

MNT-EC Professional Development Handout

Workshop Title: State of STEM Education
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Equity Definition:

Equity prioritizes the creation of opportunities for minoritized students to have equal outcomes and participation in educational programs that can close the achievement gaps in student success and completion.

[Equity Walk and Equity Talk](#)

Resources

[National Science Foundation \(NSF\) STEM Education Site](#)

[National Center for Education Statistics \(NCES\): Status and Trends in Education of Racial and Ethnic Groups](#) – there is a section specifically on STEM. ***These data only include US citizens and permanent residents.

[National Science Board \(NSB\): Science & Engineering Indicators](#)

Literature

[STEM Identity]

Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching, 44(8), 1187-1218:

In this study, we develop a model of science identity to make sense of the science experiences of 15 successful women of color over the course of their undergraduate and graduate studies in science and into science-related careers. In our view, science identity accounts both for how women make meaning of science experiences and how society structures possible meanings. Primary data included ethnographic interviews during students' undergraduate careers, follow-up interviews 6 years later, and ongoing member-checking. Our results highlight the importance of recognition by others for women in the three science identity trajectories: research scientist; altruistic scientist; and disrupted scientist. The women with research scientist identities were passionate about science and recognized themselves and were recognized by science faculty as science people. The women with altruistic scientist identities regarded science as a vehicle for altruism and created innovative meanings of "science," "recognition by others," and "woman of color in science." The women with disrupted scientist identities sought, but did not often receive, recognition by meaningful scientific others. Although they were ultimately successful, their trajectories were more difficult because, in part, their bids for recognition were disrupted by the interaction with gendered, ethnic, and racial

factors. This study clarifies theoretical conceptions of science identity, promotes a rethinking of recruitment and retention efforts, and illuminates various ways women of color experience, make meaning of, and negotiate the culture of science.

[Social Responsibility in STEM]

Garibay, J. C. (2018). Beyond traditional measures of STEM success: Long-term predictors of social agency and conducting research for social change. Research in Higher Education, 59(3), 349-381.

Despite the importance of preparing socially responsible graduates in science, technology, engineering, and mathematics (STEM) to address the current state of poverty and inequality, very few studies in higher education have examined the development of STEM students' outcomes critical to promoting a more equitable society, typically focusing on the impact of one program or course. To address this gap in the literature, this study used frameworks of undergraduate socialization as well as social justice perspectives in STEM education to examine the undergraduate experiences and institutional contexts that predict STEM bachelor's degree recipients' development of two democratic educational outcomes seven years after college entry: social agency and values toward conducting research that will have a meaningful impact on underserved communities. The study utilized multilevel modeling on a national longitudinal sample of 6341 STEM bachelor's degree recipients across 271 institutions. Longitudinal student data from the 2004 Cooperative Institutional Research Program's (CIRP) Freshman Survey and 2011 Post-Baccalaureate Survey were merged with institutional data from the Integrated Postsecondary Educational Data System and CIRP Faculty Surveys. Various undergraduate socialization experiences and institutional contexts were found to predict STEM bachelor's degree recipients' democratic educational outcomes, including academic majors, participation in student organizations and research, experiences with faculty, and peer and STEM faculty normative contexts. Implications of the findings for research, policy, and practice are discussed.

Dissertation Study Abstract

Prior research has examined underrepresented students in engineering from a deficit-oriented perspective. Black students are the most vulnerable subgroup in engineering due to low undergraduate completion rates and low participation in the workforce. We know that successful Black engineering students exist, and often thrive, at highly selective and competitive and predominantly White institutions (PWIs). These institutions can be unwelcoming and unsupportive environments for Black students, exposing them to risk factors that threaten their success.

This qualitative study examines the lives and collegiate experiences of 57 Black undergraduate engineering students at 15 predominantly White Institutions (PWIs) with highly-competitive engineering programs across six states through semi-structured in-person or virtual interviews. Using Harper's (2010) *Anti-deficit achievement framework for research on students of color in STEM* as a theoretical framework, the goal of this study is to understand the individual and institutional factors that most contributed to their persistence, retention,

academic success, and completion of their programs. Portraiture (Lawrence-Lightfoot & Davis, 1997) served as the methodological framework for its ability to capture the complex and multi-dimensional nature of the human experience.

Seven themes emerged as representative of the Black engineering experience: (1) foundations in engineering; (2) adapting to college STEM rigor; (3) building community; (4) peer mentoring and support; (5) navigating the racial climate; (6) identifying institutional priorities; and (7) obstacles. The empirical conclusions from this study are as follows: formalized and extemporaneous collegiate communities helped Black engineering students adapt to college environments and reduce the risk of attrition; quality of pre-college math and science experiences influenced but were not determinative of future success; diversity strategies were perceived as ineffective and disingenuous; and the global racial climate had direct and potentially damaging effects for race relations on local campuses. This study offers new considerations for efforts around diversifying engineering and places higher expectations for ensuring continued access, persistence, and success on the institution and its agents.

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