



# SYMPOSIUM PROPOSAL

## FACTORS AFFECTING THE ACCESS, RETENTION, AND GRADUATION OF BLACK, HISPANIC, AND FEMALE STUDENTS IN STEM FIELDS

### Abstract

This proposal seeks to build upon the research that is already in place regarding the access, retention, and graduation of female and minority students (specifically those who identify as Black or Hispanic) within the STEM fields. Existing research contains contradictions and lacks sound empirical work, but this paper will aspire to address these issues and provide more insight into the various factors affecting female and minority students in STEM fields

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It was estimated that approximately two million new professionals were needed to enter science, technology, engineering, and mathematics-related (STEM) fields by 2010 to replace the baby boomers retiring from the STEM workforce (Malcom, 2010). STEM careers have typically been dominated by White males, however in the last two decades there has been an increase of women and minorities within the field. This proposal seeks to explore the various factors affecting the access, retention, and graduation of women and minorities in STEM fields so that secondary and postsecondary institutions may better address the needs of these students. Since there are several categories of minority students, as well as (students who identify as multiple races or ethnicities, this paper will focus solely on those students and persons who identify as “Black students” or “Hispanic students/Latino(a) students” as well as female students enrolled in STEM degrees.

Black students represent a unique minority group within the STEM fields. Research by Landivar (2013) states that Black students represent only about 6% of the STEM workforce population, even though their employment rate is relatively equal to that of all other working groups (except American Indian who rated below average). This indicates that Black students are facing some form of obstacle(s), barrier(s), or lack of encouragement when it comes to entering the STEM field. A study done by Chen (2009) found that even though Black students were equally as likely to enroll into a STEM program as Whites, they are half as likely to attain a degree in the field (this statistic is similar for the Hispanic student population). However, they were more likely than White students and Hispanic students to change majors, and more likely than all ethnicities to leave postsecondary education without a degree or certificate at all (Chen, 2009). This indicates that there are certain barriers affecting the retention of Black students at a higher rate than other ethnic groups.

Hispanic students make up only 3%-7% of the STEM workforce within the United States (Borman, Hanson, Lee & Tyson, 2007). This percentage is similar to the percentage of Black students within the STEM field. However the number is more significant for the Hispanic student population because their participation in the workforce between 1970 and 2011 has increased by 12% as compared to Black students whose workforce participation increased by only 2% (Landivar, 2013). This shows that an increasing workforce presence within the Hispanic student population is not being reflected within the STEM field. The ethnic make-up of undergraduate populations at colleges and universities is changing quickly, there are more minorities represented than ever before, and Hispanic students are on track to be one of the fastest growing populations among college students (Suarez, 2003; Alon, Domina & Tienda, 2010). Due to this trend, a large amount of research is being conducted to study the conundrum of Hispanic students falling behind in their STEM degree achievement. It should be noted that according to some literature, there has been a lack of “theoretically sound empirical work” as well as a lack of research on factors affecting degree attainment by Hispanic students within the STEM field (Crisp, Nora, & Taggart, 2009). However, research theorizes that both pre-college factors and factors whilst enrolled in a college or university affect the selection of a STEM degree as well as the completion of such a degree by Hispanic students differently than they affect non-Hispanic students (Suarez, 2003). These factors can be institutional, personal, or academic.

Women are an interesting group within the STEM field. They are a fast-growing group, yet are still found to be underrepresented in both college and the workforce, especially at higher levels (Adams, Blodorn, Garcia, Hammer & O’Brien, 2014). There are various factors which affect their access, retention, and graduation in the STEM field based on different socioeconomic factors,

race/ethnicity, and familial obligations; however, for the sake of this paper, we will focus on issues which affect the majority of women in STEM. Postsecondary students who are women enroll at a rate of 14% (compared to men at 33%) into STEM majors (Chen, 2009). They account for almost half of the general workforce, but only make up about 26% of the STEM workforce (Landivar, 2013). A theory for this, and one that echoes throughout most of the factors regarding women's involvement in STEM, is the masculinity commonly associated with STEM fields (Adams et al., 2014). This contributes in many ways to the lack of women participants in the STEM fields. It can influence faculty to give recommendations for men over women. It also has negative effects on women's test courses (and positive effects on men's). Finally, and probably most importantly, is the expectations and values associated with the STEM field for women. Expectations are not as high for women when it comes to the success or graduation with a STEM degree. There also is not as much value or interest placed on women regarding the STEM field. However, although this section is based on a "generalized" view of factors affecting STEM women, it is important to note that several studies have shown that Black students women enroll and graduate from STEM fields at a higher rate than other women, partly because they tend to hold a less "gender stereotyped" view of STEM fields (Adams et al., 2014; Chang, Eagan & Hurtado, 2010).

The goal of this proposal is to find common factors associated with all these groups so that they could be comprehensively or cohesively addressed at either the secondary level or the postsecondary level. It is more likely that the factors are too wavering between the groups to be able to form a well-rounded, postsecondary plan for addressing the concerns. However, this does not mean that there are not identical factors in each group. Perhaps most importantly was the factor of self-efficacy which resonated through most of the research. Self-efficacy could be increased in these groups in a variety of ways, whether through encouragement or increased

involvement by parents, faculty, and peers. This lends to another identical factor which consistently appeared between the groups: identifying with others. All groups showed increased interest in STEM majors and careers when they were able to identify with faculty, peers, or potential colleagues/employers. It should be noted that this identification is specific to race and gender. A Black student will not necessarily identify with a Hispanic student, even though they are both minorities, and a female Hispanic student will still have a hard time identifying with a male Hispanic student, even though their race is the same. It is important that there is increased, identifiable diversity in the STEM fields, both for role-model purposes and for workforce purposes. However, it is important to note that the “identifying” factor is not necessarily related to schools as a whole. While Black students tend to fare better in STEM fields at HBCUs, the same is not true for women at women’s colleges, or Hispanic students attending HSIs.

These identical factors can be tied into most student success programs with some effort between faculty and employers. However, it is important to realize that even though there are shared traits, one cannot surmise to address all factors amongst these groups in the same way. Each race, ethnicity, and gender have their own unique obstacles and must be helped and assisted accordingly. Further exploration into this group of students will hopefully provide answers to lingering questions regarding influential factors such as self-efficacy, high school to college transitioning, coursework, and more.

## References

- Alon, S., Domina, T., & Tienda, M. (2010). Stymied Mobility or Temporary Lull? The Puzzle of Lagging Hispanic College Degree Attainment. *Social Forces*, 88(4), 1807-1832.
- Borman, K., Lee, R., Tyson, W., & Hanson, M. (2007). Science, Technology, Engineering, and Mathematics (STEM) Pathways: High School Science and Math Coursework and Postsecondary Degree Attainment. *Journal of Education for Students Placed at Risk (JESPAR)*, 12(3), 243-270 Retrieved from <http://www.tandfonline.com.ezproxy.lib.uh.edu/doi/pdf/10.1080/10824660701601266>
- Chen, X. (2009). Students Who Study Science, Technology, Engineering, and Mathematics (STEM) in Postsecondary Education. *Institute of Education Sciences*. Retrieved from <http://nces.ed.gov/pubs2009/2009161.pdf>
- Crisp, G., Nora, A., & Taggart, A. (2009). Student Characteristics, Pre-College, College, and Environmental Factors as Predictors of Majoring in and Earning a STEM Degree: An Analysis of Students Attending a Hispanic Serving Institution. *American Educational Research Journal*, 46(4) Retrieved from: <http://aer.sagepub.com.ezproxy.lib.uh.edu/content/46/4/924.full.pdf+html>
- Eagan, M., Hurtado, S., & Chang, M. (2010). What Matters in STEM: Institutional Contexts That Influence STEM Bachelor's Degree Completion Rates. Retrieved from [http://www.heri.ucla.edu/nih/downloads/ASHE 2010 - Eagan, Hurtado, Chang - What matters for STEM Completion.pdf](http://www.heri.ucla.edu/nih/downloads/ASHE%202010%20-%20Eagan,%20Hurtado,%20Chang%20-%20What%20matters%20for%20STEM%20Completion.pdf)
- Malcom, L. (2010). Charting the pathways to STEM for Latina/o students: The role of community colleges. *New Directions for Institutional Research*, 2010(148), 29-40.
- Landivar, L. (2013). Disparities in STEM Employment by Sex, Race, and Hispanic Origin. *American Community Survey Reports*.
- O'Brien, L., Blodorn, A., Adams, G., Garcia, D., & Hammer, E. (2014). Ethnic variation in gender-STEM stereotypes and STEM participation: An intersectional approach. *Cultural Diversity and Ethnic Minority Psychology*, 21(2), 169-180. Retrieved from <http://www.apa.org/pubs/journals/releases/cdp-a0037944.pdf>
- Suarez, A. L. (2003). Forward Transfer: Strengthening the Educational Pipeline for Latino Community College Students. *Community College Journal of Research and Practice*, 27(2), 95-117.

Tyson, W., Lee, R., Borman, K., & Hanson, M. (2007). Science, Technology, Engineering, and Mathematics (STEM) Pathways: High School Science and Math Coursework and Postsecondary Degree Attainment. *Journal of Education for Students Placed at Risk (JESPAR)*, 243-270.