Project STEP-UP
STEM Trends in Enrollment and Persistence for Underrepresented Populations

An Analysis of Parent Occupation and Student Choice in STEM Major

Erica Harwell

Introduction

Efforts to increase the number of students earning science, technology, engineering, and math (STEM) degrees in the United States continue to influence postsecondary STEM recruitment and retention efforts. In order to increase the number of students studying and working in the STEM fields, more students need to choose a STEM major as an undergraduate. The need to diversify the STEM fields makes this an especially important decision for underrepresented students in particular. The purpose of this study is to better understand factors that may impact a student's decision to major in STEM fields at large, public, research universities. Literature suggests that students in STEM majors were exposed to the idea of pursuing a STEM career early in their education, long before their undergraduate career begins. This study seeks to understand the pre-college factors of undergraduate students who select a STEM major. The following research questions were investigated:

- Do differences in choice of STEM major exist among students with at least 1 parent in STEM?
- Do students report parental influence of major decision differently by parent occupation?

Parental occupations and the level of parental influence on choice of major are examined to better inform higher education STEM recruitment efforts.

Literature

The literature regarding parental occupation and student's choice of college major often focuses on parent level of education, which is closely related to a student's socioeconomic status, rather than the parent's field of work. Parents' socioeconomic status has shown to have an indirect influence on students' success in college because it influences the pre-college factors experienced by the students (Gruca, Ethington, & Pascarella, 1988; Ware & Lee, 1988). Previous literature examining student majors and parental occupations is varied depending on student race/ethnicity, major, and gender. Literature often emphasizes the importance of self-efficacy when a student is determining his/her interests and eventual college major. Bandura (1977) explains self-efficacy as a determinant in what one will do when faced with adversity. Self-efficacy will influence how or if one sees goals to completion. If a student has a parent in a STEM career, they will see that career as a feasible option, and it supports their commitment to the goal of a STEM career increasing their likeliness of persisting in that major field (Leslie, McClure, Oaxaca, 1998). Eccles (2005) connects these self-efficacy concepts more closely to parental occupation with the *Expectancy Value Model of Achievement-Related Choice*. The model describes a student's expectation for success as dependent on a student's self-efficacy and the student belief regarding the difficulty of the goal they are pursuing. According to *Achievement-Related Choice*, educational and occupational choices are guided by several factors, one of which includes, "the

Recommended Citation: Harwell, E. (2012). *An Analysis of Parent Occupation and Student Choice in STEM Major*. Project STEP-UP. University of Illinois at Urbana-Champaign.

individual's culturally based role schemas, such as those linked to gender, social class, religious group, and ethnic group" (Eccles, 2005, p.12). This paper will examine the parental occupations of students in different majors. Comparisons will also be made between male and female students to investigate the possibility of differences in major decision because of a student's "role schema" as described by Eccles (2005). Recruitment efforts often focus on the individual students, but other efforts target the whole family in exposing them to STEM career options. This study will also shed light onto student's self-reported influence of major. Parental influence is often a reason for targeting the whole family when implementing STEM major recruitment efforts (Loftus, 2009).

Data and Methodology

This study draws upon the Project STEP-UP survey data collected from a total of 4,560 college students in 2010 (n=1,881) and 2011 (n=2,679) from a variety of majors at ten large research universities. The survey was specifically targeted to students in STEM majors, and the majority of the respondents were STEM majors, but all majors were eligible to respond. Underrepresented and female students were specifically oversampled to increase their response rate. The specific questions used in this particular study are:

- What was your father/male guardian's job title and in what industry did he work?
- What was your mother/female guardian's job title and in what industry did she work?
- Who most influenced your decision to choose your major? *(Respondents were asked to select from the following: Guidance Counselor, Parents, Peers, High School Teacher, Minister, Sibling, Family Friend, Other (please specify), I prefer not to answer)*

Descriptive statistics and cross-tabulations with chi-square analysis were used to inform this study. Of the total respondents, 40.6 percent were male and 58.5 percent were female. The majority of respondents were white (72.8 percent). Approximately 12 percent were Asian or Pacific Islander, 4 percent were Hispanic or Latino, 4 percent were Black, not Hispanic, and less than 1 percent reported being Native American or Alaskan Native. The majority of respondents were not first generation students. Nearly 20 percent of fathers earned a high school diploma or less and approximately 22 percent of mothers earned a high school diploma or less.

Definition of STEM

There are many definitions of STEM used to study the underrepresentation of students in STEM fields. Often, these definitions are restricted to include only fields such as engineering and physical or life sciences. This study uses a different definition for distinguishing between parental STEM and non-STEM occupations and student STEM and non-STEM majors. For the purposes of this study, STEM occupations are those that require a postsecondary degree with a substantial amount of math or science curriculum. This definition was chosen based on the *Expectancy Value Model of Achievement-Related Choice*. A parent with at least a bachelor's degree in a math or science related field would possibly be able to break the "schemas" students experience early in their education.

This material is based upon work supported by the National Science Foundation under Grant No. 0856309. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Parental Occupation

The structure of the survey allowed respondents to specify their parent's job and industry through an open-ended text box, rather than asking them to choose from a pre-defined list that may not capture the breadth and depth of parental occupations. Based on this definition of STEM, parental occupation for all students in the survey was coded based on STEM, non-STEM, and unclassifiable/ Prefer Not to Answer (PNA). Occupations in fields such as physical science research, life science research, math or science education, health occupations, and computer science occupations as well as computer support positions were included in the STEM category. Non-STEM occupations were occupations that would not be considered STEM such as occupations in the social sciences, non-math or science education, business, or law enforcement.

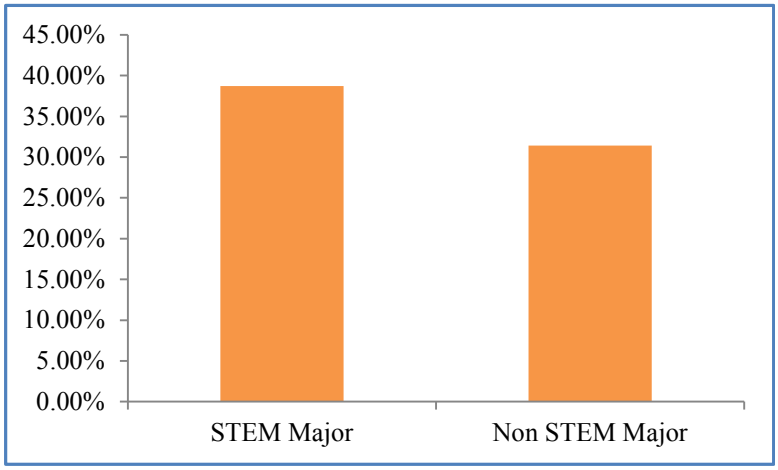
Student Majors

Student majors were categorized as STEM versus non-STEM according to the math or science required for the particular major. Majors such as engineering, engineering sciences, physical and life sciences, and nursing were considered STEM. Majors such as business, social sciences, education, and humanities were considered non-STEM. A complete list of majors can be found in the Appendix.

Findings

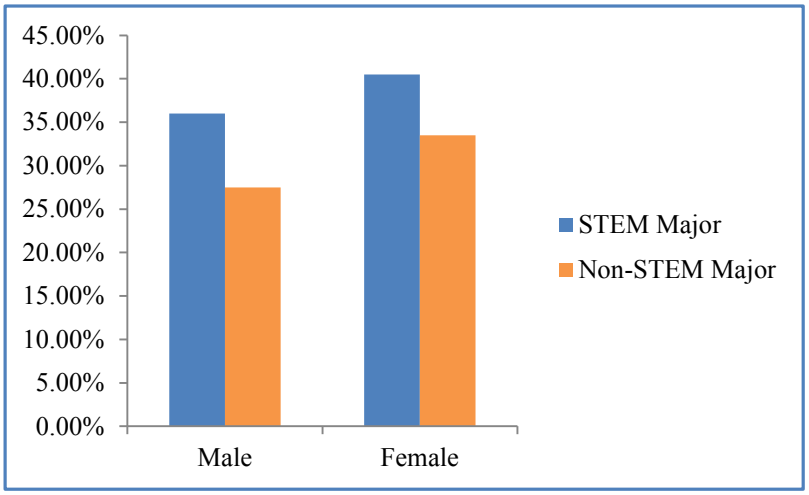
Of the total survey respondents, 84.7 percent were STEM majors, and 28.2 percent of the total respondents had at least 1 parent in a STEM field. Of the respondents who were STEM majors, 38.7 percent had at least 1 parent in STEM compared to 31.4 percent of non-stem majors with at least 1 parent in stem ($p<.01$, see Figure 1).

Figure 1. STEM Major vs. Non-STEM Major (with at least 1 parent in STEM occupation)



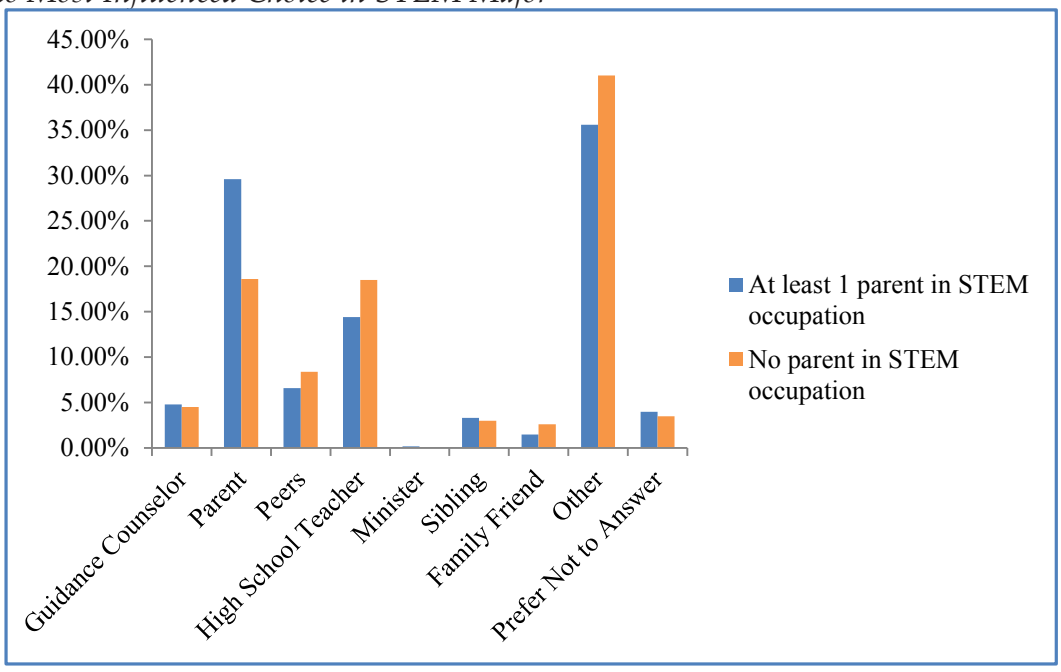
As seen in Figure 2, 40.5 percent of female STEM majors had at least 1 parent in STEM compared to 36.0 percent of males.

Figure 2. *Male vs. Female (with at least 1 parent in STEM occupation*



When respondents were asked who most influenced their choice of current major, parents were one of the most cited influencers for both parents in STEM as well as parents in non-STEM careers (see Figure 3). Nearly 55 percent of STEM majors who reported that their parent(s) most influenced their choice of major did not have a parent in STEM.

Figure 3. *Who Most Influenced Choice in STEM Major*



Discussion

The results regarding parental occupation suggest that students with at least one parent in a STEM field choose to major in STEM at a higher rate than students without parents in STEM. However, the results also suggest that students' choice of college major is greatly influenced by their parents, regardless of parent's occupation. Both STEM and non-STEM parents were reported to have the most influence on student choice of STEM major. Findings inform recommendations that include providing parents with knowledge of STEM programs. According to this survey, students with parents in STEM were more likely to be in a STEM major, but results regarding who most influenced a student's major suggest that parents can play an important role in encouraging STEM majors for their children. Perhaps the confidence instilled in students, especially females, seeing their parents in a STEM major could also be conveyed by informing parents of the importance of parental messages regarding STEM opportunities for their students. Increases in funding to recruitment programs during middle school and high school years to allow this information to be disseminated to parents as well as students is important to ensuring more students have access to STEM careers.

Limitations

Different definitions of STEM will result in different empirical results. Many studies investigating the pre-college factors of STEM majors use different definitions of STEM; this makes comparison of studies that investigate STEM fields difficult. For this survey, allowing students to respond to parental occupation questions openly allowed the researcher to record students' perception of parental occupation. This was helpful in that students were not able to select an occupation from a list that sounded similar to their parents' position. However, this also made it difficult at times to get an accurate picture of some of the parental occupations.

This survey was targeted to students in STEM majors, which explains the large number of STEM major respondents. This also may not provide an accurate representation of non-STEM majors at the specific campuses involved. The survey did not have a diverse enough sample to investigate race or ethnicity differences among the respondents. Finally, these students are all from major research universities, which may suggest a certain level of education from their parents. The findings may also reflect the recruitment patterns and policies of large, research-intensive universities. Finally, the majority of respondents were not first generation college students, which may explain the influence of parents both in terms of choice of major and occupations.

Conclusion

To increase the number of underrepresented students in STEM, focus needs to be directed toward recruitment efforts. The involvement of parents in the recruitment process is one additional opportunity STEM recruiters have to expose students to the opportunities a STEM major will provide. Considering the results regarding parental influence of major, reaching out to parents, who are not themselves in STEM fields, is one avenue of recruitment that is worth being explored.

Appendix: Classification of Student Majors

STEM
Agriculture, Agriculture Operations and Related Sciences
Biological, Biomedical Sciences
Computer and Information Science/ Support Services
Engineering
Engineering Technologies/Technicians
Health Professions and Related Clinical Sciences
Mathematics/Statistics
Physical Sciences
Science Technologies/Technicians

Non-STEM
Architecture and Related Services
Business, Management, Marketing, Related Support Services
Communication, Journalism, and Related Programs
Communications Technologies/Technicians, and Support Services
Education
English Language, Literature/Letters
Family and Consumer Sciences/Human Sciences
Foreign Languages, Literatures, Linguistics
History
Legal Professions Studies
Liberal Arts and Sciences, General Studies and Humanities
Multi/Interdisciplinary Studies
Natural Resources/Conservation
Parks, Recreation, Leisure, Fitness Studies
Psychology
Public Administration/Social Service Professions
Reserve Officer Training Corps (ROTC)
Social Sciences
Visual and Performing Arts

References

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191-215.

Eccles, J. S. (2005). Studying gender and ethnic difference in math, physical science, and information technology. *New Directions for Child and Adolescent Development*, 110, 7-14.

Gruca, J. M., Ethington, C. A., & Pascarella, E. T. (1988). Intergenerational effects of college graduation on career sex typicality in women. *Research in Higher Education*, 29(2), 99-124.

Leslie, L. L., McClure, G. T., & Oaxaca, R. L. (1998). Women and minorities in science and engineering: A life sequence analysis. *The Journal of Higher Education*, 69(3), 239-276,

Loftus, M. (2009, October). All in the family: To reach the next generation of engineers, involve parents too. *Prism Magazine*, 43-45.

Ware, N. C. & Lee, V. E. (1988). Sex differences in choice of college science majors. *American Educational Research Journal*, 25, 593-614.

About Project STEP-UP

The STEM Trends In Enrollment & Persistence for Underrepresented Populations (STEP-UP) project is a study that is investigating the underrepresented undergraduate students' participation in the Science, Technology, Engineering, and Mathematics (STEM) fields at large, public, research universities. STEP-UP focuses on the experiences of undergraduate women, students of color, and low-income students in STEM majors, and factors that impact their enrollment, persistence, and degree completion in the sciences. STEP-UP project is generously funded by the National Science Foundation (NSF), the Ford Foundation, and the Alfred P. Sloan Foundation.

About the Author

Erica Harwell is pursuing her master's degree in the department of Education Policy, Organization & Leadership at the University of Illinois at Urbana-Champaign. Her research interests include access and retention of underrepresented students in higher education, as well as students' pathways to degree completion.

Project STEP-UP

University of Illinois at Urbana-Champaign
1310. South Sixth Street, MC 708
Champaign, IL 61820
217.244.5274

Follow Project STEP-UP

http://stepup.education.illinois.edu/

http://twitter.com/ProjectStepUP

Project Staff

Lorenzo Baber, Ph.D.
Erin Castro
Casey George-Jackson, Ph.D.
Erica Harwell
Derek Houston
Ife Onyenekwu
Mariana Martinez
Blanca Rincon
William Trent, Ph.D.
Kimberly Walker
Montrischa Williams