Identification of Lower-Level Courses to Predict Accounting Students' Success in Upper-Level Courses: A Structural Equation Model

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We examine how lower-level courses can contribute to students' success in upper-level courses in the accounting curriculum, using the structural equation modeling technique. We identify math-related courses, Managerial Accounting, and Intermediate Accounting I as key predictors of student success in upper-level accounting courses. As Managerial Accounting is the last accounting course in the business curriculum, academic advisors and administrators could focus on students in this course to promote professional careers in accounting and help them to make informed decisions regarding the accounting major in the business program.

INTRODUCTION

The purpose of this project is to identify lower-level courses that could serve as predictors of accounting students' academic success in upper-level accounting courses. The typical accounting curriculum at higher education institutions in Texas is comprised of three sequential groups: general education, including supplemental courses (around 60 semester credit hours); business core courses (around 30 semester credit hours); and major (accounting) courses (around 30 semester hours). The successful completion of these courses leads to a bachelor's degree in accounting. Thus, it is important for accounting faculty and administrators to understand (1) how contents and material in lower-level courses could help accounting students to achieve success in upper-level courses and (2) which lower-level courses are primarily accountable for students' success in upper-level accounting courses.

Accounting graduates are in high demand in the job market, especially after the enactment of the Sarbanes-Oxley law (2002) that has raised the accountability of U.S. public firm boards, managers, and auditors in response to a number of major financial scandals. Educators need to produce a great number of competent accountants in order to satisfy the increase in industry demand. For example, Certified Public

Accountant (CPA) firms have increased their new hires from 20,951 in 2000 to 33,321 in 2010 (American Institute of Certified Public Accountants, 2011). In particular, there is a strong impetus for universities to produce a greater number of knowledgeable African American accountants. Mitchell and Flintall (1990) discussed the shortage of black CPAs in the late 1980s. At that time, African Americans represented less than 1% of professionals in the accounting profession, compared to 3.3% in medicine and 2% in law. The number of African Americans in the accounting profession has gradually increased; for example, in 2010, they represented 3% of all accounting employees at CPA firms. However, only 1% of the AICPA membership is African American. As a result, African Americans continue to be underrepresented in the accounting profession, even though they constitute more than 10% of the U.S. population. The low representation of minorities—in particular, African Americans in the accounting profession—has concerned educators and accounting practitioners for several decades. This concern has produced research projects (Williams et al., 1988) and established scholarship programs that assist minorities successfully to complete their accounting education (Flesher & Gabre, 2009).

Academic studies have attempted to identify the key cognitive skills needed for students' success in accounting courses. In general, math skills were found to be the key cognitive knowledge required for successful accounting students (Roy & MacNeill, 1967; Clark & Sweeney, 1985; Booker, 1991; Ward et al., 1993; Gist et al., 1996). Similar findings are reported for African American students (Booker, 1991; Ward et al., 1993; Gist et al., 1996). Verbal skills are another cognitive measurement highly correlated with math skills (Murnane et al., 2000). However, no study has examined how fundamental cognitive skills acquired in lower-level courses are associated with the academic performance of students in upper-level courses in the accounting curriculum. Thus, this study extends the findings of prior studies by analyzing the accounting curriculum at one historically black university in the southwestern region of Texas to understand how students' academic performance in upper-level accounting courses is associated with their performance in lower-level courses.

We analyzed transcripts of 149 accounting graduates from 2002 to 2011, using the structural equation modeling technique; we identified math-related courses, Managerial Accounting, and Intermediate Accounting I as important predictors of student success in upper-level accounting courses. We cannot emphasize enough the importance of math skills in accounting as reported by prior studies. Managerial Accounting appears to be a crucial course for administrators and academic advisors to identify business students with good potential in accounting, as this is the second accounting principles course in the business curriculum. Finally, Intermediate Accounting I, "gatekeeper" in the accounting program, shows a positive correlation with other upper-level accounting courses.

This study contributes to the accounting pedagogical literature by identifying the varying relevance of lower-level courses in the accounting curriculum to students' academic achievements in upper-level courses. Thus, the findings of this study could help administrators and faculty to revise the accounting curriculum for improved educational outcomes and to offer relevant academic advising to students. Academic advisors and administrators need to provide high achievers in Managerial Accounting with information about their future career opportunities in accounting. This information could help students make informed decisions about their future careers, and contribute to raising, in particular, the number of competent African American accountants in the future.

The remainder of this paper is organized as follows: Section 2 provides a literature review and model development, Section 3 includes empirical results, and Section 4 concludes the study.

LITERATURE REVIEW AND MODEL DEVELOPMENT

In the education field, extensive studies have been conducted to identify factors that contribute to student academic success at the college level. In general, most findings confirm that math and English language are the most important cognitive skills that determine student academic success (Adelman, 1999; Trusty & Niles, 2003; Murnane et al., 2000). Furthermore, a number of studies have focused on the association between math skills and student performance in accounting courses (Roy & MacNeill, 1967; Clark & Sweeney, 1985; Booker, 1991; Ward et al., 1993; Gist et al., 1996). Booker (1991), Ward et al.

(1993), and Gist et al. (1996) focused on African American students and reported that math skills were one of the primary determinants of their success in accounting courses. Verbal skills are another cognitive measurement highly correlated with math skills (Murnane et al., 2000). Accounting is a process that collects business transactions and transforms them into a structured business language by following prescribed rules and regulations. Thus, successful accounting students should possess strong verbal skills that facilitate comprehension of the accounting issues they face and help them devise appropriate solutions by referring to relevant legal sources. The new credit hour requirements for a communication course for CPA examination candidates, enacted by the Texas State Board of Public Accountancy, reflect the increase in demand for accountants' strong communication skills. They should complete at least two semester hours in accounting or business communication before taking the uniform CPA examination. However, not much research has been done on how verbal skills affect accounting students' academic success. Further, Brown et al. (2002) considered the principles of macroeconomics course to be the single most important indicator related to student success in business education. Ballard and Johnson (2004), on the other hand, reported a positive association between students' math skills and their performance in economics courses.

Most prior studies have focused on pieces of academic knowledge and skills that are considered relevant to student success in accounting; these skills are mostly learned in secondary education. However, researchers are yet to examine the accounting curriculum for how lower-level courses contribute to learning the fundamental skills needed for their success in upper-level accounting courses. Understanding the influence lower-level courses have on student performance in upper-level courses can help faculty and administrators justify the sequential prerequisites in the accounting curriculum. In addition, such knowledge can continuously improve the accounting curriculum and enable stronger academic advising to students.

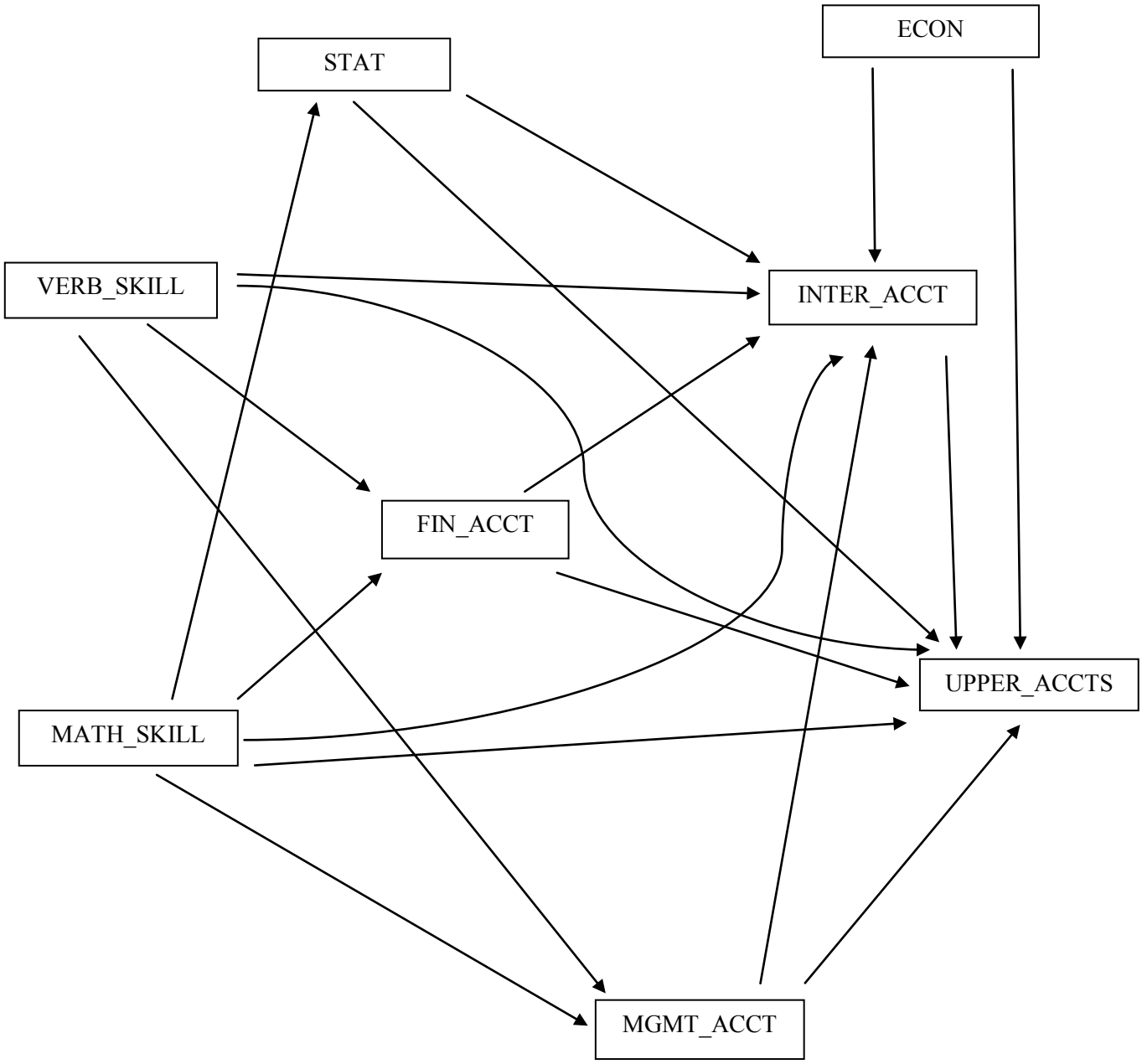
We collected the transcripts of alumni accounting students from one university in the southwestern region of Texas. The School of Business at the university offers a Bachelor of Business Administration (BBA) and two graduate programs, a Master of Business Administration (MBA) and a Master of Science in Accounting (MSA). The undergraduate accounting major is one of the five disciplinary majors in the BBA. The BBA's curriculum requires two courses in English composition, one speech course, and three courses in mathematics, such as College Algebra, Finite Math, and Calculus. These courses are intended to strengthen business students' abilities of analytical and critical thinking. Furthermore, all business majors are required to complete two courses in economics, two courses in accounting, one business statistics course, and several principle courses in other business disciplines. Upon completing the lower-level courses, accounting majors advance to upper-level courses in accounting, including Intermediate Accounting I and II, Cost Accounting, Federal Income Tax I, Business Law, Accounting Information Systems, Auditing, Advanced Accounting, and two accounting-related electives.

Since most courses are academically correlated, no single regression model can evaluate the effect of lower-level courses on student academic success in the presence of multiple causal relationships. Thus, we chose structural equation modeling (SEM) to analyze the relationships that exist between courses in the accounting curriculum. SEM consists of a measurement component and a structural component. In the measurement component, the relationships between a set of observable variables and their latent variables are analyzed and established. A researcher can collect observable variables, but latent variables are beyond human measurement; thus, a latent variable is extracted from a set of observable variables for further analysis. The structural component specifies the causal relationships between variables, much like the regression model. In SEM, however, multiple causal relationships are constructed simultaneously in one comprehensive model; SEM is also known as the path model (Hoyle, 1995). Thus, SEM is an effective research methodology for simultaneously constructing a set of multiple independent and dependent variables. It is then possible to produce empirical interpretations through the analysis of these variables (Gefen et al., 2000).

SEM follows three steps: specification, estimation, and evaluation. The relationships between the variables are determined in the specification phase, followed by the estimation phase, which evaluates a

hypothesized model against the data set. Finally, the researcher evaluates the goodness-of-fit pertaining to the model to ensure rigorous empirical implications (Stephenson et al., 2006).

FIGURE 1
THE RESULTANT PATH MODEL



Notes:
VERT_SKILL: three courses in English composition and speech; MATH_SKILL: three math courses; FIN_ACCT: Financial Accounting; MGMT_ACCT: Managerial Accounting; STAT: Business Statistics; ECON: Microeconomics and Macroeconomics; INTER_ACCT1: Intermediate Accounting I; UPPER_ACCTS: upper-level accounting courses.

In Figure 1, we illustrate accounting students' academic success through their performance in five major categories: verbal skills (three courses in English), analytical skills (three courses in mathematics), comprehension in social science concepts (two courses in economics), statistics (one business statistics course), and basic knowledge in accounting (Financial Accounting and Managerial Accounting). Since Intermediate Accounting I (INTER_ACCT1) is the gatekeeper course, this course is separated from other upper-level accounting courses (UPPER_ACCTS).

Verbal skills (VERB_SKILL) are measured as the grade point average (GPA) of two English composition courses and one speech course; math skills (MATH_SKILL) are measured as the GPA of three math courses; social science knowledge (ECON) is measured as the GPA of two economics courses: macro and micro. Knowledge of basic accounting concepts is measured with financial accounting (FIN_ACCT) and managerial accounting (MGMT_ACCT) courses. Grades in Business Statistics are used as a proxy for knowledge of business statistics (STAT), and INTER_ACCT1 is measured with the Intermediate Accounting I grades. Success in accounting courses is measured by the GPA of upper-level accounting courses (UPPER_ACCTS), such as Intermediate Accounting II, Cost Accounting, Federal Tax I, Advanced Accounting, Accounting Information Systems, Auditing, and Business Law.

Figure 1 includes paths among the variables described above. Both VERB_SKILL and MATH_SKILL are assumed to directly and indirectly affect students' academic success in FIN_ACCT, MGMT_ACCT, INTER_ACCT1, and UPPER_ACCTS. Furthermore, MATH_ACCT would affect students' academic success in STAT. STAT, FIN_ACCT, MGMT_ACCT, and ECON are designed to influence students' performance in INTER_ACCT1 and UPPER_ACCTS either directly or indirectly. Finally, INTER_ACCT1 directly influences UPPER_ACCTS.

EMPIRICAL RESULTS

We used SEM to estimate how the academic skills and knowledge that students earned in lower-level courses affected the academic performance of students in upper-level courses. We collected the required data from graduation evaluation forms completed by academic advisors for those who had graduated between 2002 and 2011. Normally, this form is completed during the last semester to ensure that graduate students finished all of the required courses.

We originally collected 203 graduation evaluation forms, but deleted 54 forms that lacked grade points for the courses required for the SEM analysis. Thus, we were left with 149 useable forms. Table 1 includes fit summary statistics of the path model. The Root Mean Square Residual (RMSR) measures the absolute model fit by computing an average of the discrepancies between observed and estimated covariance matrices. RMSR values are expected to be lower than 0.08 (Hu & Bentler, 1999). Table 1 shows .071 as the value of RMSR, which is lower than the benchmark. However, the Goodness-of-Fit Index (GFI) value, at 0.868, and Bentler's Comparative Fit Index value, at .788, are lower than the benchmark value (greater than .90), as indicative of a good model fit (Hair et al., 2006). Nonetheless, Browne and Cudeck (1993) noted that "[F]it indices should not be regarded as measures of usefulness of a model. They contain some information about the lack of fit of a model, but none about plausibility" (p. 157); this path model still provides viable empirical results.

Table 2 measures each independent variable's effect on a dependent variable in three ways: direct, indirect, and total. All independent variables have a direct effect on a dependent variable. For example, MATH_SKILL affects MGMT_ACCT, INTER_ACCT1, and others. The effect of MATH_SKILL on MGMT_ACCT is straightforward and can be measured directly. In addition, its direct effect value is equal to the total effect value in the absence of indirect effect. The effect of MATH_SKILL on INTER_ACCT1 is twofold: direct and indirect. For example, through FIN_ACCT and MGMT_ACCT, MATH_SKILL directly and indirectly influences INTER_ACCT1. As a result, the total effect (.337) of MATH_SKILL on INTER_ACCT1 is measured as a sum of direct (.086) and indirect effects (.251).

TABLE 1
FIT INDICES OF THE PATH MODEL WITH RESPECT TO UPPER_ACCTS

Index	Value
Root Mean Square Residual (RMSR)	0.071
Goodness of Fit Index	0.868
Bentler's Comparative Fit Index	0.788

Notes:
We collected 203 graduation evaluation forms of alumni accounting students who had graduated from 2002 to 2011. As 54 forms lacked grade points for the courses required for the SEM analysis, the final sample included 149 usable graduation evaluation forms.

MATH_SKILL influences all of the accounting courses, including FIN_ACCT and MGMT_ACCT. Its total effects are statistically significant at the .01 level. On the other hand, VERB_SKILL's effect on accounting courses is limited. The effect of VERB_SKILL on FIN_ACCT is statistically insignificant. Further, VERB_SKILL indirectly influences UPPER_ACCTS and INTER_ACCT1. In addition, total effect (.133) VERB_SKILL has on UPPER_ACCTS is much smaller than the effect MATH_SKILL has on UPPER_ACCTS (.418). Thus, as reported in prior studies (Booker, 1991; Ward et al., 1993; Gist et al., 1996), our results confirm the importance of math skills for success in upper-level accounting courses. Because of the similar contents in math and statistics courses, STAT and MATH_SKILL show a high level of influence. The total effects of STAT on INTER_ACCT1 and UPPER_ACCTS are statistically significant at the .05 and .01 levels, respectively.

ECON's effects on upper-level courses in accounting were not statistically significant. These results are inconsistent with Brown et al. (2002), which considered the principles of macroeconomics courses as the single most influential course for business students' academic success. Since this study only focuses on upper-level courses in accounting, unlike Brown et al.'s (2002) examination of business courses in general, the discrepancies in the two studies' findings can be attributed to the different sets of courses that were examined.

The next question is whether the grades earned in accounting principles courses are indicators of students' academic success in upper-level courses. Surprisingly, FIN_ACCT had no influence on students' academic performance in upper-level courses, while MGMT_ACCT served as a main indicator for students' grades in future accounting courses. For example, the direct effects of MGMT_ACCT on both INTER_ACCT1 and UPPER_ACCTS are statistically significant at the .01 level. The total effects of MGMT_ACCT on both INTER_ACCT1 and UPPER_ACCTS follow suit.

It is not clear why FIN_ACCT had no significant effect on INTER_ACCT1 and UPPER_ACCTS, even though its contents and topics are extended in upper-level courses. Here are some plausible explanations: FIN_ACCT is the first accounting course for students at the College of Business in which a substantial number of students fail to earn a passing grade. In addition, a number of students from other colleges take FIN_ACCT as their required accounting course. The high failing rate and the presence of non-business majors in FIN_ACCT might lower its power to serve as a predictor of accounting students' future academic success. In contrast, the failing rate in MGMT_ACCT is not as high as in FIN_ACCT, which is a prerequisite for MGMT_ACCT. Thus, students in MGMT_ACCT are expected to possess basic accounting knowledge from their prior accounting course, FIN_ACCT. Further, there are few non-business students in MGMT_ACCT. As a result, grade points in MGMT_ACCT serve as a relevant proxy for students' grades in upper-level accounting courses.

Table 2 provides the R-squared values of dependent variables. Students' grades in INTER_ACCT1 are explained up to 32.6% by the lower-level courses employed in the model. Three variables, VERB_SKILL, MATH_SKILL, and MGMT_ACCT have significant coefficients in the model (e.g., greater than .2)—a significant explanation for the grade distribution in INTER_ACCT1. The variables employed in the model explain the grade distribution in UPPER_ACCTS up to 71.2%. The coefficients of

MATH_SKILL, MGMT_ACCT, and INTER_ACCT1 are large (e.g., greater than .2), and thus these variables serve as major proxies for the grade distribution in UPPER_ACCTS.

TABLE 2
EFFECTS OF INDEPENDENT VARIABLES ON A DEPENDENT VARIABLE

Path[&]	Total Effect	Direct Effect	Indirect Effect	R-Squared
VERB_SKILL -> FIN_ACCT	0.120 (1.220)	0.120 (1.220)		0.093
MATH_SKILL -> FIN_ACCT	0.290 (2.914)***	0.290 (2.914)***		
VERB_SKILL -> MGMT ACCT	0.244 (2.910)***	0.244 (2.910)***		0.246
MATH_SKILL -> MGMT ACCT	0.393 (4.645)***	0.393 (4.645)***		
MATH_SKILL -> STAT	0.649 (6.610)***	0.649 (6.610)***		0.228
VERB_SKILL -> INTER_ACCT1	0.233 (2.530)**	0.146 (1.606)	0.088 (2.454)**	0.326
MATH_SKILL -> INTER_ACCT1	0.337 (3.223)***	0.086 (.745)	0.251 (3.770)***	
ECON -> INTER_ACCT1	0.102 (1.308)	0.102 (1.308)		
STAT -> INTER_ACCT1	0.157 (2.350)**	0.157 (2.350)**		
FIN_ACCT -> INTER_ACCT1	0.084 (1.171)	0.084 (1.171)		
MGMT_ACCT -> INTER_ACCT1	0.318 (3.770)***	0.318 (3.770)***		
VERB_SKILL -> UPPER_ACCTS	0.133 (2.705)***	0.028 (.708)	0.105 (3.202)***	0.712
MATH_SKILL -> UPPER_ACCTS	0.418 (7.380)***	0.181 (3.569)***	0.237 (5.345)***	
ECON -> UPPER_ACCTS	0.068 (1.764)	0.045 (1.300)	0.023 (1.281)	
STAT -> UPPER_ACCTS	0.151 (4.575)***	0.115 (3.863)***	0.036 (2.203)**	
FIN_ACCT -> UPPER_ACCTS	0.034 (.972)	0.015 (0.484)	0.019 (1.152)	
MGMT_ACCT -> UPPER_ACCTS	0.278 (6.689)***	0.206 (5.328)***	0.072 (3.239)***	
INTER_ACCTI1 -> UPPER_ACCTS	0.228 (6.331)***	0.228 (6.331)***		

Notes:

1. VERB_SKILL: Verbal skills as the grade point average (GPA) of three courses in English composition and speech.
2. MATH_SKILL: Math skills as the GPA of three courses in math.
3. FIN_ACCT: Grade points in Financial Accounting.
4. MGMT_ACCT: Grade points in Managerial Accounting.

5. STAT: Grade points in Business Statistics.
6. INTER_ACCT1: Grade points in Intermediate Accounting 1.
7. ECON: The GPA of two economics courses: macro and micro.
8. UPPER_ACCTS: The GPA of upper-level accounting courses, including Intermediate Accounting II, Cost Accounting, Federal Tax I, Advanced Accounting, Accounting Information Systems, Auditing, and Business Law.

[&] -> indicates the direction of influence between two variables in the path model.
***statistical significance at the 0.01 level;
**statistical significance at the 0.05 level;
*statistical significance at the 0.1 level.

CONCLUSIONS

One of college educators' paramount tasks is to identify students with potential and nurture them as they gain the required knowledge and skills for their chosen fields. According to a recent study, half of the African American accountants surveyed did not know a CPA before they started college (Ross, 2009). For several decades, the underrepresentation of competent African-American accountants has been of social concern. Therefore, this study examined accounting graduates' transcripts from one historically black university in the southwestern region of Texas in order to identify courses that could serve as predictors of accounting students' success.

As shown in the findings, educator must emphasize math skills in the accounting program, as they are the most influential factor for predicting student success in upper-level accounting courses. The Managerial Accounting course serves as an effective predictor of student success in future accounting courses. Furthermore, Intermediate Accounting I—the gatekeeper to upper-level accounting courses—is an important predictor of future success.

This study's findings have a couple of implications for producing successful accounting graduates. First, because of the heavy workload of math courses, a number of students could not pass them on a timely basis. Accordingly, it is not unusual for students to take math courses in conjunction with upper-level accounting courses. Thus, student advisors should ensure that students complete their math courses as scheduled. Alternatively, upper-level accounting courses could specify math courses as prerequisites. Second, most non-accounting majors take Managerial Accounting as their last accounting course in the business curriculum. Given the strong association between grades in Managerial Accounting and success in upper-level accounting courses, this course may provide an opportunity for academic advisors or administrators to promote professional careers in accounting and to let students make informed decisions regarding their major in the business program. This may be crucial to promoting diversity within the accounting profession.

Any conclusions in this paper should be interpreted in light of concerns about the path model fit, which varies depending on how the fit indices are computed. The path model's instability may have arisen from the small sample size, as there were only 149 usable observations for seven parameters in the model. Furthermore, the results were obtained from one sample at one university; therefore, generalizations should be restricted. Future studies should use larger sample sizes for a more thorough and representative analysis of this issue.

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