

**article:1085****Identifying Factors Influencing Engineering Student Graduation: A Longitudinal and Cross-Institutional Study**

The authors studied 15 years of data for students of 9 universities to identify pre-college-entrance factors that influence undergraduate engineering students' success and estimate the magnitude of their impact. Most previous studies were much more limited in scope. Improving our understanding of factors that influence retention should be useful in suggesting approaches to improving student success in engineering and aid advisors of engineering students. Studying data from multiple institutions benefits generalizability, while studying data longitudinally allows the study of trends over time and estimation of future trends.

Ethnicity, gender, high school grade-point average (GPA), SAT math score, SAT verbal score, and citizenship status are investigated. GPA and SAT scores are continuous numerical variables, while the others are categorical with levels that imply no ranking.

Several statistical methods are utilized to investigate the effects of these predictors on engineering graduation. Multiple logistical regression models allow us to test for and estimate the effect of each predictor on engineering graduation while controlling for the other predictors. Type III analyses of effects provide the magnitude of each predictor's effect by holding the other predictors constant. The  $\chi^2$  test of independence [1], is employed to test the null hypothesis that graduation is independent of the predictor. The stepwise selection procedure adds in predictors in decreasing order of the magnitude of their effect until adding another predictor no longer meets the 0.05 significance level. The parameters (model slopes) are estimated using Maximum Likelihood Estimates. With these estimated slope values, we obtained estimates of the Odds Ratio [1], which for a continuous variable provides the increase in the probability of graduation per unit increase in the predictor variable. For categorical predictors, the Odds Ratio is the ratio of probability of graduation between two levels on the categorical variable.

All predictors except gender were significant ( $p < 0.0003$ ) when the pooled data were modeled, indicating that graduation in engineering depends significantly upon those factors. High school GPA and math SAT scores were positively correlated with graduation rates for all universities for which this data were available. Verbal SAT scores correlated negatively with odds of graduation at seven of the universities, which is particularly interesting in light of industry's emphasis on communications skills. The insignificance of gender in the pooled data is due to males having a higher graduation rate at some institutions and females having a higher graduation rate at others.

Coefficient of determination analysis indicates that the factors studied account for a small but meaningful and statistically significant fraction of the variation in student graduation. There is an upper limit on how much variance can be predicted from pre-existing factors—choices students make after matriculation affect student success significantly.

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[i] Agresti, A. (1996) An Introduction to Categorical Data Analysis, John Wiley & Sons, Inc., New York.

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[: Back to Fall 2005 Issue Vol. 1, No. 2](#)

[: Back to List of Issues](#)

[: Back to Table of Contents](#)