>X</i>
Y	1	
X	-0.28316	1

As we observe in the Regression output, the regression model is not statistically significant at the $\alpha = 0.05$ level of significance; however, that was not the objective of this study. Rather, the objective of this study was to discover whether a correlation exists between Days Absent (X) vs. Course Grade (Y). The results from the Correlation Matrix indicate that there, indeed, exists a negative correlation between Days Absent (X) and Course Grade (Y) with the Pearson correlation coefficient, $r = -0.28316$. This result is interpreted as a moderate negative correlation exists between Non-Mandatory Attendance (in the form of number of Days Absent) and Course Grade. In layman terms, there is evidence that as the number of Days Absent increases, a student's Course Grade tends to decrease and vice-versa.

CONCLUSIONS

This study consists of determining whether a correlation exists between non-mandatory attendance and course grade in a fourth-year industrial engineering course and the result was compared to the result of a previous study in determining whether a correlation exists between mandatory attendance and course grade in a third-year industrial engineering course. Next, we shall address the two research questions in this study.

RQ1: *Is there a correlation between non-mandatory attendance (in the form of days absent) and course grades? The null hypothesis postulates that no relationship exists between attendance and course grade.*

H₀: *There is no correlation between non-mandatory attendance and course grades.*

H_a: *There is a correlation between non-mandatory attendance and course grades.*

The Pearson correlation coefficient, $r = -0.28316$ indicates that a negative correlation exists between non-mandatory attendance and course grade in this fourth-year industrial engineering course.

RQ2: *How does the conclusion from this study compare to the conclusion in a previous study (Keyser, 2019)? In other words, does a correlation exist between non-mandatory attendance (i.e., days absent) and course grades as was concluded between mandatory attendance (i.e., days absent) and course grades?*

H₀: *There is no correlation between mandatory attendance and course grades.*

H_a: *There is a correlation between mandatory attendance and course grades.*

The result of this study reveals that a negative correlation exists ($r = -0.28316$) between *non-mandatory* attendance and course grade in a fourth-year industrial engineering course, which agrees with the result from a previous study, a negative correlation exists ($r = -0.259$) between *mandatory* attendance and course grade in a third-year industrial engineering course. The correlation results indicate that as the number of days absent increases, course grades tend to decrease for courses in these two studies – one with a mandatory attendance policy (Keyser, 2019) and one with a non-mandatory attendance policy. Both courses were taught by the same professor using the same technology at the same university during Fall 2018 semester.

AREAS OF FUTURE STUDY

Future studies could include an analysis of mandatory attendance and non-mandatory attendance vs. course grades by other professors in different departments at the same university; a comparative analysis between undergraduate- and graduate-level hybrid courses, as well as conducting a similar analysis involving professors from other universities who utilize a hybrid classroom modality.

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