PATHWAYS TO A STEMM PROFESSION BY JON D. MILLER AND LINDA G. KIMMEL.

The pathway to a STEM profession begins at home, due in large measure to domestic environments that influence, intentionally or unintentionally, the educational aspirations of young people. Parental encouragement to participate in scientific, mathematical, and technical activities has an early and powerful impact.

This article from the Peabody Journal of Education, by Jon D. Miller and Linda G. Kimmel, is an examination of a set of 21 variables that can help predict the employment of young people in science, technology, engineering, mathematics, and medicine (STEMM). Using data from the 23-year record of the Longitudinal Study of American Youth (LSAY), the authors outline factors that appear most important for young people in becoming STEM professionals. They are responding to ongoing concerns that insufficient numbers of people are seeking to enter these fields. They point to comparative international testing which suggests that American students learn less science in school than comparable students in Europe, and Japan, and other nations.

The work begins with a brief review of previous studies of the topic, including those that focus on life-cycle frameworks and broad theories of career development.

Using the LSAY data offers a rich empirical description of student experiences in middle school, high school, college, and graduate or professional schools, as well as relevant life experiences in those years. LSAY, funded by the National Science Foundation, has tracked more than 5,000 students beginning in 1987 for seven years, and then resuming annual data collection beginning in 2007.

The pathway to a STEM profession begins at home, due in large measure to domestic environments that influence, intentionally or unintentionally (for example parental educational levels), the educational aspirations of young people. Parental encouragement to participate in scientific, mathematical, and technical activities has an early and powerful impact. Also important are the levels of parental encouragement to seek post-secondary education. Low parental encouragement often coincides with inadequate schools, due to various economic and social factors including race and ethnicity. On the other hand, enrollment in an 8th grade algebra class is a significant indicator of post-secondary enrollment as well as STEMM professional careers.

The authors use a structural equation path model to demonstrate the relative influence of each factor in multiple-factor models. This takes account of the reality that some variables occur prior to others in life. For example, birthplace and gender are very early factors, while intentions to engage in post-secondary education come later. Looking at the total effects of the variables in this model shows that the major predictor of a STEMM career is a student's intention during high school to enroll in a STEMM program in college, strongly related to the study of high school calculus and early enrollment in an algebra course. This factor is influenced by earlier socialization in the home and family.

They then turn to a pathway model, using the LSAY data. That data shows that seven percent of the students were employed in a STEMM profession 20 years after high school. The factors already mentioned above play important roles in this career choice, including parental encouragement and early algebra enrollment. Also important are the education levels of the parents (the higher the level the greater incidence of STEMM careers).

There is a significant gender difference at that point, with young men 2.5 times more likely than young women to be engaged in a STEMM profession. Looking at the longer range data affirms that employment in a STEMM profession is the product of early parental encouragement, early algebra, high school and college calculus studies, and a combination of appropriate undergraduate and graduate degrees.

Using all this data and various models, several points become clear. Home and parental factors are very important, mathematics plays a central role in choosing STEMM work, and there is a persistent gender difference in STEMM employment. There are many studies that also show a lack of racial and economic diversity in STEMM professions.

Thus, Miller and Kimmel conclude that increasing interest and engagement in STEMM studies and work require efforts on multiple fronts. Greater engagement with families is a key area, as is continuing to push public schools to offer early algebra education. This latter point is complicated by how well parents are able to help their children do their homework, which itself is related to levels of parental education and economic security.

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http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.625.1584&rep=rep1&type=pdf

Thanks to generous support from the Carnegie Corporation of New York, *Our Neighborhood,* is a compilation of stories and research from the family engagement field. It is intended to be a living repository and guide for STEM Learning Ecosystems and other communities interested in cultivating strong community partnerships to prepare the next generation.

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