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THE EFFECT OF MATHEMATICS ABILITY ON PERFORMANCE IN PRINCIPLES OF ACCOUNTING

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ABSTRACT

The study of mathematics provides an excellent basis for the applied techniques of accountancy and finance although most accounting educators readily acknowledge that mathematical ability has a significant impact on student performance in accounting courses, to date no statistical research has appeared that numerically quantifies the effect. The present research estimates the incremental effect of mathematics ability on student performance in principles of accounting by means of regressing student performance in a principles course on the student's score on 24-question mathematics pre-test, as well as on other determinants of performance such as Grade Point Average. The overall effect of mathematic ability is estimated, and also the effect of mathematic ability in specific areas of mathematics such as proportions and percentages. It is found that while each one of the mathematic score variables is highly significant according to the standard t-statistic test, the overall explanatory power of the regression equation, as measured by its R-squared, is not increased very much in a numerical sense by the addition of any one of them to a regression equation that already includes as an explanatory variable Grade Point Average. This finding does not imply that mathematics is unimportant to student performance in accounting, but rather that mathematics ability is so highly correlated with other academic ability indicators that disentangling the effect of math ability from the effect of other ability indicators is statistically problematic. Nevertheless, the pre-test itself can be utilized to conveniently identify at-risk students in principles of accounting courses, especially for those with measured low arithmetical and percentages and proportions skills.

Keywords: *Mathematical Ability, Principles of Accounting Courses, Standard T-Statistics Test, Low Arithmetical, Percentages and Proportion Skills.*

INTRODUCTION

The discipline of accounting is concerned with accurate numerical measurement of precisely defined operational concepts. It follows that practitioners of accounting should be comfortable with mathematics in general and numbers in particular. Most accounting educators believe that arithmetic skills are important for students to understand accounting systems and financial statement analysis. It seems obvious that academic and professional success in accounting will be facilitated by a high level of mathematical skill.

Most business schools have implemented mathematic requirements in basic calculus and matrix algebra, but the amount of application of these techniques tends of be limited in many business courses, with the result that some students may postpone taking required mathematic courses until late in their college careers (Mitchell, 2005). A perennial debate topic is the usefulness of higher mathematics in the applied business disciplines, and the extent to which mathematical techniques could and should be utilized in coursework.

LITERATURE REVIEW

Weaker and more problematic relationships have been found between performance and secondary school courses in accounting, sex (normally female students do better than male students), personality characteristics, effort measures, and intervention variables such as supplementary instruction (Johnson, 2004). Researchers have found that the following factors are significantly prevent students from majoring in accounting: Discrimination, work task assignments, poor education, cultural differences, low self efficacy and self confidence, distrust, unfamiliar work environment, socio economic status, work values, and mathematic skills, (Jackling, 2011). In their study, Cohen and Hanno (2013) suggested that students who chose not to major in accounting did so based on recommendations and advice from people important to them, but more significantly, they perceived it to be too number-oriented and boring. Calero (2006) cited that accountants have been typically referred to as number crunchers'given that book-keeping and auditing work has emphasized or been associated with an emphasis upon numerical accuracy, routine recording and calculation methods, together with attention to detail (Parker 2000). Yunker, (2009) maintained that accounting as a discipline is concerned with accurate numerical measurement of accurately defined

operational concepts. Researchers have also asserted that the negative views in accounting as a profession are linked to poor numerical skills (Parker 2000). These numerical skills are seen as essential for someone to be successful as an accountant (Parker 2000). Other studies (Mitchell 2005) have also established a positive relationship between accounting and mathematics, when he demonstrated that a possession of greater numerical ability drives a better performance in accounting. Although they were more specific than others, Wong and Chia (2006) indicated that a higher degree of proficiency in mathematics is associated with a higher performance in financial accounting.

PURPOSE OF STUDY

Our purpose here is to augment our understanding of the effect of mathematical skill on academic success in accounting in two ways. First, our intention is to statistically estimate the *incremental* effect of mathematical ability on performance in principles of accounting, holding constant other important determinants. Mathematical ability is obviously correlated with general intellectual ability. Therefore, because of the positive relationship between general intellectual ability and success in accounting courses, a positive relationship between mathematical ability and success in accounting is to be expected. But what is the effect of mathematical ability specifically holding constant general intellectual ability on success in accounting courses? Secondly is to differentiate the effects of various specific types of mathematical ability on success in academic accounting. Several different branches of mathematics are relevant to the discipline of accounting. Are some of these branches more important than other branches in determining a student's success in principles of accounting? As in the case with overall math ability, the importance of each area is to be assessed in terms of incremental explanatory power.

RESEARCH DESIGN

A by-product of the research is a mathematics pre-test oriented specifically to the discipline of accounting. The test is capable of providing information on at risk students as well as specific mathematical areas where review may be useful.

METHODOLOGY

The methodology of this research is empirical. At the beginning of the semester, students in principles of accounting courses were given a mathematics pre-test. The test items cover certain areas especially relevant to accounting. After the end of the semester, each student's

performance on the mathematics pre-test was matched with his/her overall performance in the principles of accounting course. Regression analysis of the data indicates that:

(1) the positive effect of mathematics skills on accounting performance is strongly significant;

(2) controlling for the student's general ability and other key factors bearing on accounting performance, the measured incremental effect of math skill on performance is quite small;

(3) in numerical terms, the measured incremental effect of the different branches of mathematics on accounting performance is very similar.

First, the major application of standardized tests in higher education is for college admission decisions. It is essential, for purposes of college admissions, that the performance of any one applicant be accurately compared to the mean performance of a very large reference group. The present project, on the other hand, is not concerned with comparing the performance of the students who took the test with that of a larger reference group. The questions of interest may be tentatively answered on the basis of a single application of the test with the provision that the sample size be sufficiently large. The sample size amounted to several hundred, which compares favorably with the majority of prior contributions to the determinants of success literature. Second, there is a substantial amount of precedent in the literature for the use of special purpose tests and other instruments in research of this sort. The purpose of the research is usually to estimate the effect of very specific characteristics and abilities of students on their achieved academic success. A relatively short special purpose instrument can often measure these special characteristics and abilities more precisely than a large standardized instrument. The investigators in this research, all of them senior-level faculty with several decades of combined experience in higher education, were especially interested in whether specific types of mathematical ability are more closely related to student success in principles of accounting courses than other types. The test instrument was designed accordingly. With respect to the fundamental issue of validity (whether the overall pre-test actually measures general mathematical ability), we point to the relatively high simple correlation between math ACT score (MACT) and score on the overall pre-test (MSCORE1): 0.677.

STATISTICAL RESULTS

Table 1 presents selected descriptive statistics for the variables included in the regression analysis. For each variable, the number of available observations (cases) is listed. These range from a maximum of 535 for the math scores and other information obtained from the test instrument, to a minimum of 420 for the ACT scores (composite and mathematics).

The mean math scores shown in Table 1 are directly comparable, since each represents not the absolute number of questions of a certain type answered correctly, but rather the percentage of questions of a certain type answered correctly. The lowest of the five scores is MSCORE3 (47.032), pertaining to percentages and proportions, while the highest is MSCORE2 (74.509), pertaining to arithmetic calculations. The fact that the weakest area is found to be percentages and proportions is consistent with the casual empiricism of many accounting professors (including those conducting this research) that students seem to have special difficulty in converting and interpreting ratio concepts. In Table 1, the first variable is CSCORE (course score), the dependent variable measuring the student's performance in the accounting class. All of the other variables are independent variables: potential determinants of performance.

First, there is a list of personal and situational variables that prior research has suggested may be significant determinants of performance: SEX, AGE, CLASS, COURSE, TIMEDAY, ACCTMAJ. This list is followed by two general academic ability variables: ACT (composite ACT score) and GPA (grade point average). ACT measures the student's general academic potential prior to commencing college, while GPA measures the student's performance in other college courses than principles of accounting since the time of matriculation. Finally, there are the specific math ability variables: MACT is the student's mathematics ACT score, and MSCORE1 through MSCORE5 represent the student's score on each of the five dimensions of the math pre-test: overall, arithmetic, percents and proportions, algebra, and word exposition.

TABLE 1: VARIABLES INCLUDED IN THE REGRESSION ANALYSIS

NAME	EXPLANATION	MEAN	STD. DEV.	CASES
CSCORE	Course score (percent)	73.952	12.645	468
SEX	Sex (1=Female; 0= Male)	0.338	0.473	535
AGE	Age (1=under 18 to 5 = over 23)	2.811	0.841	535
CLASS	Class (1=fresh. To 4=senior)	2.487	0.644	535
COURSE	Course (1=principles 11; 0=principles 1)	0.214	0.411	535
TIMEDAY	Time of Day (military time)	1082.9	191.79	535
ACCTMAJ	Accounting Major (1=major; 0=non-major	0.100	0.301	535
ACT	ACT Composite	21.402	3.427	420
GPA	Grade point Average	2.704	0.761	506
MACT	ACT Mathematics	21.411	3.964	420
MSCORE1	Math score1: Overall (percent)	60.397	18.874	535
MSCORE2	Math score2: Arithmetic (percent)	74.509	16.283	535
MSCORE3	Math score 3: Percents & Proportion (percent	47.032	27.018	535
MSCORE4:	Math 4: Algebra (percent)	59.649	23.875	535
MSCORE5:	Math5: World Exposition (percent)			

TABLE 2: CORRELATION MATRIX:

ACADEMIC CAPABILITY VARIABLE

	CSCORE	GPA	ACT	MACT	MSCORE 1
CSCORE	1.00				
GPA	0.727	1.000			
ACT	0.378	0.329	1.000		
MACT	0.326	0.299	0.791	1.000	
MSCORE 1	0.327	0.286	0.591	0.677	1.000
MSCORE 2	0.241	0.171	0.387	0.464	0.780
MSCORE 3	0.295	0.258	0.542	0.613	0.888
MSCORE 4	0.280	0.272	0.530	0.601	0.840
MSCORE 5	0.321	0.273	0.554	0.554	0.891

	MSCORE1	**MSCORE 2**	**MSCORE 3**	**MSCORE 4**	**MSCORE 5**
MSCORE 1	1.000				
MSCORE 2	0.780	1.000			
MSCORE 3	0.888	0.580	1.000		
MSCORE 4	0.840	0.510	0.583	1.000	
MSCORE 5	0.891	0.637	0.832	0.744	1.000

Table 2 is a matrix of simple correlation coefficients among the more important variables in the research: the performance variable CSCORE, the general academic ability variables GPA and ACT, and the specific math ability variables MACT and MSCORE1 through MSCORE5. One of the major pitfalls in multiple regression analysis is the problem of multi-collinearity, caused by excessively high correlations among different explanatory variables in the equation. Evidently, when two explanatory variables are closely correlated, it is difficult for regression analysis to isolate the separate effects of the two variables. A general rule is that simple correlation coefficients in excess of 0.5 in absolute value are a warning sign that multi-collinearity may seriously affect the results. Most of the simple correlation coefficients among the MSCORE variables are well above 0.5, which indicates that it would be unwise to include more than one at a time in a regression equation. Among the lower of the correlation coefficients in the table is that between ACT and GPA: 0.329. The initial ability of the student, as measured by pre-college ACT, does not have as strong a correlation with performance in college, as measured by GPA, as might be expected. This suggests that both ACT and GPA might be used together as determinants of accounting performance without incurring a serious multi-collinearity problem.

The basic statistical analysis tool utilized in this research is multiple regressions. The analysis is performed in steps designed to estimate the incremental explanatory power of two categories of variable: general academic ability, and mathematical ability. Within the latter category, we look first at the incremental explanatory power of math ACT versus the incremental explanatory power of overall math pre-test score, and second at the incremental explanatory power of scores on the specific components of the math pre-test.

EVALUATION AND CONCLUSION

This central purpose of this research has been to estimate the effect of mathematics ability, as measured by performance on a mathematics pre-test covering several different areas of mathematics that would appear to be especially relevant to the study of accounting, on student performance in principles of accounting, as measured by percentage of total available points earned (CSCORE), holding constant other determinants of success. The statistical analysis was structured to enable: first, estimation of the incremental explanatory power of general academic ability measures over a set of personal and situational variables; and second, estimation of the incremental explanatory power of math ability variables over a reduced set of statistically significant general ability and situational variables. It was found that a substantial set of personal and situational variables account, in a statistical sense, for only a small part (under 2 percent) of the total variation in CSCORE. The two measures of general academic ability utilized in the research are composite ACT score and GPA achieved in other courses. Of the two, GPA was found to have the statistically stronger effect on performance in accounting principles, raising the explanatory power of the regression equation to 55.3 percent when used separately from ACT and to 56.8 percent when used together with ACT.

Two measures of mathematics ability were then examined: MACT is the student's score on the mathematics component of the ACT, and MSCORE1 is the student's percentage score on a mathematics pre-test written specifically for this research. Both have statistically significant but numerically small incremental effects on CSCORE, holding constant other determinants. While both effects are small, the numerical effect for MSCORE1 is somewhat larger than that for MACT, which may be due to the fact that the special purpose math pre-test utilized in this research was specifically designed to emphasize areas of mathematics assumed to be especially important to the study of accounting. The fundamental conclusion from the project is thus that mathematics ability does have statistically significant incremental explanatory power over and above that contained in the GPA measure of general academic ability and certain other determinants of success in principles of accounting but not very much incremental explanatory power.

REFERENCES

Calero A. (2006) "Determinants of Student Performance in Accounting Principles I and II," *Issues in Accounting Education*.

Cohen B. & Hanno D. (2013) "The Relative Performance of Female and Male Students in Accounting Principles Classes," *Journal of Education for Business* 67(4)

Jackling S. (2011) "Factors that Predict Success in Principles of Accounting Classes," *Journal of Education for Business*

Johnson, F. (2004). "Basic Math Skills and Performance in an Introductory Economics Class," *Journal of Economic Education* 35(1): 3-23.

Mitchell, J. (2005).The Role of Supplemental Instruction in the First Accounting Course," *Issues in Accounting Education* 16(4); 537-547

Parker G. (2000) Quantitative Skills and Performance in Principles of Finance: Evidence from a Regional University, *Financial Practice and Education* 10(2): 167-174, Fall-Winter 2000.

Wong D. & Chia K. (2006). The Selection of a Business Major: Elements Influencing Student Choice and Implications for Outcomes Assessment," *Journal of Education for Business*

Yunker A.A. (2009). Some Determinants of Student Performance in the First College-Level Financial Accounting Course, *The Accounting Review* 63(1).

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