Diversifying the STEM Professoriate: Defining the issue at hand

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ABSTRACT

This paper identifies the primary issues that have confounded efforts to increase the number and proportion of underrepresented groups within STEM faculty. Drawing on extant research, the paper establishes that despite increases in diversity and inclusion within other areas of academia, STEM fields continue to experience disproportional lags in diverse representation throughout the STEM pathway and especially within STEM academic careers. The paper argues that there are two primary foci that must both be addressed to achieve a diverse workforce: increases to the pool of credentialed candidates and a critical examination of the recruitment, hiring, and retention practices and policies. While this paper is focused within the context of higher education and the diversification of STEM faculty, its findings and argument are applicable for areas of industry beyond academic careers.

Keywords
Higher Education, STEM, Faculty, Diversity

INTRODUCTION

Broadening participation within STEM faculty is key to broadening participation in STEM fields and cultivating a STEM workforce able to tackle 21st century challenges. Research on increasing the success of underrepresented students has suggested that when taught by underrepresented faculty, underrepresented students achieve at significantly higher rates and as much as 20-50% of the course achievement gap between these groups and majority students disappears (Dee, 2007; Ehrenberg, Goldhaber, & Brewer, 1995; Fairlie, Hoffmann, & Oreopoulos, 2011; Hoffman, & Oreopoulos, 2007). Similarly, Price (2010) found that Black male and female students persisted at higher rates in STEM majors when taught by faculty with corresponding race and gender.

Despite the centrality of diversity in learning and student success, efforts to increase underrepresented faculty have been largely unsuccessful (Turner, Gonzalez, & Wood, 2008), particularly in STEM (National Academies, 2011; Nelson & Brammer, 2010; Nelson & Rogers, 2003). In 2013, 1.5 million faculty (tenured, tenure-track, contingent, and adjunct in all fields) were employed at degree-granting institutions in the U.S. (51% full-time; 49% part-time), and of those who were full-time faculty only 21% were non-White and 48.8% were female (NCES, 2015). Within STEM fields these disparities are even larger. The National Science Foundation (2015) reported that in 2013, underrepresented minority faculty occupied a mere 8% of associate and full professorships in STEM fields at 4-yr institutions.

National attention towards the issue of broadening participation in STEM pathways and the professoriate have resulted in a deeper understanding of the barriers experienced by underrepresented populations (e.g., Hernandez, Schultz, Estrada, Woodcock, & Chance, 2013; National Academies, 2016; Tsui, 2007) and the creation of many programs aimed at enhancing the success of these students through STEM pathways—most specifically aimed at increasing underrepresented students' competitiveness within faculty markets; however, large-scale systemic change has been very limited (NCES, 2015; NSB, 2016). This begs the question, "Why has broadening participation not occurred in STEM faculty given the increases in our understanding?" The answer to this question is necessarily complex.

A BOTH/AND ISSUE

Opportunities to increase faculty diversity are partially limited by the number of underrepresented groups ready to pursue graduate programs in STEM (Knowles & Harleston, 1997; National Academies, 2016). While the number of first-time, full-time college students entering 4-year postsecondary institutions with STEM degree aspirations have increased by 10% in the past decade (NSB, 2014), overall STEM completion rates have remained stagnant and significant disparities continue between historically underserved students and their peers (Eagan, Hurtado, Figueroa, & Hughes, 2014; National Academies, 2016).

A growing body of literature has identified the barriers to persistence and enrollment in STEM graduate programs for underrepresented populations, including: classroom environment (National Academies, 2016), sense of belonging (Johnson, 2012; National Academies, 2016), finances and debt (Malcom & Dowd, 2012); academic challenges (Haak, HilleRisLambers, Pitre, & Freeman, 2001; Tsui, 2007; Villarejo, Barlow, Kogan, Veazy, & Sweeney, 2008; Stephan & Ma, 2005). Programs exposing students to academic research have perhaps been most often recommended, with researchers establishing relationships between participation and retention in STEM, graduate degree aspirations, and career interests in research for students from underrepresented backgrounds (Connolly, Savoy, Lee & Hill, 2016; Eagan, Hurtado, Chang, Garcia, Herrera, & Garibay, 2013; Espinosa, 2011; Jones, Barlow, & Villarejo, 2010; Pender, Marcotte, Domingo, & Maton, 2010; Russell, Hancock, & McCullough, 2007; Tsui, 2007). In addition, researchers highlight the importance of engagement in departmental or science clubs and organization (Espinosa, 2011), active learning in science classrooms (Haak et al., 2011), and encouragement and mentorship from faculty (Cole & Espinoza, 2008; Eagan et al., 2013; Tsui, 2007) in fostering STEM persistence and post-baccalaureate degree aspirations.

Increases in faculty diversity require increased persistence in STEM majors, interest in graduate education, and career aspirations in science for undergraduates from underrepresented backgrounds; however this is a necessary but insufficient focus.

The bulk of past research, and resulting initiatives, on broadening participation of underrepresented groups within STEM fields have primarily focused on increasing the pool of STEM graduates. Despite continued disparities in STEM degree attainment, these initiatives have in fact increased in number the proportion of STEM doctoral graduates from underrepresented populations. Yet despite these small increases, the number and proportion of diverse STEM faculty remain disproportionally limited. Why? Because to diversify the STEM professoriate, we must increase the pool of diverse STEM graduates AND critically evaluate the recruitment, hiring, and retention practices and policies for STEM faculty.

Systemic Issues in Recruitment, Hiring, & Retention

Scholars have highlighted how faculty hiring practices and policies can mitigate or exacerbate underrepresentation within the academy. Recent research from the Bureau of Labor Statistics has demonstrated that while the number of full-time faculty positions (tenure-track and contingent) has remained stagnant or decreased in the last decade while the number of Ph.D. candidates for these positions has increased creating a surplus of highly qualified candidates (Stephan, 2012; Xue & Larson, 2015). While research on this topic is mixed, some suggest women and underrepresented minority candidates are disadvantaged as processes become more competitive, as institutions send signals that there are shortages of qualified candidates from underrepresented backgrounds or make fewer efforts to recruit diverse candidates because they are perceived as "hard to get" and too costly (Kulis, Shaw, & Chong, 2000; Tuitt, Sagaria, & Turner, 2007). Some have also called attention to implicit bias in the hiring process, as search committee members (who are often White and/or male) unconsciously preference individuals that remind them of themselves and more critically assess the qualifications and scholarly pursuits of women and underrepresented minority candidates (Hill, Corbett, & Rose, 2010; Reuben, Sapienza, & Zingales, 2014).

While there is little empirical work validating successful strategies, institutions able to increase faculty diversity report placing emphasis on diversity as a priority, and the implementation of strategic initiatives like search committee trainings about bias and diversity, pre-search campus visits with potential candidates, cluster hires, and strategic placement of advertisements in resources targeting women and people of color (Collins & Johnson, 1988; Glass & Minnotte, 2010; Kayes, 2006; Smith, Turner, Osei-Kofi, & Richards, 2004).

Increasing numbers of women and underrepresented minorities recognize the competitiveness of the faculty

job market and are dissatisfied with the values and norms of academic science, which may dissuade many talented scientists from pursuing faculty careers. Recent research suggests that as students' progress through Ph.D. training, interest in pursuing academic research careers significantly decreases (Fuhrmann, Halme, O'Sullivan, & Lindstaedt, 2011; Russo, 2011; Sauermann & Roach, 2012). Declines may be particularly stark for populations underrepresented in the academy, with recent research showing underrepresented minorities and women, and underrepresented minority women in particular, having the lowest levels of interest in faculty careers at research universities at the end of their graduate training (Gibbs, McGready, Bennett, & Griffin, 2014). Scholars have connected these declines to a lack of alignment between trainees' personal values and the structural dynamics of the academy, namely low postdoctoral pay, high faculty workload, and decreased availability for grant funding as increased emphasis has been placed on scholarly productivity (Fuhrmann, Halme, O'Sullivan, & Lindstaedt, 2011; Gibbs & Griffin, 2013).

Only by focusing on both essential pieces of this issue—faculty pool building and critical examination of the recruitment, hiring, and retention practices and policies of STEM faculty—will diversification of STEM faculty be achieved.

A WAY FORWARD

Transitions from undergraduate into graduate STEM programs, graduate school into postdoctoral positions, and then from postdoctoral training to STEM faculty positions, represent critical junctures in STEM pathways. However, there is limited extant empiric literature on the forces, factors, and structures that facilitate these transitions throughout STEM pathways and across institutions towards faculty careers, nor whether or how these differ for persons from underrepresented backgrounds. Consequently, policy makers, universities, and scientific societies have a limited evidence-base from which to design, implement, and evaluate interventions that facilitate transitions along STEM pathways.

The goal of the Association of Public and Land-grant Universities' (APLU) NSF INCLUDES Project is to increase the number of STEM faculty at APLU member institutions from underrepresented and underserved groups: Women, members of minoritized racial and ethnic groups, persons with disabilities, and persons from low-socioeconomic backgrounds.

The project seeks to achieve this diversification through three project goals:

- Develop a set of diagnostic tools and practices to help institutions more effectively recruit, hire, retain, and support faculty from traditionally underrepresented populations within STEM.
- Identify and begin implementation of a series of transformative institutional activities aimed at increasing participation along the STEM pathways toward the professoriate in order to grow a more diverse pool of STEM students who can eventually become professors.
- Evaluate the adequacy and coverage of current data sources and metrics available to track the progress and success of STEM students from entry into postsecondary education through the professoriate.

Two particular areas of focus are the evaluation and revision of current faculty hiring practices and increasing career development and cultivating anticipatory socialization of underrepresented students into academic science and towards the STEM professoriate (Clark, 1983; Jahn & Myers, 2014).

The diversification of STEM faculty will contribute to broadening participation in the STEM workforce by directly increasing the number of underserved individuals in STEM faculty careers. A more diverse faculty would stimulate a larger secondary effect—or halo effect—by facilitating the increased interest and success of STEM students from underrepresented groups through experiences with a more nationally representative faculty (Antonio, 2000; Hagedorn, Chi, Cepeda, & McLain, 2007; Hurtado, 2001; Turner, González, & Wood, 2008). Moreover, the diversification of STEM faculty and the STEM workforce will simply lead to better science, innovation, and our society's ability to tackle our most pressing problems and thereby improve the world we live in (Guterl, 2014).

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