PREDICTABILITY OF SUCCESS IN ACCOUNTING COURSES: THE IMPACT OF MOTIVATION

David E. Morris, North Georgia College & State University
Thomas W. De Berry, North Georgia College & State University

Abstract

Despite recent criticisms of the Scholastic Aptitude Test (SAT), empirical studies continue to demonstrate its value in predicting student success. This study combines the consideration of two previously researched factors in predicting success in accounting courses—SAT scores and student motivation. The study uses linear regressions to test a simple model for quantifying the impact of motivation of the predicting power of SAT scores. Results seem to support the model's approach.

INTRODUCTION

Few educators have never agonized with the question of "Why don't they get it?" Perhaps as basic but illusive as the answers to the proverbial chicken or egg question and the nature vs. nurture question is the answer to: "Is it willingness or is it ability?" All educators know anecdotally of students who seemed to possess great academic preparation and talent for learning, but who nevertheless fail to make high grades in their courses because the students simply are not interested and therefore not motivated in the courses and/or in their education in general. Conversely, examples abound of students who seem to possess poor preparation, who seem to have less-than-superior abilities and talent for learning, and who nevertheless earn top grades in courses simply because they want it more than most; they seemingly overcome their shortages in ability with strongly-motivated hard work. While it is also true that students who seem to possess the desirable combination of adequate ability and motivation do occasionally fail to secure high grades due to the "bad luck" of an unfortunately-timed illness, automobile accident, family emergency, etc., most would agree that, distilled to the elemental level, student success in college depends most of all on two things: the ability and the motivation of the student.

Quantifying either of these, ability or motivation, is not an easy task. Each of these have various tests and measures that purport to accomplish this, but these are subject to criticism and doubts regarding their validity and applicability to various students. In our study, we rely on a common measure of ability for academic success, and take note of its relative predictive strengths in varied contexts to offer insights to the impact of motivation on predicting student success in accounting courses.

REVIEW OF RELEVANT LITERATURE

The SAT has suffered a firestorm of criticism in recent years. Some have called the SAT biased, claiming it to be unfair to females, minorities, and low-income students (Weissglass, 1998). Opponents of the exam claim that students from wealthy families

can afford SAT preparation measures that give them an advantage with the test. In 2001, the President of the University of California, Richard Atkinson, created uproar by proposing that the SAT be eliminated as a required part of the college application. He stated that he feared students are learning how to manipulate exam questions rather than learning important skills, and stated, "America's overemphasis on the SAT is compromising our educational system" (Anonymous, 2001). By 2003, the University of California, with a new President, found itself in controversy again regarding its alleged disregard in 2002 at its Berkeley campus of the relative SAT scores of admitted students—admitting Latino and African American students with SATs of 1000 or below while turning down about 3,200 students with SATs above 1400 (Burdman, 2004).

Asserting that the intensity and quality of the high school curriculum—not high school grades, class rank, or standardized tests such as the SAT—are the best predictors of college success, Adelman (1999) discusses the work of Claude Steele, a psychologist at Stanford University who has researched the damage done to minority students by the domination of focus on the SAT. Steele's work documents a phenomenon that critics of the SAT point to: minority students are repeatedly told by public propaganda that they are not expected to perform well on such tests; as a result, they "freeze up" when they take such a test.

Proponents of exams such as the SAT, however, say otherwise. Larry Elder (1999), writing about a then-recent PBS "Frontline" show that attacked the SAT, summarized the following criticisms of the SAT: (1) the SAT does not measure intelligence; (2) the SAT does not measure knowledge, but instead the ability to take the test; (3) students from relatively affluent families possess an unfair advantage over poorer students; (4) the SAT does not predict academic success, except for the freshman year, and then only to a minor extent; (5) because minorities such as Latinos and African Americans perform badly, the test unfairly hinders their abilities to be admitted to selective schools; (6) such minorities do not perform well on the SAT because they get intimidated and "psyched out;" (7) the SAT hinders the creation of a diverse student body, and (8) Asians, usually considered minorities, are suspiciously grouped with supposedly advantaged whites regarding SAT performance. Elder rebuts many of these criticisms, and points to the loose, sliding scale use of SAT scores for admissions by such schools as University of California—Berkeley as outrageously inappropriate.

Camara and Echternacht (2000) state the following:

> The SAT has proven to be an important predictor of success in college. Its validity as a predictor of success in college has been demonstrated through hundreds of validity studies. These validity studies consistently find that high school grades and SAT scores together are substantial and significant predictors of achievement in college.

Barro (2001) in an article whose title is particularly telling—"Why Colleges Shouldn't Dump the SAT"—states that the claims of opponents of the SAT about its ineffectiveness have been largely anecdotal. He further states that SAT scores possess strong predictive power for students' grades in college. Barro points out that the United States Department of Education conducts a study every three years that provides information for a nationally representative sample of colleges and their students' GPAs, admissions exam scores (including SATs), and other variables. Barro notes that he

considered the results from this study for 1990, 1993, and 1996—approximately 33,000 observations—for his own analysis.

Barro (2001) considers race and gender variables, parental income and education, and other factors, in addition to admissions tests scores, as predictors for college grades. He not only finds the variable for admissions test scores to be significant, but strongly so; his t-statistic for the admissions test variable is 60. Barro further finds some indication of a bias against women with the SAT, but none for ethnic minority groups. Two specific findings of Barro that are particularly interesting and relevant to the results of our study are (1) that admissions test scores have as strong of a predictive power for grades for college seniors as they do for college freshman grades, and (2) that the mathematics part of the admissions test is nearly twice as strong of a predictor of college grades as is the verbal part of the test.

Turning to student success with accounting courses specifically, the context of our study, Danko et al (1992) report on a successful two-year effort in developing predictive models of student performance in intermediate accounting. Carpenter et al (1993) consider the previously noted topics of criticism for SATs—the effects of race and gender—in predicting student performance in accounting courses. However, they enrich their study by considering the combination of these factors of race and gender with an attitudinal one, that of student expectations of success. They find that both majority and minority students begin introductory accounting courses with their expectations about success in these courses based on their past history of academic success. They state that, because of this, minority students beginning introductory accounting courses have lower expectations about success in these courses because they have enjoyed less academic success previously. They find that majority students have more success in introductory accounting courses than minority students, and that minority students are much more likely to drop the course than are majority students. Regarding gender, Carpenter et al find that, while female students begin introductory accounting courses with lower expectations of success than do male students, the females perform at equal levels and have similar attrition rates as those for males. These results would seem to indicate that the particular variable of attitude toward the course, as indicated by expectations for success as the course begins, is predictive of actual success for minority students but not for female students.

Gist et al (1996) approach the subject of the bearing of race and gender on predictors of success in introductory accounting courses by studying exclusively minority students; they examine which predictors of success highlighted by other studies do indeed prove to be strong predictors in a minority student sample. Gist et al cite work by Booker and also by Ward et al, who found that American College Test (ACT) scores are significant predictors of student performance in accounting principles courses. Gist et al consider mathematical skills, college admission test scores, GPA, and gender for relationship with performance in an accounting principles course among 127 students at one historically Black university. They find GPAs, SAT scores, and grades in a calculus course to each be positively correlated (in that order of importance) with grades in the accounting principles course. In contrast, they find no correlation between gender and course grades, when controlled for other variables.

Unlike Barro (2001), Gist et al (1996) find that, while the composite SAT score is a significant predictor of course grade, the verbal SAT score alone is significantly

correlated with the course grade, while the math SAT score alone is not. However, Gist et al note that Ward found the opposite results with ACT scores, and explain that their own results might have come from the use of the variable for performance in a calculus course in their own study. They state the following regarding this partitioning of admission test scores:

> Given the quantitative nature of accounting and that written communication skills are required for the preparation and presentation of accounting information, a priori, one might expect performance on both the math and verbal components of college admission tests to be significant determinants of accounting course performance.

Another aspect of the Gist et al (1996) study that is particularly relevant to our own study is their use of academic major of the students as a control variable. They cite a previous study by Doran et al who found that being an accounting major is significantly and positively correlated with test performance in the two introductory accounting courses. For their part, Gist et al note that accounting majors and economics majors performed better in the course than did non-business or non-declared majors. However, when they dropped the accounting major indicator variable to test the stability of the model, the results of the test variables did not change, but the indicator variable for economics majors is not significant. They performed this analysis because of what they identified to be a "potential circularity problem," and thus a problem with their approach to studying any impact of the students' majoring in accounting on predictors (SAT scores included) of course success. They note that some students may declare accounting as a major before taking the introductory accounting courses, while others may declare it after having taken these and having performed well. In addition, students who are not accounting majors may defer taking the introductory accounting courses until later in their curriculum, leading to a maturation process having an effect on performance.

The final study that we consulted regarding predictors of student success in accounting courses was by Harrell et al (1985). These authors studied 77 undergraduate students majoring in accounting and used Vroom's force model of expectancy theory as a conceptual framework for understanding a student's motivation to succeed. Vroom's expectancy theory states that individuals have different sets of goals and can be motivated if they believe that there is a positive correlation between efforts and performance, with favorable performance leading to a desirable reward that satisfies an important need. The theory further states that the desire to satisfy the need must be strong enough to make the effort worthwhile. The theory is based on an "expectancy belief," which is summarized by the statement, "Employees have different expectations and levels of confidence about what they are capable of doing." Vroom suggests that an employee's beliefs about expectancy, along with instrumentality and valence, interact psychologically to create motivation (ValueBasedManagement.net, 2004).

Harrell et al (1985) find this model to be a very accurate predictor of student motivation and find that students' motivation to strive for academic success is a significant predictor of their actual academic performance. Thus, the work of these authors documents evidence of the impact of motivation of accounting students on their performance in their coursework.

In summary, while the SAT has been visibly criticized as a measure of predictability of student success in college, much evidence is present of its predictive

power, even among female and minority students, and even specifically among accounting students. Its continued widespread use also makes it appropriate as a tool for predicting student ability. Measuring motivation of students in course performance is perhaps less objective, with less in literature about such efforts with accounting courses. Quantification of the impact of motivation on the predictive power of measures of student ability seems to be absent in the literature. However, even specifically among accounting students, motivation has been effectively linked to actual performance in coursework.

DEVELOPMENT AND EXPLANATION OF MODEL

Starting with the assumption that student success in a course, as measured by the final grade, is significantly impacted by both the student's ability and their motivation, the theory tested in this research can be stated simply that student grades are positively correlated with these two student characteristics. The theory further predicts that motivation is greater among students who are accounting majors taking accounting courses than among students taking accounting courses when their major is something other than accounting. This expectation comes from the assumption that students who are interested in a field of study, as evidenced by choosing to major in that field, are more motivated in the study of it than are less interested (non-major) students. While motivation for performance in a course may originate in various ways, such as fear of losing scholarships or being dismissed from college or desire to please or impress parents, spouses, or friends, it is theorized that, ceteris paribus, interested students will possess more motivation than disinterested ones.

Stated very simply mathematically:

$$y = f\{x1, x2, x3\} \quad (1)$$

where: y = student course grade,
x1 = student ability,
x2 = student motivation, and
x3 = all other independent variables

The above functional equation emphasizes the truth discussed in this paper's Introduction—student success is partially a function of many variables, most of which defy quantification or even identification. Factors such as performance by the course instructor, quality of the textbook and other materials, conditions of the classroom facility, time of day of the course, rigor of the student's course/workload combination, etc. can be represented by the variable x3. However, it is, of course, variables x1 and x2 that are the focus of this research.

The theory tested with this research can be further stated mathematically, again simply:

$$y = (x1)(x2) + x3 \quad (2)$$

That is, that the function of ability of the student and the motivation of the student are multiplicative. It is the interaction of ability and motivation that impacts the student's performance. To illustrate with a simple example, ignore the impact of x3 or consider it to be a constant in the equation for the moment. Consider a student with relatively strong ability as measured by a SAT score of 1100 that also is relatively motivated in a course. If this level of motivation could be quantified and assigned a multiplier value of, for example, .085, the student's resulting performance would be:

$$93.5 = (1100)\ (.085) \quad (3)$$

Thus, we would expect a student with relatively strong ability and a reasonably high level of motivation to earn an "A" in the course. A similarly-gifted student, however, who is less motivated, causing a motivation multiplier value of, for example, .07, would more likely earn a "C" in the course since:

$$77 = (1100)\ (.07) \quad (4)$$

Conversely, a student who possesses a lesser ability and talent for learning and/or less preparation but who nevertheless works very hard in the course because (s)he is very motivated might still earn a "B" since:

$$81 = (900)\ (.09) \quad (5)$$

Several facts about this model are of course obvious, and these authors readily admit them. First, the variable x3 in the model above, representing all other factors that impact student performance besides ability and motivation, cannot be ignored or considered a constant. This was discussed in the Introduction of this paper, and the importance of these factors cannot be overemphasized. This fact alone makes this research model very simple. Second, as was also discussed in the Introduction, motivation is a variable in this model that defies direct quantification. As educators, we believe, anecdotally, that we see at times either the presence or absence of it with specific students; however, motivation cannot be easily measured or weighed using direct means. Because of this, a major contribution of this research is the development of an indirect means for isolating a quantified impact of motivation on student course performance.

DATA AND METHODOLOGY

In our study, we obtained final numerical grades of 221 students in undergraduate accounting courses in one university. The courses are a combination of introductory accounting principles courses and upper-division accounting courses. The introductory accounting principles courses were taken by students majoring in accounting, finance, management, and marketing, as well as by several non-business majors. The upper-division accounting courses were taken exclusively, or almost so, by students majoring in accounting. Verbal and Mathematics SAT scores were also obtained for the students in the sample. Ordinary Least Squares (OLS) regressions were conducted, using the student grades as the dependent variable. Various combinations of the Verbal SAT score, the Math SAT score, and an Interaction term for the two components of the SAT were introduced as independent variables in several OLS regressions.

The OLS regressions were performed using data for all courses and all students in the sample (principles courses and upper-division courses), and also for only principles courses and also for only upper-division courses. The purpose of this latter approach is to stratify the sample into (1) data for a mix of all types of business majors and even non-business majors and (2) data for exclusively accounting majors. By separating the data into these two groups for our OLS regressions, we are able to obtain results for (1) all students in all courses in the sample, (2) students only in the courses that are taken by a mix of majors, and (3) students only in the courses that are taken exclusively by accounting majors.

Since differences in the adjusted R squared values in OLS models whose independent variables are statistically significant reveal relatively weaker or stronger

demonstrations of predictive power of the independent variables on the dependent variable in the model, we indirectly isolate the impact of motivation by comparing the adjusted R squared values of the OLS models with the stratified data. Specifically, comparing the adjusted R squared for the OLS model using sample data for only the principles (mix of majors) courses to that for the OLS model using sample data for only the upper-division (accounting major) courses provides an indirect measure of the difference in the predictive power of the ability variables (SAT scores) on the dependent variable (student grades). In our model, that difference in predictive power is attributed to the interactive impact of the motivation variable (majoring in the subject matter of the course).

In other words, according to the theory tested with this research, our a priori expectation would be that the predictive power of a model measuring the correlation between the ability variables (SAT scores) and the dependent variable (student grades) would be stronger when the data sample contains only accounting major students (who would have a relatively higher multiplier value in the motivation variable), than when the data sample contains only principles courses with a mix of student majors (who would have a relatively lower average multiplier value in the motivation variable). Put very simply, we would expect a higher adjusted R squared for the OLS model using only upper-division courses, and a lower adjusted R squared for the OLS model using only principles courses. Since an OLS model using all data in the sample would be a mix of all majors in all accounting courses, we would expect its adjusted R squared to be somewhere in between the two results just described.

RESEARCH RESULTS

In the various combinations of single and multiple independent variables tested in OLS regressions, we considered (1) Verbal SAT score, (2) Math SAT score, and (3) an Interaction term comprised of the product of the Verbal SAT score and the Math SAT score. We obtained the strongest results using only the Interaction term for (1) all students in all courses in the sample, and (2) students in only accounting-major courses. While the strongest results for students in only the principles courses (the mix of all majors) came using only the Verbal SAT scores, these results are only very slightly better than those using only the Interaction term for this sub-sample also. Since comparability of the OLS models overall (the adjusted R squared values) is the key to our research approach for indirectly quantifying the impact of motivation on student grades, we present results using only the Interaction term as the independent variable for all three sub-samples—to aid in comparability. These results are presented in Table 1.

[Table 1 About Here]

The independent variable of the Interaction term is statistically significant in each of the three OLS models whose results are presented in Table 1. While the adjusted R squared values in each of these three OLS models are small, their relative ordering is precisely consistent with our a priori expectations. The small adjusted R squared values reveal relatively modest predictive power of the independent variable. However, as discussed in the Development and Explanation of Model section of this paper and

represented in Equations 1 and 2 in this section, this is easily understood. The correlation between student success, as measured by course grades, and the "x3" variable—all other independent variables—can be expected to be quite strong. This variable represents a host of factors; if it could be quantified, its predictive power on student grades would likely be very strong.

However, as explained earlier, it is the differences in the adjusted R squared values of each of the three OLS models, as well as their relative ordering of size, that is particularly revealing with our research results. Consistent with our theory, the ability variable (the Interaction term of SAT scores) provides most explanation for the dependent variable (student grades) for those courses taken by accounting majors, and least for the principles courses taken by the mix of majors. The ability variable (the Interaction term of SAT scores) provides a measure of explanation for the dependent variable (student grades) that lies between the values of the two extremes when the sample includes a mix of non-accounting major and accounting major students in the courses.

According to our theory, the reason for these results is the multiplicative impact of motivation, the "x2" variable in Equations 1 and 2, on the ability variable (the Interaction term of SAT scores). Since accounting major students are assumed to have a stronger level of motivation in an accounting course than do non-accounting majors in an accounting course, the "multiplier value" of this "x2" variable (<u>if</u> it could be directly quantified) for the accounting major students would be higher. Therefore, the product of the ability variable (the Interaction term of SAT scores)—the "x1" variable, and this motivation variable—the "x2" variable, would be higher for accounting major students. This higher value of the multiplicative independent variables would be more strongly correlated with higher student grades when the value of the ability variable (the Interaction term of SAT scores) was high. The correlation would likewise be stronger with low values for the ability variable (the Interaction term of SAT scores) and low student grades. The impact of motivation is that of "an intensifier" on the correlation between student ability and student success/grades.

As an aside, the OLS regressions were performed using data from separate, individual upper-division accounting courses. We again tested various combinations of single and multiple independent variables in OLS regressions using (1) Verbal SAT score, (2) Math SAT score, and (3) an Interaction term comprised of the product of the Verbal SAT score and the Math SAT score. While not directly testing our research theory, a clear trend with results might be revealing about which measure of student ability best predicts success with specific individual upper-division accounting courses. These results are presented in Table 2.

[Table 2 About Here]

DISCUSSION AND CONCLUSIONS

As presented in Table 1, our results seem to support our research theory that students majoring in accounting taking accounting courses are more motivated in those courses than are students not majoring in accounting taking accounting courses, and that this greater motivation interacts with the relative abilities of the students to cause a

stronger correlation between student abilities and their course success. A weaker correlation exists between student abilities and their course success when the lesser level of motivation interacts with the relative abilities of the students.

While not resulting in a variable coefficient, with a t-statistic for measure of significance, our model provides an indirect quantification of the impact of motivation on the predictability of success with accounting courses. The adjusted R squared for the OLS regression with data from all accounting courses taken by all majors in the sample is only .03, the corresponding value for data from only accounting majors in their upper-division courses is .12. It would appear that the stronger correlation between student abilities and course grades in the "accounting-major-only" sub-sample was caused by something, and our theory is that the "something" was the interacting of their motivation in the course with their abilities.

The secondary aspect of our research results presented in Table 2 reveal some much stronger adjusted R squared values with data from individual upper-division accounting courses (taken one at a time)—with some models providing explanations of variations in the dependent variable (grades) that ranged around one-third to one-half. We do not know why these results were so strong with some individual courses and not with others. Perhaps this is fertile ground for future research. However, the results for individual courses when the adjusted R squared values indicate strong correlation between grades and abilities with accounting-major students in upper-division accounting courses would seem at least consistent with our theory of greater motivation in this context interacting with abilities to "intensify" or "multiply" this correlation.

No one clear measure of student ability (Verbal SAT only, Math SAT only, etc.) emerges as the "winner" in best predicting success with the course. As Gist et al (1996) discuss, the nature of accounting is such that both quantitative skills and communication skills are required for success with accounting courses. We would expect this to be especially true with upper-division accounting courses, and this expectation is certainly consistent with our results. In some courses, the Verbal SAT score seemed to be the measure of ability that best predicted the student grade; with others, the Math SAT score seemed to work best. In some, it seemed to be the interaction of the two. In still others, no combination of these measures of ability produced statistically significant results.

When considering limitations of this study, we acknowledge, as we already have clearly, that our model and results provide only an indirect quantification of the impact of motivation. While psychological tests may exist to accurately measure in a quantifiable way the level of motivation of an individual for a particular task or function, these are clearly not a part of this model. However, as pointed out earlier in our literature review, we find no application in the literature regarding the predictability of student ability measures on accounting course success in which a direct measure of motivation has been used.

Other limitations include the sample sizes—especially for the regressions with individual specific upper-division accounting courses. These perhaps explain why our OLS analysis produced no statistically significant results with certain upper-division courses. In addition, the small sample sizes may make even those that did have statistically significant results perhaps less dependable. We consider the sample sizes for the data stratified into (1) all students in all courses, (2) students only in the courses that are taken by a mix of majors, and (3) students only in the courses that are taken

exclusively by accounting majors to be reasonable, especially as compared to previously-published results by other authors (e.g. Gist et al (1996), with a sample of 127 students and Harrell et al (1985), with a sample of 77 students).

Regarding limitations of our study, likely the most noteworthy one has already been emphatically discussed—that of the impact of the "x3" variable—all other factors that impact grades besides abilities and motivation. Along with this is our "iterative" approach to indirectly measuring the impact of motivation by "smoking it out" as the difference in adjusted R squared values between two sub-samples of data with assumed predictably-differing levels of motivation for the courses. However, as discussed in the Development and Explanation of Model section of this paper, we consider this to be an innovative approach, whose results are worthy of consideration—especially when one considers the extreme difficulty in directly quantifying motivation for the course, as well as the extreme difficulty in even identifying, much less measuring, the other factors that would be inherent in the "x3" variable of our model.

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Table 1. OLS Regression Results

Description of Sample	Sample Size	Description of Independent Variable	t-statistic	Adjusted R Sq. Values
(1) only principles courses	105 students	Interaction term only	2.08	.03
(2) all courses*	221 students	Interaction term only	4.49	.08
(3) only accounting-major courses	98 students	Interaction term only	3.71	.12

* Included in this are 18 students in one course, ACCT 4370 Managerial Accounting, which is upper-division but is taken largely by non-accounting business majors. Therefore, it is excluded from either of the two sub-samples of (1) only principles courses and (2) only accounting-major courses. See Table 2 for OLS regression results for this course individually.

Table 2. OLS Regression Results

Upper-division Courses Only

Description of Sample	Sample Size	Description of Model	t-statistic of Statistically Variables Verbal	Math	Interact.	Adjusted R squared Values
ACCT 3380 Fraud Examination	22	Verbal SAT only	3.39	--	--	.33
		Math SAT only	--	4.02	--	.42
		Inter. Term only	--	--	3.81	.39
ACCT 3310 Intermediate Accounting I	18	**No model yielded statistically significant results.**				
ACCT 4310 Advanced Issues in Financial Accounting	26	Verbal SAT only	2.75	--	--	.21
		Inter. Term only	--	--	2.33	.15
ACCT 4370 Managerial Accounting*	18	Verbal SAT only	2.28	--	--	.20
		Math SAT only	--	2.25	--	.19
		Inter. Term only	--	--	2.94	.31
ACCT 3350 Federal Income Taxation	7	**No model yielded statistically significant results.**				
ACCT 4330 Accounting Information Systems	25	Verbal SAT only	3.27	--	--	.29
		Verbal and Math SAT only	2.48	#	--	.26
		Inter. Term only	--	--	2.66	.20

* See discussion of results for this course in Table 1.

\# The Math SAT variable was not statistically significant in this model.