article:2278

Is Modeling of Freshment Engineering Success Different from Modeling of Non-Engineering Success?

Is Modeling of Freshman Engineering Success Different From Modeling of Non-Engineering Success? Cindy P. Veenstra, Eric L. Dey and Gary D. Herrin, University of Michigan

Summary

With the need for more engineers, the engineering community has established a high priority for increasing engineering student retention, especially freshman retention. Academic success is a key factor for freshman engineering retention. To better understand the academic success of engineering freshmen at the University of Michigan, the academic success of engineering freshmen was compared to three other students sectors: Pre-medicine, non-engineering STEM students, and non-STEM students.

The research questions included: 1. Are there significant differences in the pre-college characteristics between Engineering and the other student sectors? 2. How well do the selected pre-college characteristics predict freshman academic success within each sector? 3. Do the ACT test or SAT test scores give better predictiveness of freshman engineering academic success?

The 2004 and 2005 freshman class cohorts were included in the research. Predictors of student success included pre-college variables from the UCLA/CIRP survey. These variables included attitudes about college, academic and career goals, and high school activities. The ACT and SAT scores and high school GPA/rank were also selected as possible predictors. Based on previous research, there was interest in comparing the predictiveness of the ACT scores compared to the SAT scores. Academic success was defined with the first year GPA.

A model was developed from the literature for freshman engineering retention and included nine pillars (major categories) for student success. The methodology was statistical in nature; it included multiple comparisons of the average characteristics, factor analysis and regression analysis. The pre-college characteristics were divided into nine groups, representing the model's pillars for student success. Factors were developed for each pillar using the principal

axis factor method in SPSS 15.0.

From the multiple comparisons of the pre-college characteristics, it was found that the most significant differences in averages between the engineering sector and other sectors was with characteristics related to the high school achievement, quantitative skills, and confidence in quantitative skills. In particular, the engineering student sector displayed a significantly higher ACT Math, ACT Science and ACT Composite compared to the other student sectors. It is noteworthy that there were few significant differences between engineering and the other three sectors with respect to social engagement. The ACT subset was more predictive for the first year GPA than the SAT subset for the engineering sector. As a result, the regressions that compared the four student sectors included factors based on the ACT scores. With a R2 of 0.38, the prediction of the first year GPA for the engineering sector was considered highly successful. Compared to similar studies, the higher prediction was due to consideration of interactions.

Besides the factors related to high school grades and quantitative skills, the interaction between these two factors was highly significant (p=.000). In addition, confidence in quantitative skills and career goals were found to be significant. In comparison to the other three student sectors, the only common predictor for the first year GPA was the factor related to high school grades (primarily high school GPA and rank). Significantly, Quantitative Skills (ACT Math, ACT Science and placement test scores) was only significant for the engineering sector. In contrast, for the non-Engineering sectors, the factor known as the High School Performance (included the ACT Composite) was significant.

In this study, there was no statistically significant difference by gender within sector in the first year GPA. No significant differences in the first year GPA existed between URM and non-URM students within sector after adjusting for the regression covariates. The apparent initial significant difference in the first year GPA between the URM and non-URM students was related to academic preparation. With the same level of preparation, it would be expected that both groups, on the average, would achieve the same level of academic success (i.e. first year GPA).

Thus, as other studies have shown, knowledge of math and science is highly important for success in engineering college, while overall knowledge is important for academic success in the non-Engineering majors. The fact that this study was conducted at one university with a comparison of student sectors within the same freshman class adds validity to this research. The prediction of academic success for the non-engineering STEM sector was more similar to the non-STEM sector than to the Engineering sector. This provided evidence that prediction of

engineering academic success is different from the other STEM disciplines.

Research support was provided by the University of Michigan's College of Engineering and the Rackham Graduate School. Dr. Malinda Matney from the Division of Student Affairs and Andrew Cameron from the Registrar's Office provided support for the development of the research database.

Author 1: Cindy Veenstra; cpveenst@umich.edu
Author 2: Eric Day; dey@umich.edu
Author 3: Gary Herrin; gdherrin@umich.edu

Article Link: http://www.asee.org/jee

: Back to 2009 Spring/Summer Issue Vol. 4, No. 3

: Back to List of Issues

: Back to Table of Contents