Reni Abraham

Digital Gaming and Simulation

Houston Community College Southwest

5601 West Loop South

Houston, Texas 77081

reni.abraham@hccs.edu

http://swc2.hccs.edu/digigame/

Abstract

The retention of students from one semester to another in a science, technology, engineering or math (STEM) major profits the nation as a whole. The purpose of this study was to conduct a site-specific research to determine the predictability in the students' persistence in STEM majors based on their SAT-MATH scores. The participants were 5,531 students that entered a mid-sized public university at Texas between the years of 2000 and 2001 and had a major declared on file. After a linear regression was conducted to check the assumptions, a binary logistic regression was performed on the recoded dichotomous categories with the students' SAT MATH score. The results indicated that the SAT-MATH score is a predictor of students staying in STEM, switching out of or into STEM, or never attempting STEM majors. The researcher believes that the results of this study will assist college counselors in better advising freshmen students in selection of courses, declaring majors, and making correct career choices. Additionally, it will give insight to academic departments to make adjustments and or realign the curriculum to attain an increased persistence in STEM majors.

Keywords: majors, curriculum, math performance, persistence, STEM, binary logistic regression

SAT-MATH an Indicator of Gain or Loss in STEM Majors

U.S. Secretary of Education Arne Duncan stated, "…ensuring our nation's children are excelling in the STEM fields is essential for our nation's prosperity, security, health and quality of life". Augustine raised the concern about the current younger generation being the first in U.S. history to be less educated compared to their parents. Moreover, surveys showed two-thirds of the parents' believe their children are likely to sustain a lower standard of living than they, themselves, enjoyed. Furthermore, the United States is no longer competing with neighbors down the street, rather, with neighbors in Korea, China, India, and Taiwan, because of globalization (Friedman).

Friedman stated, "In 62 % of American jobs over the next 10 years, entry-level workers will need to be proficient in algebra, geometry, data interpretation, probability and statistics" (302). The U.S. Department of Education reported a quote from the National Association of Manufacturers that estimates by 2012 over 40% of factory jobs in the United States would require a postsecondary education. However, almost 50% of high school students do not have the basic comprehension of math needed to qualify for a production associate's job at an automobile plant (U.S. Department of Education). "The world is moving into a new age of numbers," Baker and Leak stated in their Business Week article that highlighted how mathematics is having an impact in different areas of business, which in turn affects an individuals' life.

Furthermore, the U.S. Government Accountability Office released a report pertaining to science, technology, engineering, and mathematics (STEM) education. According to the report, during the years 2003 to 2004, about 160,000 college students graduated with a baccalaureate in the United States and out of that number only 6% graduated with a degree in mathematics.

Additionally, more than 50% of the undergraduate degrees awarded in China were in the STEM fields, compared to 16% in the United States (U.S. Department of Education). President Obama emphasized that America's leadership of tomorrow depends on how the students of today are educated, especially in STEM fields. Furthermore, he reminded educators' that their goal is to raise the science and math achievement of our students over the next decade (Indiana Department of Education).

Problem Statement

U.S. Department of Education's former Secretary of Education, Richard Riley, stated, "mastering mathematics is a gateway to college". For the U.S. to maintain international competitiveness more skilled workers would be needed in mathematics and related disciplines (U.S. Department of Education; U.S. Government Accountability Office). Back in 2000, the Glenn Commission reported, "We [U.S.] as a nation must take immediate action to improve the quality of math and science teaching in every classroom in the country. If we delay, we put at risk our continued economic growth and future scientific discovery" (National Commission on Mathematics and Science). Moreover, a decade before, as part of the Glenn Commission, the nation's governors set a goal to make U.S. students be first in the world in mathematics and science achievement by year 2000 (National Commission on Mathematics and Science); however, the Glenn Commission reported that the nation's efforts have not matched the goals that were set. Furthermore, the Organization for Economic Co-operation and Development's (OECD) Programme for International Student Assessment (PISA) indicated that in 2009, the U.S. was statistically significantly below the OECD's average in mathematics and ranked 31 among the 65 countries in the report. This continues to raise the concern that the U.S. graduates are not being prepared to succeed in the global economy.

Increasingly, the global economy is interdependent in all walks of an individuals' life and the American workplace demands widespread mathematics related knowledge and abilities (National Commission on Mathematics and Science). The people need mathematics in everyday decision-making (Baker and Leak; National Commission on Mathematics and Science). More importantly, mathematics is intricately woven into the nation's security, such as, developing strategic defense systems and weapons. Hence, it is of great importance to advice students, as accurately as possible, about pursuing and completing STEM majors.

Review of the Literature

Conley defined *success* as completing courses with a level of competency that allows the student to be eligible to take the next level course in the subject area. College admissions officials typically use both high school GPA and scores on standardized tests and or college placement tests to predict, an applicant's probability of academic success in the first year of college (Breland et al.). Academic success is typically measured by first-year college GPA. According to several researchers, many students that start in a STEM major do not graduate or switch to non-STEM major (Burtner; May, and Chubin; Mendez et al.; White).

The knowledge of mathematics is a critical factor in the field of engineering. Veenstra, Dey, and Herrin explored the data collected through a survey. Their findings confirmed the common perception that skills and abilities in mathematics will increase the performance in engineering major. However, in contrary to common perception, the field of biology also needs mathematics. According to a five cohort study conducted by the biology department at College of Notre Dame of Maryland indicated that there was a statistically significant correlation between students' success in an introductory biology course and their SAT-MATH score (Bonner).

Standardized tests such as SAT have been analyzed to determine students' college success. Chimka, Reed-Rhoads, and Barker studied the engineering college student graduation. Their results and the results yielded by researchers Min et al. indicated that higher the SAT-MATH scores were, the more likely the student was to graduate with an engineering degree. Additionally, Camp et al. studied about women in hard and soft sciences and engineering; their results indicated that women with higher SAT-MATH scores are more inclined to be in hard science and engineering majors.

Dropout rate of undergraduate engineering students in semesters three to five showed that females had a higher dropout rate than males (Min et al.; Youngkyoung et al.). Possible conflicting results were reported in a study of four universities; males achieved higher graduation results in three of the four institutions, but at the fourth university, more females than males graduated (Zhang et al.). Strahan's research for the first semester findings seemed to be in opposition to the studies conducted by Min et al. and Youngkyoung et al., where females were more likely to drop out of engineering programs. In yet another study of prehospital care students, females were 51% more likely to drop out than males (Madigan). In research focused on nursing students, first year male students gained higher marks than females, but the trend was reversed in the students' second year (McCarey, Barr, and Rattray).

Regarding majors in the STEM (science, technology, engineering, and mathematics) fields, students of Asian-American and Anglo-American ethnicities were more likely to choose pharmacy as a major than African-American and Hispanic students (Keshishian et al., 2010). Alternately, other research concluded that White males did not have an advantage into higher education STEM fields (Riegle-Crumb and King). Non-White racial and ethnic students were more likely to switch from a STEM major to another major than White students (Shaw and Barbuti).

Advisors, counselors and faculty, use pre-college characteristics and retention in science, and several different existing student data to advise students. Some colleges and universities, and academic programs have begun requiring a minimum SAT-MATH score to pursue a major in one of the STEM majors (Scott, Tolson, and Huang).

Gap in the Literature

There are many articles and research with regard to STEM, the decrease in STEM majors, and the importance of STEM graduates for the U.S. economy. Similarly there are many articles and research with regard to SAT-MATH, how universities are using it as a criterion for admission, and how the score are an indicator for student's success or failure in STEM majors. However, there is no research, to date, examining the SAT-MATH scores as a predictor for students that start and continue to stay in a STEM major, start in a STEM major and then switch to non-STEM major, start in a non-STEM major and switch to a STEM major, or never opted to try a STEM major.

Theoretical Framework

The study used social and cultural capital theory as its conceptual framework. The research literature supports that strong cultural, social and academic support networks are necessary for successful transition from high school to college. According to Bourdieu, cultural capital derives from one's *habitus*, learned characters and skills which are acquired through activities and experiences of everyday life. Therefore, the student's cultural capital consists of those skills, capabilities, penchant, knowledge, and conduct that are both needed to be successful in school, to achieve particular outcomes, such as high achievement and high aspirations

(Bourdieu). Many researchers stressed the ways students profit from social resources as well as strengthening school and home environments (Bourdieu and Passeron; Lareau and Horvath; McDonough). Appling Bourdieu's concepts, McDonough states that, structure of high school and home can influence a student's decision-making about their future and their social mobility. Thus it is essential that all environments that the student encounters must make an effort to encourage and impress upon the student, the national and personal importance of STEM.

Purpose of the Study

Therefore, the purpose of this study was to conduct a site specific research to determine if the student's completion of science, technology, engineering, or mathematics (STEM) majors could be predicted by their Scholastic Aptitude Test (SAT)-MATH scores. Data examined were the SAT-MATH scores, major sought the first semester, and the student's declared major. An examination of the data across the 6-year period will assist in determining if the SAT-MATH scores could be used as a predictor of students' completion of STEM major.

Research Questions

The research questions addressed in this study were: (a) Is the SAT-MATH score a predictor of students' choosing a STEM major during the first semester and continuing to stay with STEM?; (b) Is the SAT-MATH score a predictor of students' choosing a STEM major during the first semester and switching to a non-STEM major?; (c) Is the SAT-MATH score a predictor of students' choosing a non-STEM major during the first semester and switching to a STEM major?; and (d) Is the SAT-MATH score a predictor of students' choosing a non-STEM major during the first semester and continue to stay with a non-STEM major?

Method

A quantitative method was applied to the dataset provided by the Institutional Research staff at a medium-sized university in Texas for a six year period. The original sources to the data are different departments at the university, such as, admissions, registrar, academia, etc. The Institutional Review Board's permission was acquired prior to the beginning of the study.

Participants

The participants were selected from the dataset compiled by the Institutional Research staff at a medium-sized university in Texas for a six year period. Included in the analysis were 5531 cases that had SAT-MAT scores and had chosen a major of study the first semester they were admitted to the university and had an official declaration of major on file with the university. The number of students that had chosen a STEM major the first semester they were admitted to the university was 514 students, whereas only281 students had declared majors on file.

Reliability and Validity

The data was queried from the university's Legacy System, through an existing computer program. The original source of the data was from the university admissions office, registrar, instructors, etc. The system and the retrieval program have been in place for many years and have eliminated many of the anomalies in the database, hence creating reliability. Validity of the data is as good as the data entered in to the system by the students, staff, and instructors of the university. The Institutional Research staff compiles and reports the data by conducting queries to the database.

Delimitations and Limitations

The data analyzed was from one medium-sized state university in Texas. Therefore, caution must be taken to use the findings of this study to generalize about other universities and institutions in other states. This university has only one engineering program is delimitation, so the researchers were not fully able to examine all elements of STEM. Limitations included non-reported data, incorrect data, missing data, and falsified data. Because the systems used to gather this information have been in place for a long time, the integrity of the data was believed to be high.

Results

Preliminary Analysis

Several cases of missing data were noted for SAT-MATH and declared major on file. The researcher decided to eliminate the cases with missing data as there would still be a significant number of cases for analysis. Additionally the first major and the declared major data were recoded as 0 for STEM majors and 1 for non-STEM. Then four categories were created in Excel: (a) those that started with STEM majors and continued in STEM majors (STEM-STEM); (b) those that started in a STEM major and switched to a non-STEM major (STEM-NSTEM); (c) those that started in a non STEM major and switched to a STEM major (NSTEM-STEM); and (d) those that started in a non-STEM major and continued in a non-STEM major (NSTEM-NSTEM). Each category then was populated with the SAT-MATH scores for the students of the particular category.

Descriptive statistics were performed on the above four categories to determine how many cases were in each category, the mean SAT-MATH score, and the standard deviation (see Table 1). The NSTEM-STEM was the least populated category, which means that fewer students switch from a non-STEM major to a STEM major. This category had a mean SAT-MATH score of 559. The most populated category was NSTEM-NSTEM, which means that the most number of students that started in a non-STEM major stayed in the non-STEM major. This category had a mean score of 497 for SAT-MATH. Surprisingly, the STEM-STEM category did not have the highest mean SAT_MATH score.

In SPSS, the above selected cases were grouped into four dichotomous categories and coded as follows: (a) STEM-STEM (SS), 0 for SS and 1 for not SS; (b) STEM-NSTEM (SN), 0 for SN and 1 for not SN; (c) NSTEM-STEM (NS), 0 for NS and 1 for not NS; and (d) NSTEM-NSTEM (NN), 0 for NN and 1 for not NN. The researcher then proceeded to perform linear regression to examine the assumptions and the binary logistic regression to predict membership (Mertler & Vannetta, 2010; Field, 2009). Furthermore, as the number of outliers was less than 5% of the total of each group, the researchers decided to include them in the analysis (Mertler & Vannetta, 2010).

Regression result indicated an overall model of the predicator (SAT-MATH) statistically significantly predicted students' decision on pursuing or not pursuing a STEM major, $R^2 = .007$, $F(4, 5526) = 9.43$, $p < .001$. This model accounted for 0.7% of variance in students' decision in pursuing or not pursuing a STEM major. The Mahalanobis' Distance was calculated to determine if there were any multivariate outliers. The critical value χ^2 (Chi-squared) was determined to be 18,014 for the $df = 5524$ (n-p-1 = 5526-1-1) at $p = .01$. According to Mertler and Vannetta any χ^2 value above the critical value of 18,014 should be deleted; however, no value exceeded the critical value in this analysis so it was determined that there were no multivariate outliers when considering the variables noted.

In addition, the residuals were scattered and were not clustered in certain areas and thus indicative of meeting the assumption of homoscedasticity. Furthermore, the multicollinearity was conducted by examining the Collinearity Statistics, Tolerance column. All of the coefficients were >.10, indicating that no predictors were explaining the same construct. Thus, the data could be continued to be analyzed for regression.

Research Questions

The goal of this research was to predict SAT-MATH on a dependent variable (DV) that was categorical; a logistic regression was the procedure of choice. Each case belongs to one of these categorical independent variables (IV), STEM-STEM, STEM-NSTEM, NSTEM-STEM, or NSTEM-NSTEM. As the dependent variables were all categorical and dichotomous, a binary logistic regression was performed.

Regression results indicated that the overall model fit for the predictor with each of the DVs was extremely large. However, the SAT-MATH score was statistically significantly reliable with all the groups, except for STEM-NSTEM group; ($\chi^2(1) = 0.071$, $p = .790$). The STEM-NSTEM model correctly classified 93.7% of the cases. Table 2 provides all the details. Regression coefficients are presented in Table 3. Wald statistics indicated that SAT-MATH scores statistically significantly predicted the student's choice of STEM or non-STEM majors, expect for when they start with a STEM major and then switch to a non-STEM major. The odds ratio (*Exp(B)*) represents an increase in odds of being classified when the predicator variable, SAT-MATH, increase by 1. The odds ratio for STEM-NSTEM and NSTEM-NSTEM were greater than 1 which is one of the criterions for a good-fitting model.

Discussion

The results of the current study showed that SAT-MATH scores is a predictor for if a student started in a STEM major and will stay in the STEM major, started in a non-STEM major and switched to a STEM major, or started in a non-STEM major and continued in the non-STEM major. The results did not show predictability of students starting in a STEM and switching to a non-STEM major. It should be noted that students that graduated with a STEM major had the higher SAT-MATH scores. It is worth noting that the preparation and passion for mathematics must start at a very early age which then will assist students achieve a higher score in SAT-MATH. It is crucial that students develop passion, interest, and usefulness of mathematics in their personal life. The most frequently cited reason for dropping out of a STEM major is lack of interest (Seymour; Seymour & Hewitt). The researcher concurs with researchers Crisp, Nora, and Taggart that a higher score in SAT-MATH will influence students pursue a STEM major and persevere to completion.

Conclusion

U.S. Department of Education reported that the security of the U.S. requires increased technical skills of men and women. The educational system has to find ways to encourage both men and women in mathematics. As former Secretary of Education, Margaret Spelling, indicated in the U.S. Department of Education report, educators need to improve the way children are taught math starting with elementary schools. Educators need to imbed higher-order thinking for later in life. By entrenching at an early age, children will appreciate and understand the importance of math in their life. As they grow to be men and women more career doors will open for them, and they will be ready to compete in the global economy.

U.S. Secretary of Education, Arne Duncan said in a town hall meeting, “Investing in early learning is one of the smartest things we can do as a nation” (Brenchley). In the same meeting, the U.S. Human and Health Services Secretary Kathleen Sebelius explained:

> The only way America can out-compete the rest of the world is if we out-educate the rest of the world … And the only way we can do that is if every child gets a healthy start and a rich early learning experience (Brenchley).

Higher education professors and institutions have started partnerships with the secondary school teachers and schools (Chasteen et al.; Phillips and Kimmins). These partnerships are providing professional development to teachers, to broaden their knowledge of the field and build mentorships with higher education professors. Moreover, students are getting opportunities to go to the higher education institutions on field trips and summer camps, where they receive hands-on, engaging, experiences. These opportunities embed a lasting impression in the students. Another strategy that several higher education institutions are using to transform secondary education is by taking their projects to the secondary school classrooms and campuses. I personally have gone to classrooms and career day events, with samples of what the college students in the degree programs have produced. Secondary school students stand in amazement, watching, and eager to be engaged in the project. Students remember these events and opportunities, and pursue degree programs in these fields.

At the end of the Cultural Revolution in 1976, China transformed its educational system (OECD). Although, China entered the global economy in the recent years, it has made progress ever since. In the 2009 PISA ranking, Shanghai-China was ranked number one, compared to U.S., ranked at 17, with a score below the OECD average, in mathematics (OECD). This ranking for China is remarkable, for a country, which shut down schools and sent their teachers to work in to the fields and factories until 1976. Therefore, the U.S. as a whole, students, educators, government, industry, and parents, stand to lose if all do not unite, share the obligation and act (Wise). Arne Duncan, Education Secretary, alerted the nation, when he saw the 2009 PISA results that, “U.S. students must improve to compete in a global economy…. many countries that are far ahead of us and improving more rapidly than we are. This should be a massive wake-up call to the entire country” (Hechinger).

Work Cited

Augustine, N. R. “A category 5 storm … headed our way.” AMSTATNEWS. Web. 2010

Baker, S., & Leak, B. “Math will rock your world.” Business Week, 3968, 54-62. Web. 23 January, 2006.

Brenchley, C. “A major investment in helping students get off on the right foot.” Ed.gov Blog. 2011.

Bonner, J. M. “A Biology course for the less-than-prepared prospective Biology major. “ Journal of College Biology Teaching, 35(1), 74-81. Web. 2009.

Bourdieu, P. “Outline of a theory of practice” (R. Nice trans.). Cambridge, England: Cambridge University Press. Web. 1977.

Bourdieu, P. “Cultural reproduction and social reproduction. In J. Karabel & A. H. Halsey (Eds.), Power and Ideology in Education, (pp.487-511). New York: Oxford University Press. Web. 1977.

Bourdieu, P., and Passeron, J. “Reproduction: In education, society and culture.” Beverly Hills, CA: Sage. Web. 1977.

Breland, H., Maxey, J., Gernand, R., Cumming, T., and Trapani, C. “Trends in college admission 2000: A report of a national survey of undergraduate admission policies, practices, and procedures.” Web. 2002.

Burtner, J. “The use of discriminant analysis to investigate the influence of non-cognitive factors on engineering school persistence.” Journal of Engineering Education 94(3), 335–338. Web. 2005.

Camp, A. G., Gilleland, D. S. , Pearson, C., and Vander Putten, J. "Differentiating between women in hard and soft science and engineering disciplines." Journal of College Student Retention, 11(3), 363-384. Web. 2010.

Chasteen, S. V., Perkins, K. K., Beale, P. D., Pollock, S. J., and Wieman, C. E. "A thoughtful approach to instruction: Course transformation for the rest of us." Journal of College Science Teaching, 40(4), 24-30. Web. 2010.

Chimka, J. R., Reed-Rhoads, T., and Barker, K. "Proportional hazards models of graduation.." Journal of College Student Retention: Research, Theory & Practice, 9(2) 221-232.Web. 2007.

Conley, D. T. "Redefining college readiness." Educational Policy Improvement Center. Web. 2007.

Crisp, G., Nora, A., and Taggart, A. "Student characteristics, pre-college, college, and environmental factors as predictors of majoring in and earning a STEM degree: An analysis of students attending a Hispanic serving institution." American Educational Research Journal, 46(4), 924-942. Web. 2009.

Friedman, T. L. "The world is flat: A brief history of the twenty-first century." Capitol Reader Political Book Summaries. (p.302). New York: Farrar, Straus and Giroux. Web. 2005.

Hechinger, J. "U.S. teens lag as China soars on international test." Bloomberg News. Web. 2010.

Indiana Department of Education. " Obama announces expansion of successful Indiana math and science teaching fellowship program." Web. 2010.

Lareau, A., and Horvat, E.M. "Moments of social inclusion and exclusion: Race, class, and cultural capital in family-school relationships." Sociology of Education, 72, 37-53. Web. 1999.

Madigan, V. “Predicting prehospital care students' first-year academic performance.” Prehospital Emergency Care, 10, 81-88. Web. 2006.

May, G., and Chubin, D. “A retrospective on undergraduate engineering success for underrepresented minority students.” Journal of Engineering Education 92(1): 1–13. Web. 2003.

McCarey, M., Barr, T., and Rattray, J. “Predictors of academic performance in a cohort of pre-registration nursing students.” Nurse Education Today, 27, 357-364. Web. 2006.

McDonough, P. “Choosing colleges: How social class and schools structure opportunity. “Albany, NY: State University of New York Press. Web. 1997.

Mendez, G., Buskirk, T. D., Lohr, S., and Haag, S. Factors associated with persistence in science and engineering majors: An exploratory study using classification trees and random forests. Journal of Engineering Education, 97(1). Web. 2008.

Mertler, C. A., and Vannatta, R. A. “Advanced and multivariate statistical methods “ (4th ed.). Glendale, CA: Pyrczak. Web. 2010.

Min, Y., Zhang, G., Long, R. A., Anderson, T. J., and Ohland, M. W. “Nonparametric survival analysis of the loss rate of undergraduate engineering students.” Journal of Engineering Education, 100(2) 349-373. Web. 2011.

National Commission on Mathematics and Science Teaching for the 21st Century. “Glenn commission proposes blueprint to improve math and science teaching in 21st century.” Web. 2000.

National Commission on Mathematics and Science Teaching for the 21st Century. “Before it's too late.” Web. 2000.

Organization for Economic Co-operation and Development. "What students know and can do: Student performance in reading, mathematics and science." Web. 2009.

Organization for Economic Co-operation and Development. "Korea and Finland top OECD's latest PISA survey of education performance." Web. 2010.

Organization for Economic Co-operation and Development. "Shanghai and Hong Kong: Two distinct examples of education reform in China." Web. 2010.

Phillips, E. R., and Kimmins, D. "Improving the state of math and science education." TMSTEC. Web. 2007.

Riegle-Crumb, C., and King, B. "Questioning a White male advantage in STEM: Examining disparities in college major by gender and race/ethnicity." Educational Researcher, 39(9), 656-664. Web. 2010.

Scott, T. P., Tolson, H., and Huang, T. Predicting retention of mathematics and science majors at a research one institution and suggested advising tools. Journal of College Admission, (204), 20-24. Web. 2009.

Seymour, E. The problem iceberg in science, mathematics, and engineering education: Student explanations for high attrition rates. Journal of College Science Teaching, 21, 230-238. Web. 1992.

Seymour, E., and Hewitt, N.M. Talking about leaving: Why undergraduates leave the sciences. Boulder, CO: Westview Press. Web. 1997.

Shaw, E., and Barbuti, S. "Patterns of persistence in intended college major with a focus on STEM majors." NACADA Journal, 30(2), 19-34. Web. 2010.

U.S. Department of Education. ”Mathematics equals opportunity.” A White Paper Prepared for U.S. Secretary of Education Richard W. Riley. Washington, DC: U.S. Department of Education. Web. 1997.

U.S. Department of Education. “Answering the challenge of a changing world: Strengthening education for the 21st century.” Web. 2006.

U.S. Department of Education. “Duncan endorses efforts to improve STEM education.” Web. 2009.

U.S. Government Accountability Office. “Higher education: Federal science, technology, engineering, and mathematics programs and related trends “ Web. 2005.

Veenstra, C. P., Dey, E. L. and Herrin, G. D. “Is modeling of freshman engineering success different from modeling of non-engineering success?” Journal of Engineering Education, 97(4), 467-479. Web. 2008.

Wise, B. High schools at the tipping point. Educational Leadership: Reshaping High Schools, 65(8), 8-13. Web. 2008.

White, J. L. “Persistence of interest in science, technology, engineering, and mathematics: an analysis of persisting and non-persisting students.” Dissertation. Web. 2005.

Youngkyoung, M., Guili, Z., Long, R. A., Anderson, T. J., and Ohland, M. W. (2011). “Nonparametric survival analysis of the loss rate of undergraduate engineering students. “Journal of Engineering Education, 100, 349-373. Web. 2011.

Zhang, G., Anderson, T.J., Ohland, M. W., and Thorndyke, B.R." Identifying factors influencing engineering student graduation: A longitudinal and cross-institutional study. Journal of Engineering Education, 95, 313-320. Web. 2004.

Zhao, Y.” What knowledge has the most worth?” Education Digest: Essential Readings Condensed for Quick Review, 74(4), 48-52. Web. 2008.

Zwick, R. ”College Admissions in twenty-first-century America: The role of grades, tests, and games of chance.” Harvard Educational Review, 77(4), 419-428. Web. 2007.

Table 1

Descriptive Statistics of SAT-MATH scores for students grouped by STEM to STEM, STEM to non-STEM, non-STEM to STEM, non-STEM to non-STEM

Variables	*n*	*M*	*SD*
STEM-STEM	161	563	82
STEM-NSTEM	353	499	78
NSTEM-STEM	120	559	82
NSTEM-NSTEM	4897	497	77

Table 2

Regression Summary

Dependent Variables (Independent Variable: SATMATH)	-2 Log likelihood	Chi-square	*df*	Sig.	Percent Correct
STEM-STEM	1350.54	105.56	1	.000	97.1
STEM-NSTEM	2625.57	0.071	1	.790	93.6
NSTEM-STEM	1089.74	66.99	1	.000	97.8
NSTEM-NSTEM	3857.22	81.74	1	.000	88.6

Table 3

Regression Coefficients

Dependent Variables (Independent Variable: SATMATH)	*B*	*Wald*	*df*	*Sig.*	*Exp(B)*
STEM-STEM	-.010	103.267	1	<.001	.990
STEM-NSTEM	.000	0.071	1	.790	1.000
NSTEM-STEM	-.009	66.788	1	<.001	.991
NSTEM-NSTEM	.005	80.729	1	<.001	1.005