A Note About Prerequisites for The Successful Completion of Principles of Financial Accounting

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ABSTRACT

Following years of confronting the pervasive problem of poor pass rates among principles of financial accounting students, the authors extend earlier research that found that instituting a prerequisite of both English and mathematics improves the likelihood of successfully completing financial principles with a grade of "C" or better (McCarron and Burstein, 2016). This study uses the same archival data from students who enrolled in financial principles over a thirteen-year period to examine more closely the relationship English and mathematics individually have to the successful completion of financial principles. New logistical regression models assess whether completing either a college-level mathematics or English course alone improves a student's odds of success in financial principles in comparison to a model containing both math and English. A student who completes only an English class before taking financial principles has a slight advantage in passing financial principles over the student who completes only a math class prior to financial principles.

Keywords: mathematics, English, prerequisite, successful completion, principles of financial accounting

INTRODUCTION

Business programs accredited by the Association to Advance Collegiate Schools of Business (AACSB) traditionally require that students take mathematics in the freshman year before the sophomore year when the two introductory accounting courses are taken (American Accounting Association, 1973). Administrators at most institutions encourage students to enroll in English during their freshman year at college. However, at colleges without AACSB accreditation the traditional structure in which 1000-level courses are taken in the freshman year, 2000-level courses are taken in the sophomore year, thusly, may not be strictly observed such that the completion of a college-level mathematics or English course may not be required before a student enrolls in financial principles. This fact combined with many students' desires to finish college as quickly as possible indicates that sometimes entering freshmen attempt financial principles in their first semester in college without taking either English or math prior. In cases where students must take learning support (remedial) classes in their first semesters, they often enroll in financial principles as soon as they exit those courses, again without completing college-level English or math.

The college the research subjects attended allowed students to register for financial principles as first-semester freshmen; there were no prerequisites to the course. It began as a two-year college that offered both a professional two-year degree as well as a program to prepare students to transfer into a four-year business program although it now offers a four-year bachelor's degree in business. As a result, students often delayed completion of any college-level math course until their final semester when they expected to graduate. They did not receive the benefits, if any, math provides as a foundation for the study of business. While some empirical support exists for math as a prerequisite to economics exists, the evidence to support math as a prerequisite was scant until now. Because principles of financial accounting is a prerequisite for several upper level business courses in addition to the intermediate level of accounting study, it is extremely important for students to perform well in it. With the rate of failure in financial principles often upwards of 40% the researchers originally sought to identify whether taking a college-level mathematics course prior to enrolling in principles of financial accounting increases the likelihood of passing the first accounting course (McCarron and Burstein, 2016). That study found that a logistical model including measures of high school GPA, age of the student, the combined presence of both math and English taken before financial principles, and learning support English were significant predictors of success in financial principles. Although most researchers have been interested in the influence of mathematics on business courses, few studies have addressed the relation of math as a prerequisite to successful completion of principles of financial accounting. Even fewer have addressed whether English should be taken as a prerequisite to financial principles. The study reported here examines the relationship between English as a prerequisite has to the successful completion of financial principles and compares it to the relationship between math as a prerequisite and financial principles.

The study proceeds with a review of the literature relating to the successful completion of financial principles, followed by a description of the research methodology, the results and their analysis, and conclusions with suggestions for future research.

LITERATURE REVIEW

Traditionally, researchers have been concerned with the importance of the quantitative skills in relation to the successful completion of business courses generally. Various studies have attempted to find relationships between prior study and performance in introductory business courses. Several authors examined the relationship between pre-college study of bookkeeping and performance in college-level accounting courses with varying results (Eskew & Faley, 1988; Lee, 1999; Lynn, Shehata, & White, 1994; Dinius, 1991). A few studies address the relationship between math and introductory business courses, frequently focusing on economics (Alcock, Cockcroft, & Finn, 2008; Baard & Watts, 2008; Danko, Duke, & Franz, 1992; Jones, Kouliavtsev, & Ethridge, 2013).

Little prior work exists to examine the effects of a mathematics prerequisite on students' performance in financial principles. Gist, Goedde, & Ward (1996) performed multiple regression to examine the relationship between SAT score, GPA, students' scores on a business math pretest, gender, and whether the student had completed algebra or calculus with a c or better to predict the students' final accounting course average using subjects from a historically black college or university. While gender was positively related to performance, students' performance in calculus class rather than algebra factored into the explanation of the students' success in principles of accounting. The results confirm that students with higher SAT scores, GPAs, and a passing grade in calculus perform better in principles of accounting I than students without. The most important variable in predicting the results is GPA, followed by SAT score, with the grade in calculus third.

The goal of Fedoryshyn, O'Brien, Hintz, & Bosner (2010) was to examine the association between students' ability to perform business math on an 8th grade level and their final numerical grades in the principles of accounting I course. The study also included gender, student's major, and GPA at the end of the semester when the data was gathered. They constructed regression models adding the individual factors successively with the result that neither scores on the math pre-test, gender, nor major is positively associated with the students' performance in principles of accounting I. The predictive power of the model was significantly improved when students' cumulative GPA was added to the model. The authors interpret the results to mean that students who have been in college long enough to have accumulated stronger GPAs are more likely to perform better in principles of accounting I.

A more recent study based on data for five years examines the association between the student's status as a declared accounting major and the successful completion of introductory accounting (Phillips, 2015). Phillips included additional factors of grade point average, a measure of math proficiency, whether the student was a transfer student, and whether the student had repeated introductory accounting (2015, p. 28). Mathematics proficiency was measured as a score based on the math course the student had taken and the grade received in that course. The results indicate that accounting major status, GPA, and math proficiency were positively related to success in introductory accounting. The policy implications of the study are that it may be advantageous to offer different principles courses for accounting majors and nonmajors. Furthermore, performance might be improved if a minimum GPA is required for enrollment and that all math prerequisites should be satisfied prior to enrollment in the course.

Kealey, Holland, & Watson (2005) describe an experiment wherein financial principles students wrote an essay about an event identified in the Wall Street Journal. The assignment, made in the first week of the new semester, required students to

". . . read the article, then identify and discuss the factors that might have negatively affected investors' views. . ." in essay form (Kealey et al., 2005, p. 37). The students' scores on the essay were included as a predictor in a model designed to test the relation between several factors and the students' performance measured as the percentage of points earned on the exams in financial principles. The results indicate that the better a student's critical thinking skills the higher will be the percentage of points earned in financial principles. This study is the nearest example approximation to one that examines whether a prerequisite of English is related to the successful completion of financial principles.

In a logistical regression analysis McCarron and Burstein (2016) used data accumulated over thirteen years to identify variables that would increase the likelihood of successful completion of financial principles of financial accounting. Significant variables include high school GPA, the students' age, a combined variable based on whether the student had completed both a math course and an English course prior to enrolling in financial principles of financial accounting, and whether the student had enrolled in a learning support (developmental or remedial) English course prior to taking the principles course. The research presented here is an extension and refinement of that study.

METHOD

Data collection

Data for 1,635 first and second year students were collected from the academic archives eliminating any self-reporting bias. All the students had taken financial accounting principles from the same professor between 2000 and 2013, which assures that the teaching style remained relatively consistent over the 13-year period. The college did not require any prerequisites prior to taking an introductory accounting course other than the successful completion of any developmental (remedial) work in English and math. Often an enrolling freshman who did not require remedial work would register for financial principles in their first semester in college. Specification of the models

Equation (1) specifies the general form of the logistic regression function

$$\ln \text{Odds}(E) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \varepsilon \qquad (1) \text{ (Zaiontz, 2014)}$$

The dependent variable, SUCCESS in the financial principles class, is a dichotomous variable measured by whether the student received a C or better in the course. The dataset included a number of additional variables, some suggested in prior studies:

- HSGPA: High School GPA
- SATM: SAT Math score or ACTM mapped to SAT Math
- SATV: SAT English score or ACTE mapped to SAT English
- GENDER
- AGE at start of class
- PriorM: Successful prior completion of college level math class
- PriorE: Successful prior completion of college level English class
- PriorLSM: Prior completion of Learning Support (developmental learning) Math
- PriorLSE: Prior completion of Learning Support (developmental learning) English

The models do not differentiate for the particular college level math course or English course the student may have taken. Rather, the model reflects whether the student had completed any college-level math or English course prior to attempting financial principles. Table 1 (Appendix) shows summary statistics for all variables while Table 2 (Appendix) shows the correlation matrix for the original data (McCarron and Burstein, 2016)).

RESULTS AND DISCUSSION

Previous research reports that both English and math appear to be contributing factors to students' success in introductory accounting, suggesting that the general level of intellectual and academic maturity may be more relevant than specific math skills. McCarron and Burstein (2016) indicate that prior English appeared more significant than prior math as an indicator of success in financial principles. As no other study had considered the prerequisite of English as a possible factor in success in passing financial principles, the relationship between math and English as predictors of success in financial principles warranted this additional study.

The preferred model reported by McCarron and Burstein (2016) is equation (2):

$$\text{log odds} = -5.328 + 0.935 HSGPA + 0.146 AGE + 0.353 PriorMandE - 0.452 PriorLSE \qquad (2)$$

All variables were significant at the 0.01 level, and both the Cox and Snell R square (0.089) and the Nagelkerke R square (0.120) suggested a moderate but significant fit for the model.

This study investigates three models, all including age and high school GPA, both of which were important predictors of accounting success, but eliminating prior learning support English to more explicitly consider prior college level English and math classes themselves. It compares the model containing the dual math and English prerequisites to a model with only English as a prerequisite to a third containing only math, identified as:

- Two-prerequisites model, including both prior college level English and prior college level math stated as

$$\text{log odds} = -5.421 + .983 HSGPA + .133 AGE + .175 PriorMath + .305 PriorEnglish \qquad (3)$$

- English-prerequisite model, including only prior college level English stated as

$$\text{log odds} = -5.531 + 1.016 HSGPA + .136 AGE + .35 PriorEnglish \qquad (4)$$

- Math-prerequisite model, including only prior college level math stated as

$$\text{log odds} = -5.656 + .995 HSGPA + .15 AGE + .252 PriorMath \qquad (5)$$

Table 3 (Appendix) reports the strength and significance of each variable while Table 4 (Appendix) reports on both goodness of fit and a measure of the "increase in probability of success," indicating the extent to which the specific prerequisites in the model add to the probability of accounting success for a "standard" student, who is typically 20 years old with a 2.5 high school GPA. Note that while the nature of logistic regression is such that the specific

increase in probability due to a binary variable without some form of standardization cannot be stated, probability changes nonetheless are similar for students who deviate from the standard.

In the two-prerequisites model, as reported previously, prior English is the more important variable in predicting accounting success, and indeed, prior math is not statistically significant at the 0.05 level. Meeting both prerequisites increases the probability of success for our standard student by 0.119. Prior math alone, in the math-prerequisite model, is a significant predictor of success, but the increase in the probability of success is only 0.063 whereas the English-prerequisite model shows prior English as a stronger predictor of success with the increase in the probability of success at 0.087. Further, the fit of the English-prerequisite model, indicated by both the Cox-Snell and the Nagelkerke R square measures, is nearly equal to that of the dual prerequisite model.

Students are more likely to succeed in introductory accounting having previously taken both college level math and English. Prior math alone, however, is not nearly as important, perhaps because the mathematics involved in introductory accounting involve little beyond arithmetic and basic high school algebra. As "the language of business," however, accounting demands a level of verbal facility which is apparently well supplemented by college level English. The results provide empirical indirect support for the importance of critical thinking skills that college level English fosters through the processes of reading, analyzing, and writing.

LIMITATIONS AND FUTURE RESEARCH

The primary limitation to the study is that its findings may not be generalizable to other colleges. Before formulating policy statements additional testing is necessary to ascertain the models' applicability using data from another college. Tests could determine whether the relationships between prerequisites of math or English or both better indicate that students will successfully complete financial principles at different colleges. An improvement will validate the models at a different college that has adopted math as a prerequisite for financial principles but that has not necessarily specified that English must be completed prior to taking principles of financial accounting. A second limitation may be that the professor in the study used the 'user' approach to teach principles of financial accounting. At another college where the professors use the 'preparer' approach, the results may not apply.

REFERENCES

Alcock, J., Cockcroft, S., & Finn, F. (2008, December). Quantifying the advantage of secondary mathematics study for accounting and finance undergraduates. *Accounting & Finance, 48*(5), 697-718. doi:/doi/10.1111.acfi.2008.48.issue-5/issuetoc

American Accounting Association, A. (1973). Report of the Committee on Junior (Community) College Curriculum. *The Accounting Review, 48*(Supplement), 36-71. Retrieved February 9, 2016, from http://www.jstor.org/stable/3203235

Baard, V., & Watts, T. (2008). The value of prerequisites: A link between understanding and progression. *e-Journal of Business Education and Scholarship of Teaching, 2*(1), 1-10.

Danko, K., Duke, J. D., & Franz, D. P. (1992). Predicting student performance in accounting classes. *Journal of Education for Business, 67*(5), 270-274. doi:10.1080/08832323.1992.10117556

Dinius, S. H. (1991). Accounting students: Secondary-level study and academic performance and characteristics. *Journal of Education for Business, 66*(4), 244-250. doi:10.1080/08832323.1991.10117480

Eskew, R. K., & Faley, R. H. (1988, January 1988). Some determinants of student performance in the first college-level financial accounting course. *The Accounting Review, LXIII*(1), 137-147. Retrieved 2014

Fedoryshyn, M. W., O'Brien, M., Hintz, A., & Bosner, K. (2010). Arithmetical reasoning sills as a predictor of success in principles of accounting. *Academy of Educational Leadership Journal, 14*(Special), 93-107.

Gist, W. E., Goedde, H., & Ward, B. H. (1996). The influence of mathematical skills and other factors on minority student performance in principles of accounting. *Issues in Accounting Education, 11*(1), 49-60.

Jones, C. T., Kouliavtsev, M. S., & Ethridge, J. J. (2013). Lower level prerequisites and student performance in intermediate business courses: Does it matter where students take their principles courses? *Journal of Education for Business, 88*(4), 238-245. doi:10.1080/08832323.2012.688777

Kealey, B. T., Holland, J., & Watson, M. (2005). Preliminary evidence on the association between critical thinking and performance in principles of accounting. *Issues in Accounting Education, 20*(1), 33-49. doi:http://dx.doi.org/10.2308/iace.2005.20.1.33

Lee, D. S.-y. (1999). Strength of high school accounting qualification and student performance in university-level introductory accounting courses in Hong Kong. *Journal of Education for Business, 74*(5), 301-306. doi:10.1080/08832323.1991.10117480

Lynn, B., Shehata, M., & White, L. (1994). The effects of secondary school accounting education on university accounting performance: A Canadian experience. *Contemporary Accounting Research, 10*(2), 737-758. doi:10.1111/j.1911-3846.1994.tb00413.x

McCarron, K. B., & Burstein, A. N. (2016, May 19). The Importance of mathematics as a prerequisite to introductory financial accounting. *Community College Journal of Research and Practice*, 1-8. doi:http://dx.doi.org/10.1080/10668926.2016.1179235

Phillips, J. F. (2015). Accounting majors finish first - Results of a five-year study of performance in introductory accounting. *The Accounting Educators' Journal, XXV*, 25-38.

Zaiontz, C. (n.d.). *Real Statistics using Excel*. Retrieved from www.real-statistics.com: http://real-statistics.com/wp-content/uploads/2013/02/image2124.png

APPENDIX

Table 1

Descriptive Statistics: Variable Means, Standard Deviations, Maximums and Minimums

Variable	Mean	Standard Deviation	Maximum	Minimum
SUCCESS	.579	.494	1	0
HSGPA	2.82	.571	4	4.44
SATM	471.60	75.50	710	270
SATV	456.20	76.40	750	200
GENDER	.47	.499	1	0
AGE	20.60	2.60	50	17
PriorM	.42	.494	1	0
PriorE	.61	.488	1	0
PriorLSM	.17	.373	1	0
PriorLSE	.16	.370	1	0

(source: McCarron and Burstein, 2016, p. 4)

Table 2

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Correlation Matrix

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	SUCCESS	HSGPA	SATM	SATE	GENDER	AGE	PRIORM	PRIORE	PRIOR LSM	PRIOR LSE
SUCCESS	1	.244**	.159**	.186**	.057*	.080**	.123**	.122**	-.047	-.126**
HSGPA	.244**	1	.342**	.337**	.207**	-.202**	.203**	.060*	-.246**	-.207**
SATM	.159**	.342**	1	.583**	-.193**	-.112**	.146**	-.088**	-.461**	-.314**
SATE	.186**	.337**	.583**	1	-.094**	-.028	.046	.026	-.285**	-.486**
GENDER	.057*	.207**	-.193**	-.094**	1	-.026	.043	.065**	.099**	.073**
AGE	.080**	-.202**	-.112**	-.028	-.026	1	.091**	.207**	.128**	.044
PriorM	.123**	.203**	.146**	.046	.043	.091**	1	.287**	-.099**	-.035
PriorE	.122**	.060*	-.088**	.026	.065**	.207**	.287**	1	.086**	-.026
PriorLSM	-.047	-.246**	-.461**	-.285**	.099**	.128**	-.099**	.086**	1	.237**
PriorLSE	-.126**	-.207**	-.314**	-.486**	.073**	.044	-.035	-.026	.237**	1

Note: *significant at .05; **significant at .01

Source: McCarron and Burstein, 2016, p. 5

Table 3

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Logistic Regression Coefficients

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	Two-prerequisite Model			Math-prerequisite Model			English-prerequisite Model		
Variable	Coefficient	Wald statistic	Significance level	Coefficient	Wald statistic	Significance level	Coefficient	Wald statistic	Significance level
CONSTANT	-5.421	53.74	0.000*	-5.656	57.667	0.000*	-5.531	56.274	0.000*
HSGPA	0.985	94.128	0.000*	0.995	96.396	0.000*	1.016	103.63	0.000*
AGE	0.133	19.037	0.000*	0.150	24.548	0.000*	0.136	20.072	0.000*
Prior Math	0.175	2.409	0.121	0.252	5.331	0.021**			
Prior English	0.305	7.273	0.007**				0.35	10.202	0.001*

Note: *significant at .001; **significant at .05

Table 4

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Goodness of Fit Statistics

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	Cox & Snell R Square	Nagelkerke R Square	Increase in Probability of Success
Two-prerequisite Model	.085	.115	0.119
Math-prerequisite model	.081	.109	0.063
English-prerequisite model	.084	.113	0.087

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