PATHWAYS TO AN ENGINEERING CAREER BY WILLIE PEARSON JR., AND JON D. MILLER.

Several factors can predict a student's chances of success with completing an engineering degree in college, including those whose parents strongly pushed the importance of science or math education.

This article examines the flow of young adults into the field of engineering and identifies and discusses factors associated with successful entry into the field. The researchers used data from the 20-year record Longitudinal Study of American Youth (LSAY; Miller and Kimmel). (Additionally, it is important to note that this study uses an expanded definition of "STEMM" - "medicine" being the additional M.) The authors examine data sets regarding pre-college and in-college engineering factors, and design path models for each set to better isolate the relationships among variables.

First, the authors examine the initial step towards engineering education and career attainment in a table titled "Student Plans to Major in Engineering." Several commonly considered factors, including parent encouragement of math and science, expected college majors of high school students, parental education attainment, are posited. Among other findings, the authors find that "within the school context, the two most important decision points occur at the initial study of algebra and the completion of a calculus course in high school" (49).

The authors then examine the data according to the next step in engineering degree completion in a table titled "Student Enrollment in an Engineering Program." They note that only 43% of students who indicated they would pursue an engineering degree actually pursued one in college, with 22% enrolling in another STEMM major and 34% enrolling in non-STEMM majors. Additionally, a scant 3% of students who did not plan to major in engineering decided to switch to engineering. Students whose parents strongly pushed the importance of science or math education were more like to pursue engineering degrees.

Based on these two tables, the authors suggest use of a structural equation path model (Miller and Kimmel) to understand the relative impact of selected variables on engineering program enrollment. A path model assumes a causal relationship between variables on the left side of the model and those on the right side--that is, the left variables are presumed to precede those on the right, either chronologically or logically. Using this model, the authors found a relationship (path) between parent education and parent science-math push. However, there was the absence of a path from parent employment in a STEMM field to parent science-math push, suggesting that parents in STEMM fields did not encourage their children to pursue science or math any more than non-STEMM parents. Plotting paths for a total of 17 variables (categorized by gender, home and family, and secondary schooling) revealed several interesting findings, in many cases not only confirming observations from the general data sets, but offering more specific estimates for each variable when controlling for other factors. The strongest indicators in pre-college were early algebra and a strong math program, which resulted in positive attitudes toward math, concurrent parent encouragement, and ultimate completion of calculus in high school. They find that the number of calculus courses completed in college was strongly predictive of completing an engineering degree. Degree completion was also an important factor--as Ð of students who entered a PSE engineering program did not finish. Gender and family roles continued to play a consistent role in students' engineering program experiences in college, as they did in high school.

Additionally, the authors examined actual career placement in engineering for the LSAY cohorts, finding that:

- 58% of engineering baccalaureates were working in engineering fields
- 12% were working in other STEMM fields
- 20% were working in business or other not directly related fields, though their engineering education may help them perform their job
- 10% were working in non-related fields or out of the workforce for various reasons

The authors complete their article with a discussion, the primary takeaway being that mathematics was found to be the strongest, most definitive gateway (even above science) to engineering degree selection and attainment, and engineering career placement. Additionally important factors were students' interest in math and engineering in high school, an element that was supported by taking algebra and receiving positive encouragement from family. Gender also played varying roles throughout the process--for example, though boys reported receiving more parental encouragement in engineering; girls scored higher on tests. And, while women were more likely to attain a bachelor's degree from men, overall men were more likely to enter and complete engineering programs than women--a disparity that the authors highlight as a major concern.

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This annotated bibliography was compiled by TIES for *Our Neighborhood.*