2017

Student Success Is Impacted by Not Attending Gateway Quantitative Classes: A Pilot Study

Michael Latta
Coastal Carolina University

James Solazzo
Coastal Carolina University

Dennis Rauch
Coastal Carolina University

Student Success Is Impacted by Not Attending Gateway Quantitative Classes: A Pilot Study

Michael Latta
Coastal Carolina University

James Solazzo
Coastal Carolina University

Dennis Rauch
Coastal Carolina University

ABSTRACT

Universities are charged with equipping the next generation of graduates with the skills and knowledge to benefit both the businesses they will work in. Analytics are the skills needed by both for profit and non-profit operating businesses. For example, in August of 2013, Forbes printed a post on the Forbes Insights blog by Daniel Keherer titled 'Analysis Shows Jump in Marketing Analytics Jobs.' The Definitive Guide to Marketing Metrics and Analytics (Dholakia, 2015) has been freely made available by Marketo. Harvard Business School Press has also published a book titled 'Competing on Analytics: The New Science of Winning,' by Harris and Davenport (2007). The question is, are our university graduates prepared for a world of analytics? This research shows universities need to have courses and faculty ready to develop the next generation of graduates who will have to deal with analytics in the workplace.

INTRODUCTION

Data-driven decision-making requires decisions that can be backed up with high quality data and analysis (Frick, 2014). The success of the data-driven decision-making relies on the quality of the data gathered and the effectiveness of its analysis and interpretation. Marr (2016) has provided ten simple rules to follow in data-driven decision-making:

1. Start with Strategy
2. Hone in on the business area
3. Identify your unanswered business questions
4. Find the data to answer your questions
5. Identify the data you already have
6. Word out if the costs and effort are justified
7. Collect the data
8. Analyze the data
9. Present and distribute the insights
10. Incorporate the learning into the business

To assist business managers in utilizing analytics, Thomas Davenport (2013) has six questions to ask regarding analysts' conclusions about data and decisions. These six questions are below:

1. What was the source of your data?
2. How well do the sample data represent the population?
3. Does your data distribution include outliers? How did they affect the results?
4. What assumptions are behind your analysis? Might certain conditions render your assumptions and your model invalid?
5. Why did you decide on that particular analytical approach? What alternatives did you consider?
6. How likely is it that the independent variables are actually causing the changes in the dependent variable? Might other analyses establish causality more clearly?

The importance of undergraduate Business Schools to the US economy cannot be over stated. The ability for business majors to implement analytics in the future will depend on graduates knowing how to generate the analysis of data and to answer these six questions for business leaders.

Recently the cost of obtaining a Bachelor's degree has come into question as well as the extent of knowledge gained during four years of undergraduate education. For example, Fishman (2015) calculated the price tag in the form of tuition for over 150 universities in nine conferences around the country to see the amount of wasted tuition dollars when students do not attend classes. The tuition amounts came from the 2014-2015 school year. For state schools the calculation was based on the higher percentage of in-state versus out-of-state students. The calculations showed a range of lost tuition of $15.75 at a state school to $174.25 at an Ivy League school for missing a single class period.

With regards to return on investment in the form of learning and skills realized from tuition and fee expenditures, AACSB in 2013 enacted business accreditation standards which require setting of learning goals where "l*earning goals describe the knowledge and skills students should develop in a program and set expectations for what students should do with the knowledge and skills after completing a program*."

As part of assuring business major students reach the marketing major learning goals, they are required to pass a Mathematics course and a Business Statistics Course. Here, passing is defined as a minimum overall grade of C.

Attendance is part of the grading requirements for all students in the sections of Math130I and Business Statistics CBAD291. Attendance is considered the students' responsibility as it would be in an internship or on the job. The attendance grade is calculated at the end of the semester as the percentage of class periods in attendance.

The importance of attendance was shown in another analysis by the fourth author (Lowenstein, 2016) where an estimated average tuition loss of $433 per semester class skipped was calculated. That study of a Legal Environment of Business course also showed a relationship between

grades and student attendance. Poor attendance caused students to lose higher letter grades or even to fail the course altogether.

METHOD

Courses Involved

There were two courses involved. One was a Math course required for admittance to the Business Statistics course. Math130I was a gateway course for CBAD 291 which is a gateway course for all business majors. Passing both courses with a C or better grade is required to complete any business major or minor. Both of these courses are prerequisites for 300 and 400 level courses.

Math130I Catalog Description

Students from the Math130I sections in fall 2015 were included in the analysis (N=83). The course description is below:

College Algebra Intensive Study. (3) (Prereq: Mathematics Placement Test).
Review of Intermediate Algebra, properties of functions, techniques of graphing polynomial and rational functions, systems of equations, and properties and applications of exponential and logarithmic functions.

Math130I Student Learning Outcomes

The learning objectives of Math130I (College Algebra) fall into one of the following two categories: computations and concepts. The following list summarizes the fundamental computational skills and conceptualizations of algebra a student will possess when he/she successfully completes Math130I.

1. Solve linear, polynomial and rational equations and inequalities algebraically and confirm solutions graphically.
2. Perform addition, subtraction, multiplication and division of complex numbers.
3. Solve word and application problems.
4. Work with basic functions such as linear, quadratic, piecewise defined and absolute value including knowing their graphs, shifts and symmetry.
5. Understand how to factor higher order polynomial functions, graph them and find their zeros.
6. Understand rational functions, vertical and horizontal asymptotes and their graphs.
7. Be able to find the inverse of a function.
8. Understand the definitions of exponential and logarithmic functions, be able to graph them, apply the rules of exponentials and logarithms to solve equations involving them and understand their applications to growth and decay problems.

This course is required for students to progress to CBAD 291 Business Statistics.

CBAD 291 Catalog Description

(Prereq: A grade of C or better in UNIV 110, CSCI 110, and MATH130I).
Basic methods of descriptive statistics and statistical inference; probability, hypothesis testing, and linear regression with an emphasis on decision making in business. Students who complete CBAD 291 may not receive credit for Psychology 225 or Statistics 201.

CBAD 291 Student Learning Outcomes

Student Learning Outcomes: At the completion of this course, the student should be able to:

1. Become intelligent consumers of statistical information.
2. Be able to organize, describe, and analyze information through the use of descriptive statistics.
3. Understand the basic concepts of probability theory.
4. Estimate population parameters through the use of sampling and sampling distributions.
5. Conduct data analysis utilizing Microsoft Excel Analysis ToolPak.
6. Learn how to conduct hypothesis testing.
7. Select and apply appropriate methods, such as ANOVA, Chi-square, or regression, to analyze data.
8. Properly interpret the results of statistical tests and utilize this information to make informed, prudent business decisions.

Calculating Attendance Scores

For purposes of this study, the courses involved have been taught with the same syllabus by the same instructors over the years. Attendance in these courses was recorded electronically using the online attendance system. An individual student's attendance was determined by the percentage of class periods the student was in attendance. Attendance contributed to final grades for all sections of these courses.

Calculating Grade Scores

Grade scores were based on grade points that could be earned in various course activities.

Final grades were assigned using the following percentage of the TOTAL Points cut-offs:

Grade	% Score
A	90%-100%
B+	87%-89.99
B	80%-86.99%
C+	77%-79.99%
C	70%-76.99%
D+	67%-69.99%
D	60-66.99%
F	0%-59.99

At the end of the semester, the Percentage of Attendance (PA) and the Percentage of Grade Points earned (PGP) were calculated and recorded each regular semester from Fall 2013 to Spring 2016. In addition, the student's gender (GEN) was recorded and whether the student passed or failed the course was recorded.

Sample Description

There were 368 students involved in the analysis, 83 from Math130I and 285 from CBAD 291. The sample included 212 males and 156 females.

RESULTS

Pass/Fail Differences

The distribution of students by gender and whether the passed a course is presented in Table 1 blow. Overall 73% of all students enrolled in one of the courses passed and 27% failed. Males were slightly more likely to pass (74%) compared to females (72%) but the difference was not statistically significant.

Table 1
Pass/Fail by Gender

		Pass/Fail		
		Pass	Fail	Row Total
Gender	Male	156	56	212
	Female	112	44	156
	Column Total	268	100	368

Table 2 below presents the distribution of students in the two courses who passed or failed in each specific course regardless of gender. The pass rate for Math130I was 71% and the pass rate for CBAD 291 was 73%. Getting through the first gateway course was just as difficult as getting through the second gateway course.

Table 2
Pass/Fail by Course

		Pass/Fail		
		Pass	Fail	Row Total
Course	CBAD291	209	76	285
	Math130I	59	24	83
	Column Total	268	100	368

Descriptive Statistics for Attendance and Grades by Pass/Fail

The means and standard deviations for grades and attendance for students who pass and fail regardless of course taken and gender appear in Table 3 below. The mean difference for attendance by students who passed the course and who did not pass their course was 11.3. This difference was statistically significant, $t(123) = 6.6$, $p < .001$, and indicates students who fail miss over 10% of scheduled classes. With respect to grades, the mean difference in grade score for students who passed the course and who did not pass was 26.6 or more than a two and a half grade level difference, or an A student becomes a D+ student. This difference was statistically significant, $t(120) = 18.1$, $p < .001$.

Table 3
Mean and Standard Deviations in Attendance and Grades by Pass/Fail

	Pass/Fail	N	Mean	SD
Attendance	Pass	268	89.6	9.1
	Fail	100	78.3	16.2
Grade	Pass	268	81.4	7.4
	Fail	100	54.8	4.0

Descriptive Statistics for Attendance and Grades by Gender

The means and standard deviations for grades and attendance for male and female students regardless of course and regardless of whether they passed or failed a course appear in Table 4 below. There were no significant differences between males and females for either attendance or grade scores.

Table 4
Mean and Standard Deviations in Attendance and Grades by Gender

	Gender	N	Mean	SD
Attendance	Male	212	85.7	12.5
	Female	156	87.7	12.6
Grade	Male	212	74.8	15.4
	Female	156	73.3	15.1

Descriptive Statistics for Attendance and Grades by Course

The means and standard deviations for grades and attendance for students in the two courses regardless of gender and regardless of whether they passed or failed a course appear in Table 5 below. There were no significant differences between males and females for either attendance or grade scores.

Table 5
Mean and Standard Deviations in Attendance and Grades by Course

	Course	N	Mean	SD
Attendance	CBAD291	285	86.1	12.1
	Math130I	83	88.1	14.0
Grade	CBAD291	285	74.8	14.7
	Math130I	83	72.1	17.0

Relationship of Attendance to Grade

The overall correlation of grade and attendance was statistically significant (.523, $p < .001$). The correlations for attendance with grade in various sub-groups appear in Table 6 below. Correlation analysis with various subgroups was employed to explore the relationship of grade to attendance for various subgroups. To test for significant differences between correlation coefficients from independent samples, the Fisher r-to-z transformation was utilized (Fisher, 1921; Steiger, 1980). The z tests were done using the calculator at http://vassarstats.net/rdiff.html.

Table 6
Differences in Correlations of Attendance with Grade for Various Subgroups

	r	N	z	1-tail p	2-tail p
Math130I	.681**	83	2.52	.0059	.0117
CBAD 291	.471**	285			
Males	.519**	212	0.29	.3859	.7718
Females	.541**	156			
Pass	.174**	268	3.35	.0004	.0008
Fail	.518**	100			
Males/Pass	.193*	156	.27	.3938	.7872
Females/Pass	.160	112			
Males/Fail	.325*	56	2.78	.0027	.0054
Females/Fail	.724**	44			
CBAD 291/Males	.526**	181	1.57	.0582	.1164
CBAD 291/Females	.371**	104			
Math130I/Males	.607**	31	.88	.1894	.3789
Math130I/Females	.722**	52			
CBAD 291/Males/Pass	.219*	132	.87	.1922	.3843

CBAD 291/Females/Pass	.095	77			
Math130I/Males/Pass	.199	24	.32	.3745	.749
Math130I/Female/Pass	.284	35			
CBAD 291/Males/Fail	.328*	49	.63	.2643	.5287
CBAD 291/Females/Fail	.462*	27			
Math130I/Males/Fail	.564	7	1.42	.0778	.1556
Math130I/Female/Fail	.895*	17			

The correlations for attendance with grade in pair comparisons indicate the following significant differences:

- The correlation of attendance with grade is stronger for students enrolled in Math130I (.681) compared to CBAD291 (.471).
- The correlation of attendance with grade is stronger when students fail (.518) compared to when they pass (.174) their core course.
- The correlation of attendance with grade is stronger for female students (.724) compared to male students (.325) when both genders fail their core course.
- The correlation of attendance with grade is marginally stronger for male students (.526) compared to female students (.371) when they are enrolled in CBAD291.

CONCLUSIONS AND IMPLICATIONS

Universities are charged with equipping the next generation of adult professionals in education, science, business, and humanities/fine arts with the skills and knowledge to benefit both where they work and the country at large. Analytics are the current and future skills needed by operating enterprise whether for profit or non-profit. Graduation rates are an issue across the university and college system.

The National Center for Education Statistics reports the following concerning graduation rates:

> "The 6-year graduation rate for first-time, full-time undergraduate students who began their pursuit of a bachelor's degree at a 4-year degree-granting institution in fall 2008 was 60 percent. That is, 60 percent of first-time, full-time students who began seeking a bachelor's degree at a 4-year institution in fall 2008 completed the degree at that institution by 2014. The 6-year graduation rate was 58 percent at public institutions, 65 percent at private nonprofit institutions, and 27 percent at private for-profit institutions. The 6-year graduation rate was 57 percent for males and 62 percent for females; it was higher for females than for males at both public (61 vs. 55 percent) and private nonprofit institutions (68 vs. 62 percent). However, at private for-profit institutions, males had a higher 6-year graduation rate than females (28 vs. 25 percent)."

It is contended here that gateway courses such as Math130I and Business Statistics CBAD291 represent a real challenge for universities as a whole and business colleges in particular in preparing the needed future graduates who understand data driven decision making and analytics in general.

Success in these gateway courses will require higher attendance rates for both male and female students. Avoiding failure seems to be a bigger issue for female students compared to male students indicating the greater importance of increasing attendance for females who show danger signs early in gateway courses. With students who fail missing over 10% of class periods and those who fail earning a final grade two and a half grade levels below those who pass, the value of attendance takes on even greater importance. Hopefully, universities will review their policies on attendance and find ways to improve attendance rates in gateway courses.

REFERENCES

AACSB International, *2013 Business Accreditation Standards*, Standard 9, http://www.aacsb.edu/en/accreditation/standards/2013-business/learning-and-teaching/standard9/
Dholakia, S. (2015). Designing a Marketing Organization for the Digital Age, *Harvard Business School Publishing*. hbr.org/hbr-analytic-services

Harris, J. G. & Davenport, T. H. (2007). *Competing on Analytics: The New Science of Winning*. Boston: Harvard Business Review Press.

Davenport, T. H. (2013). Keep Up with Your Quants, *Harvard Business Review*, July-August.
Fishman, C. (2015). The price tag on skipping class, *Paste Magazine*, http://www.pastemagazine.com/articles/2015/01/the-price-tag-on-skipping-class.html

Fisher, R. A. (1921). On the probable error of a coefficient of correlation deduced from a small sample, *Metron*, 1, 3-32.

Frick, W. (2014). An Introduction to Data-Driven Decisions for Managers Who Don't Like Math. *Harvard Business Review*, May.

Kehrer, D. (2013). Analysis Shows Jump in Marketing Analytics Jobs, *Forbes*, http://onforb.es/16eZKP6

Latta, M. & Lowenstein, H. (2016). Opportunity Loss and Opportunity Cost: Consequences of Not Attending Class. Proceedings of the Association for Marketing Theory and Practice. Awarded Best Paper in Track.

Lowenstein, H. (2016). The great wall of FERPA: Surmounting a law's barrier to assurance of learning, *Journal of Legal Studies Education*, 33, 1, Winter, 129-164.

Marr, B. (2016). *Data-Driven Decision Making: 10 Simple Steps for Any Business*, November.
2002-2003 NCES survey, *Digest of Education Statistics*.
http://nces.ed.gov/programs/digest/d05/tables/dt05_347.asp Accessed 11/06/15.

Steiger, J. H. (1980). Tests for comparing elements of a correlation matrix. *Psychological Bulletin*, 87, 2, 245.

U.S. Department of Education, National Center for Education Statistics. (2016). *The Condition of Education 2016* (NCES 2016-144), Undergraduate Retention and Graduation Rates. http://vassarstats.net/rdiff.html. Accessed 11/26/2016.

ABOUT THE AUTHORS

Michael Latta
Professor of Marketing, Coastal Carolina University
PhD in Industrial and Organizational Psychology Iowa State University (minor in Statistics)
MS in Industrial and Organizational Psychology Iowa State University (minor in Statistics)
BS in Psychology Illinois State University (minor in Mathematics)

James Solazzo
Chair/Professor Mathematics & Statistics, Coastal Carolina University
PhD in Mathematics University of Houston
MS in Mathematics University of Houston
BS in Mathematics SUNNY Stony Brook

Dennis Rauch
Professor of Marketing, Coastal Carolina University
PhD in Marketing University of Iowa
MBA in Marketing Western Illinois University
BBA in Marketing, Western Illinois University