peerReview

Gender Equity in STEM

Mission Possible:
Empowering Institutions with Strategies for Change

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The National Science Foundation's (NSF) ADVANCE Program began in 2001 with the primary goal of supporting the development of systemic, sustainable approaches to advancing women in academic STEM (science, technology, engineering, and mathematics) fields. Over the last thirteen years, over sixty universities have received significant institutional transformation (IT) ADVANCE grants, and many more have obtained funding to implement institutional partnerships or smaller initiatives, all focused on ameliorating the persistent underrepresentation of women in academic STEM careers. ADVANCE's mission is predicated on the understanding that promoting diversity in STEM facilitates both innovation and excellence. As the program's original descriptive synopsis notes, "The pursuit of new scientific and engineering knowledge and its use in service to society requires the talent, perspectives and insight that can only be assured by increasing diversity in the science, engineering and technological workforce." More than a decade of articulating the value of diversity and supporting efforts to reduce underrepresentation has made ADVANCE a national leader in fostering diversity in academic STEM fields.

So where are we now in terms of that underrepresentation? Since 2001 there has been a slow but steady increase in the number of female faculty in STEM education fields in the United States (NSF 2013). The overall percentage of US faculty women in the physical sciences increased from 16 percent in 2001 to 22 percent in 2010; in engineering the percentage increased from 8 to 16 percent (NSF 2013). Yet hidden within these encouraging trends are some troubling patterns, particularly regarding underrepresented minority (URM) women. Despite the growing number of doctoral degrees in STEM fields awarded to underrepresented racial/ethnic minori-

ties, the percentage of women of color in academic STEM fields has in fact decreased (Asian American women are the exception) (National Science Board 2012). Moreover, American women of color continue to be underrepresented in STEM fields relative to their proportion in the overall US population; in 2010, African American, Hispanic, and Native American women collectively earned only 4.5 percent of doctorates awarded in science and engineering despite constituting 14 percent of the population of 25–64 year-olds (NSF 2013). These data clearly show that, despite advances for women overall, women of color continue to be an "untapped resource" of domestic talent for academic STEM fields (Ong et al. 2011, 200). As majority women now move forward in STEM fields at a pace exceeding that of women of color, the need to understand this disparity and find successful ways to support URM women in STEM is more urgent than ever.

We posit that one possible explanation for the overall positive increase for women faculty in STEM generally but bleaker outlook for women of color specifically is that approaches to institutionally supporting URM women have not typically been *intersectional* in perspective or approach. Originally emerging from critical race studies and gender studies, intersectionality holds that any identity category (such as gender) cannot be fully addressed (at the individual, social, or institutional levels) until understood in the full context of any individual's or group's *social location*—that is, relative to other intersecting and pertinent aspects of identity (Bowleg 2008; Crenshaw 1989; 1991).

The literature suggests that the active intersection of gender and racial/ethnic identity may indeed significantly impact the experience of URM women in STEM (Malcom and Malcom 2011). Leggon (2010) has argued that failure to systematically take the interaction

of identity categories into account results in policy, programs, and practices that are both inefficient and ineffective in developing and enhancing the STEM labor force. And available data consistently indicate that when institutions do consider the active intersection of gender and URM status through practices such as targeted hiring efforts, cultural- and identity-specific mentoring programs, or through access to ethnically/racially specific professional networking opportunities, URM women feel they "matter" and are more likely to thrive professionally (Blake 1999; Bova 2000; Kayes 2006; Thomas and Hollenshead 2001; Turner 2002).

Yet despite the promising evidence of what intersectional perspectives offer, institutional strategies for addressing underrepresentation in STEM in the United States have been routinely framed in "single target" ways that construe aspects of identity as distinct, e.g., women *and/or* underrepresented racial/ethnic groups. This means an institution often assumes an *additive* mode to fostering diversity, in which it is assumed that the disadvantaging effects of different aspects of identity can be summed together for any given individual. Under the additive approach, organizations take different kinds of URM status into account by adding categories of concern as new populations emerge or new groups are identified as underrepresented. The hope is that the cumulative effects of separate institutional initiatives will combine to adequately serve the needs of all URM faculty.

But attempts to institutionally address issues faced by persons with multiple subordinate identities by offering multiple single-identity programs may lead not to inclusion but rather to "intersectional invisibility" (Purdie-Vaughns and Eibach 2008). Because identities are not experienced vertically and independently but rather horizontally and simultaneously, "inclusive" policies may instead inadvertently promote intersectional invisibility for URM women in STEM. For example:

- Failure to see variations in the experience of "women of color" may unintentionally create new forms of marginalization. For example, in the United States, biases associated with Asian American women may be overlooked due to assumptions that Asian women do not experience racism because there is a proportional population in the STEM labor workforce.

- Programs designed to create supportive communities for women in STEM may be locations of intense stress for lesbian, bisexual, and transgender (LBT) women because they produce a dilemma where such women must expand efforts to mask their LBT status or "come out" to colleagues. Efforts meant to helpfully address work-life balance may result in additional marginalization for some LBT women.

As these examples show, interventions aimed at supporting URM women and increasing diversity in STEM may fail to create institutional spaces where complex, intertwined subordinations can be sufficiently articulated. Instead, the distinct needs and voices of the very people whose experiences lie at the juncture of multiple identities are effectively erased.

We suggest that the lack of progress of URM faculty women in US academic STEM fields (understood relative to majority US women in STEM fields) results from the kinds of issues and challenges that emerge when such well-intended initiatives (policies, support and resources, evaluation procedures, data collection structures, etc.) cannot address actual forms of disadvantage.

UNDERSTANDING THE CHALLENGES TO SUPPORTING URM WOMEN STEM FACULTY

In an effort to better understand the challenges that institutions face in supporting URM women STEM faculty, we conducted a study of eighteen universities that received large NSF ADVANCE IT grants. We focused on the efforts of IT programs funded since 2006, reasoning that an examination of later IT cohorts was warranted given NSF's progressive, evolving emphasis on diversity, now defined as "women of diverse characteristics and backgrounds including, but not limited to: race, ethnicity, disability status and sexual orientation." Our project goal was to examine these IT programs' overall attentiveness to issues faced by URM women (broadly defined) in STEM fields and identify strategies for addressing these issues, particularly if and when intersectional approaches were considered. Included in our assessment was an effort to highlight the common obstacles and enablers of these institutions' ability to successfully support URM women.

We gathered relevant publically available documentation for each IT program, including any specific program documents that the IT staff wished to share with us. Documents included the ITs' original NSF ADVANCE proposals, along with annual reports, related self-studies, and external evaluations. We then used standard content analysis procedures (Boyatzis 1998) to qualitatively measure evidence of interest in and development of diversity-related initiatives across ADVANCE programs, paying particular attention to those that considered the intersections of gender and other URM identities. We drew from the work by Diana Bilimoria and her colleagues (who developed a comprehensive assessment of the transformational initiatives of the nineteen first- and second-round ADVANCE IT grants) in order to meaningfully and consistently identify types of IT strategies (Bilimoria, Joy, and Liang 2008). Bilimoria's work resulted in the identification of a number of "pipeline" and "climate" initiatives and we used this approach to identifying initiatives to develop our own set of codes, which we then applied to our document analysis.

Findings from our document analyses then formed the basis of conversations with ADVANCE IT personnel and staff, which incorporated basic questions that we posed to all ITs and questions specific to the program goals and activities identified in our document analyses. A central question was, "What do you identify as the single most important institutional enabler and the most significant barrier to successfully supporting URM women at your institution?"

Our conversations with IT staff made it clear that programs are consistently interested in and deeply committed to supporting URM women but recognized that "we have a long way to go." There was consensus across programs that addressing the lack of women of color in STEM was a necessity and a priority and, in several instances, such efforts were a central focus of program efforts. However, while the results of our document analyses highlighted numerous differently structured programmatic efforts to support women STEM faculty, overall we found relatively few instances of programming specifically structured to address and support women of color or other URM women groups. The obstacles to doing so were often described as too great and the institutional challenges were typically characterized as overwhelming.

However, our findings revealed a persistent pattern of barriers and challenges faced by universities actively trying to promote institutional change for women at the intersections of multiple identities. Informed by our conversations with IT staff, we have identified five key "intersectional facilitators" that emerge from these challenges (and, in some cases, successes). We believe these five intersectional facilitators, complexly understood, offer innovative ways of thinking about change that can then drive new strategies for practical interventions.

THE FIVE INTERSECTIONAL FACILITATORS
Creating "Accountable Leadership" Specifically around Issues Concerning

URM Women
The ability for programs to address the specific needs of particular groups of women begins with institutional leaders who are supportive in more than principle. While expressions of support are always useful, institutional leaders (provosts, deans, department chairs) must now *move towards a more active role as invested change agents for URM women in STEM*. Our research indicates that institutional leaders who participate actively, consistently, and cooperatively in efforts aimed at supporting URM women in STEM positively drive policy. Institutional leaders lend credibility and momentum to efforts at creating institutional change around a group that is too commonly seen as a "subset" of women. These leaders can foster change on multiple levels.

For example, an individual provost might chair a committee focused on URM women's needs, sending a clear message that those needs are an institutional priority; in other cases, a high-ranking administrator can make structural changes—such as relocating the office of equity under academic affairs to enable effective interventions in hiring. Leaders should also work with change agents (including URM women) to build structures of accountability around issues for URM women into the institution. Efforts at institutional transformation (such as the other four intersectional facilitators, described below) have "teeth" when they are linked to structures of assessment and evaluation in the larger institutional framework. "Intersectional invisibility" can be reduced if people with power require that the intersection of gender and URM status be seen. IT staff noted consistently that when leaders are passive or merely reactive, "things do not change."

Identifying Climate Zones
An institutionally specific awareness of the multiple locations of climate in which

faculty find themselves is needed to understand the nuances and variations of the experience of women of color in STEM. There is no one "institutional climate." *Rather, every institution has multiple climates which may require several different strategies for intervention and change.* Institutional leaders and actors must work to both recognize and engage with multiple climates in a locally intersectional context. For example, university-wide climate can involve policies and procedures that may or may not create spaces for the voices of URM women to be heard. Climates across different disciplines and departments might be more or less welcoming to women of color. There also exist micro-climates that emerge from biases or stereotypes around certain differences (e.g., the climate for blacks v. Latinas), which can then generate specific and different experiences for particular URM women in the context of the same university or department. And all climates are located within larger local, geographical, or political climates that may be "isolating" or not supportive to URM women. For example, an intersectional perspective would ask how institutional policy can respond to the needs of women of color in a state with explicit anti-affirmative action policies.

Understanding the (N)umbers Game
It is now a truism to note that efforts at increasing the low numbers of URM women in STEM are paradoxically impeded by the low numbers of URM women in STEM. However, our research indicates that the "small N" problem can be more than shorthand for the challenges of institutional change or an expression of frustration. *This concept should also be understood as marking the boundaries of several key intersectional opportunities.*

The "small N problem" (1) signals the need for informed majority faculty to listen to URM voices and learn how to be effective allies in the specific context of that institution, (2) identifies imminent dangers

for the women of color present in the institution who are often trapped between serving as key "voices" for URM women and the exhaustion of tokenism and such representational work, and (3) alerts the institution to the dangers of hierarchizing URM groups, which may take the form of obsessively counting women of color (e.g., referencing numbers of black faculty—while not acknowledging those numbers are often a revolving door) or not tracking or addressing the need of populations of URM women with "other" subordinate identities (women with disabilities, LBT women). Institutional change agents must also leverage the "small (N)" problem as an opportunity to name and intervene in the dynamics of majority privilege and learn how to be effective allies to URM women.

Overcoming Epistemological Hurdles: The Need to Learn and Listen

There is a world of valuable research on issues facing URM women in STEM and on strategies for institutional transformation—but that does not mean that people in support of or active in transformational projects are aware of the work that has been done. There appears to be a frequent "knowledge gap" between research and the agents of change at any given institution and often among the change agent team members themselves. *Leaders and change agents must become knowledgeable about common institutional obstacles and solutions and aware of the key scholarship and research findings specifically on the issues most commonly effecting URM women in STEM.* It is critical that administrators and leaders come to the table educated so that we break the burdensome cycle of explanation and justification under which many change agents, particularly URM women, labor. For example, only when institutional leadership and change agents are knowledgeable about the research on implicit bias can they effectively hold other decision makers (e.g. search committees) accountable. Key in

these educated power structures are department chairs, who were most often identified as the "points of change."

Promoting Community Structures: Engaging URM Women on Their Own Terms

When an institution re-imagines what groups are, how they are formed, and where they are located, it allows URM women to develop and access support in new spaces. In our analyses we saw instances of models of cooperation across universities (as project partners or within consortia) and also state-wide partnerships that provide women opportunities to find other women with whom they shared a particular identity, thus allowing for collaboration or mentorship. Research shows that URM women in STEM benefit directly from structures that bring them together, increase their investment in organizational change, and bolster their knowledge about campus structures and resources (Turner, Gonzalez, and Wong 2011). At the same time, because of the particular challenges that an intersectional perspective makes clear, *URM women need opportunities to organize themselves, define their own needs, and create communities that make sense to them.* As one program with noted success in supporting women of color noted, "we don't do things 'for them'—we empower them."

Institutions need to recognize the fact that an intersectional perspective requires that change agents from majority groups create venues through which URM women can be recognized on their own terms as primary change drivers—and not as objects of study, goals to be reached, or secondary or passive recipients of change. ▪

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