



High School Students who Intend to Major in Math: Differences by Gender, Race, Ethnicity, and Confidence Levels

Casey George-Jackson, Ph.D.

Women and students of color remain underrepresented in certain college majors, including a number of majors in the Science, Technology, Engineering, and Mathematics (STEM) fields. A college student's decision to major in a particular discipline, such as mathematics, is impacted by individual-level factors, such as their future career goals, as well as programs, policies, and other contextual factors, such as departmental climate. Such contributing factors have been featured in the literature on college major choice and STEM participation (see Allen & Robbins, 2008; Riegle-Crumb & King, 2010; Shapiro & Sax, 2011; Smyth & McArdle, 2004; Soldner, Rowan-Kenyon, Inkelas, Garvey & Robbins, 2012; Tan, 2002), but little research has been conducted on how confident high school students are in their future plans regarding both their intended major and their subsequent occupation. Although currently understudied, students' confidence levels may yield insight into both the complex decision process undertaken when choosing a college major and the important differences between sub-groups of interest (George-Jackson & Lichtenberger, 2012; Lichtenberger & George-Jackson, in press).

This brief presents findings from a study examining high school students who expressed an interest in majoring in mathematics in college. Differences are explored by gender, race and ethnicity, as well as students' level of confidence in their intended future major and occupational plans. Although descriptive in its nature, the brief aims to provide insight into stu-

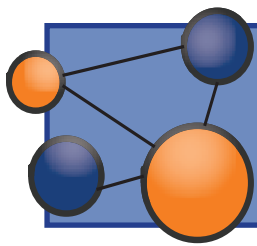
dents' decision to major in mathematics by focusing on differences in confidence levels, gender, race, ethnicity, and the alignment between their intended college major and future occupational goals.

Data

High school juniors in the State of Illinois are required to take the ACT as part of the Prairie State Achievement Exam. Prior to taking the exam, students are asked to complete a short survey, which includes a series of questions about their intended college major,

Table 1. *Demographics of Illinois High School Classes of 2002 – 2005 and Intended Math Majors*

	All Students	Intended Math Majors
Gender		
Male	48%	60%
Female	52%	40%
Race and Ethnicity		
African American	12%	9%
Asian Pacific Islanders	5%	6%
Latino	10%	5%
Multiracial	2%	1.5%
Other Race or Ethnicity	2%	2%
Native American	1%	0.5%
White	65%	72%
Prefer Not to Answer	3%	4%
Total Observations	264,290	1,512



MATH ALLIANCE RESEARCH STUDY

their future occupations, and how confident they are in these plans. Data from the Class of 2002, 2003, 2004, and 2005 were combined, resulting in approximately 510,000 observations. The analysis for this study is first restricted to students who attended public high schools and who answered key questions on the survey central to this study ($n=264,290$). A sub-sample of students who intended to major in math ($n=1,512$) was then used to make comparisons between sub-groups of interest. A summary of students' demographic information is provided in Table 1. The between-groups differences that are reported below are statistically significant ($p<0.05$).

Students were asked to indicate their intended college major, as well as their first and second occupational choices. Students were then asked how confident they were in each of these future plans. For the purpose of this brief, we only focus on the intended college major and the first occupational choice. As shown in Table 2, the majority of students were very or fairly sure of their future plans, regardless of major or occupational focus.

Results

Across the Illinois High School Classes of 2002 through 2005, the percent of students intending to major in mathematics held steady at 0.6% ($n=1,512$). Other STEM fields, such as computer science, saw a consistent decline across the cohorts of students, from Table 2. *Confidence of Intended Majors and Occupations* ($n = 264,290$)

Confidence in Intended College Major	
Very Sure	43%
Fairly Sure	45%
Not Sure	12%
Confidence in First Planned Occupation	
Very Sure	40%
Fairly Sure	46%
Not Sure	13%

7.1% in 2002 to 4% in 2005. Such changes are likely due to students' perceptions of available jobs in specific fields following graduation from college. With regards to gender, approximately 0.5% of women and 0.7% of men in each cohort intended to major in mathematics. By race and ethnicity, 0.4% of African Americans, 0.6% of Whites, 0.3% of Latinos, and 0.7% of Asian Pacific Islanders intended to major in mathematics.

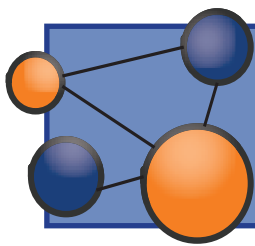
Intention to Major in Math. Of students who intended to major in mathematics, 60% were male, 40% were female, 9% were African American, 6% were Asian Pacific Islander, 5% were Latino, and 72% were White. The remaining 8% were of another race/ethnicity, multi-racial, or did not provide their race or ethnicity. Students who intended to major in math were quite confident of their future plans, with 29% being very sure of their plan, and another 50% being fairly sure.

Interestingly, women were more confident of their intention to major in mathematics than men, with 30% of women being very sure of this future plan, as compared to 24% of men. Approximately half of men and women were fairly sure that they would major in math in college. By race and ethnicity, African Americans and Latinos were most confident, with nearly 40% of African Americans and 30% of Latinos being very sure of their plan to major in math. In comparison, only 26% of Whites and 19% of Asians were very confident in these plans.

Intended Occupation. Regarding future occupation, only 0.4% of the Illinois High School Classes of 2002 through 2005, or 969 students, intended to work in mathematics. Of these students, 61% were men and 39% were women, while 9% were Black, 66% were White, 7% were Latino, and 5% were Asian. The remaining 13% of students were of another race or ethnicity. In comparison to students who intended to major in math, a slightly lower percentage of students were very sure of working in mathematics, with 21% being very sure and 50% being fairly sure of their future plans.

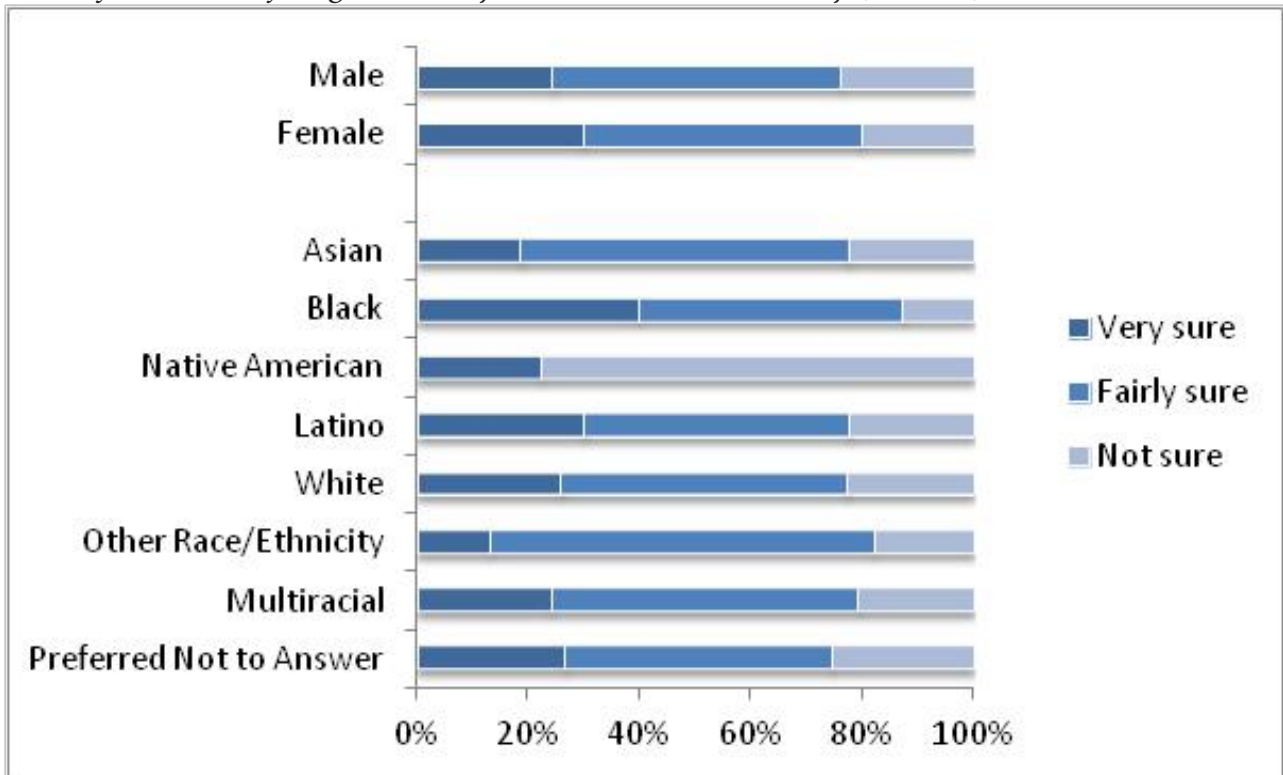
Alignment between Intended College Major and Occupation. Students who intended to major in mathematics expressed a diverse array of occupations that they plan to enter, as compared to students who intend to major in other STEM





MATH ALLIANCE RESEARCH STUDY

Figure 1. Confidence in Majoring in Math, by Gender, Race, and Ethnicity (n=1,512)



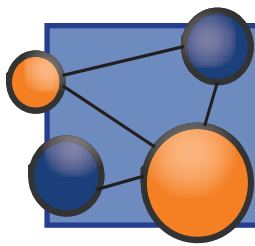
fields. In fact, intended major and occupational alignment within the same disciplines was high (80-85%) for all other majors, whereas the percent of students who intended to major and enter a career in mathematics was only 47%. Ten percent of students who intended to major in math expressed an interest in working as a teacher in a STEM subject, such as mathematics or science education, 7% indicated a desire to work in engineering, 10% in business, 9% in non-STEM education. Others expressed interest to enter field such as agricultural science, health science, and the biological and physical sciences.

By gender, 49% of men who intended to major in math also intended to work in math, as compared to 44% of women who had similar plans. A greater percentage of women who intended to major in math expressed interest in working in STEM education (14% compared to 8%, respectively), non-STEM education (13.2% versus 5.7%, respectively), and business (10.6% versus 8.2% respectively). In examining the gender composition of students who intend to major in math but work in these three fields, a



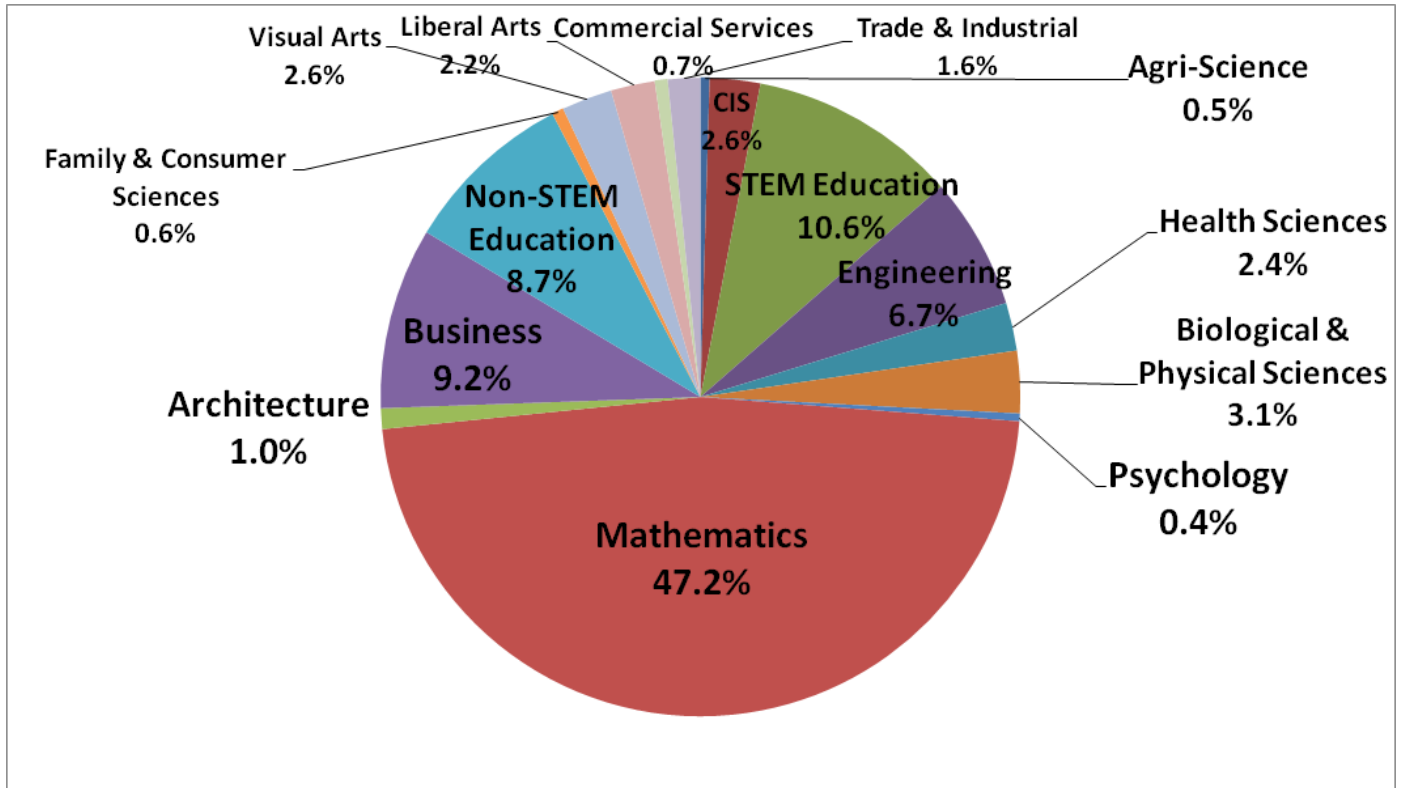
greater percentage of women expressed interest in working as a non-STEM teacher (62% versus 38%) and a STEM teacher (55% versus 45%), while a slightly higher percent of men expressed interest in working in business as compared to women (53% versus 47%). Women's expressed interest in working in STEM and non-STEM education may reflect their preference to help and nurture others (Turner & Bowen, 1999). As high school students, women (and others) may have preconceived notions about particular fields, and may make future plans based on incomplete information or inaccurate perceptions. Future work, such as qualitative inquiry, is recommended to better understand the reasons women may want to major in math but work in education. As the nation needs more well-trained math and science teachers, perhaps the shift from majoring in math to working in STEM education should not be viewed as a departure from a career in mathematics, but rather a real-world application of math knowledge and skills.

By race/ethnicity, 33% of African Americans, 50% of Whites, 42% of Latinos, and 50% of Asian Pacific Islanders had alignment between their intended



MATH ALLIANCE RESEARCH STUDY

Figure 2. Planned First Occupations of Students who Intend to Major in Math ($n=1,512$)



math major and occupation. Expressing an intention to work in business after majoring in math was a popular draw for African Americans (16%), Latinos (12%), and Asians (7%). Sixteen percent of African Americans intended to enter occupations in computer science or engineering. A career as a STEM teacher was a possibility for just under 20% of Latinos. STEM education and non-STEM education was a popular draw for Whites (12% and 9%, respectively).

Regarding migration into mathematics as an occupation, approximately 25 percent of students who chose math as their first planned occupation intended to major in other fields, with the majority planning to major in business (6.7%) and engineering (3.8%). Perhaps not surprising, the gender distribution of students who intend to major in engineering but work in math favors men (73% versus 27%). The gender gap of students coming from business majors is reduced but still favors men (55% versus 45%, respectively).

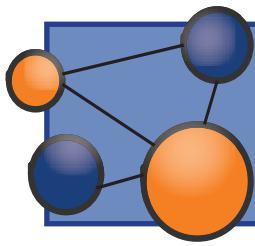
Women who planned to major in math but work in education were more confident in their plans than men who

had similar plans (18.2% versus 8.8%, respectively for STEM education; 22.2% versus 7.7%, respectively, for non-STEM education). Conversely, men who planned to work in computer and information sciences and engineering after majoring in math were more confident of their plans than women. For the computer and information sciences, 4.1% of men and 0.6% of women were very sure of their occupational plans, while 7.2% of men and 1.1% of women were very sure of working in Engineering. While differences in confidence levels also existed by race and ethnicity for students who planned to major in math but work in other fields, they are not reported here due to the low number of observations in each cell.

Recommendations & Conclusions

Although restricted to students who attended public high schools in Illinois, this brief highlights important differences in students' intentions to major in and work in math, as well as their confidence in these future plans. While women and minorities remain under-represented in mathematics, the students who do intend to major in math have higher levels of confidence than





MATH ALLIANCE RESEARCH STUDY

students who are traditionally well-represented in the discipline. Given that early interest in STEM degrees predicts degree completion in these disciplines (Maltese & Tai, 2011), the students who are very confident in their intended majors may be more likely to complete degrees in mathematics. Additional inquiry is required to determine if this is the case for the students featured in this study, as well as to determine their occupations following college graduation. Finally, early awareness and information programs should seek to provide women and students of color with information regarding opportunities to work in mathematics so that they can make informed decisions regarding their future plans for their college major and careers.

References

- Allen, J. & Robbins, S.B. (2008). Prediction of college major persistence based on vocational interests, academic preparation, and first-year academic performance. *Research in Higher Education, 49*, 62–79.
- George-Jackson, C.E. & Lichtenberger, E.J. (2012). *College confidence: How sure high school students are of their future majors*. Illinois Education Research Council. Policy Research: IERC 2012–2. Retrieved June 12, 2012 from <http://ierc.siu.edu/documents/2012-2%20STEM%20Major%20Confidence.pdf>
- Lichtenberger, E. & George-Jackson, C.E. (in press). Predicting high school students' interest in majoring in a STEM field: Insight into high school students' postsecondary plans. *Journal of Career and Technical Education*.
- Maltese, A.V. & Tai, R.H. (2011). Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among U.S. students. *Science Education, 95*(5), 1–31.
- Riegle-Crumb, C. & King, B. (2010). Questioning the white male advantage in STEM: Examining disparities in college major by gender and race/ethnicity. *Educational Researcher, 39*(9), 656–664.
- Shapiro, C.A. & Sax, L.J. (2011). Major selection and persistence for women in STEM. In Gayles, J.G. (ed.) *Attracting and retaining women in STEM. New Direction for Institutional Research, 152*, 5–18.
- Smyth, F. L., & McArdle, J. J. (2004). Ethnic and gender differences in science graduation at selective colleges with implications for admission policy and college choice. *Research in Higher Education, 45*(4), 353–381.
- Soldner, M., Rowan-Kenyon, H., Inkelas, K.K., Garvey, J., & Robbins, C. (2012). Supporting students' intentions to persist in STEM disciplines: The role of living-learning programs among other social-cognitive factors. *Journal of Higher Education, 83*(3), 311–336.
- Tan, D.L. (2002). *Majors in science, technology, engineering, and mathematics: Gender and ethnic differences in persistence and graduation*. 42nd Annual Association for Institutional Research (AIR) Forum. June 3–6, 2002, Toronto, Canada.
- Turner, S.E. & Bowen, W.G. (1999). Choice of major: The changing (unchanging) gender gap. *Industrial and Labor Relations Review, 52*(2), 289–313.

About the Author

Casey George-Jackson, Ph.D., is an IES post-doctoral research fellow at the University of Illinois at Urbana-Champaign. Her work centers on issues of educational equity, opportunity, and access to higher education for traditionally underrepresented students. Her recent research projects have included investigating individual and institutional factors pertaining to differential rates of participation and persistence in the STEM fields, undergraduate students' choice of major, and differential tuition policies. She has been involved in a number of research projects focused on improving representation of women, minorities, and low-income students in the STEM fields, including projects funded by the Alfred P. Sloan Foundation, the Ford Foundation, and the National Science Foundation. More recently, she has examined students' and families' postsecondary financial awareness and readiness. She currently serves as the PI of the Math Alliance Research Study, which is funded by the National Science Foundation.



This material is based upon work supported by the National Science Foundation under Grant No. 1242941. 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.