ADVANCING AND RETAINING UNDERREPRESENTED FACULTY IN STEM: A PROGRAM FOR VALUE-DRIVEN CAREER SUCCESS

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ABSTRACT

Despite significant investments in efforts to broaden participation, the number of women in science, technology, engineering, and mathematics (STEM) fields who leave the academy is disheartening. Some reports suggest half of women STEM faculty will leave tenure track positions within 10 years after hire (Kaminski & Geisler, 2012). For women of color, the data are equally bleak (Ginther & Kahn, 2012) and affirm the need for continuously evolving practices and policies to retain underrepresented faculty in STEM and ensure career satisfaction and success. Unfortunately, current programs for career development and mentoring largely promote rigid conformity to traditional performance expectations, which enable the persistence of narrow departmental norms regarding markers of success. By drawing on person–environment (PE) fit theory, and combining data from our own institution with evidence-based practices from others, the authors have created a faculty development program designed to upend this practice. The objective of this program is to help faculty advance their careers in the academy while staying true to what they value, while simultaneously helping departments reflect on how they can
create more inclusive and supportive environments for all faculty. The authors describe the program in detail and provide initial assessments of impact on faculty participants as well as departmental and institutional practice.

**Keywords:** Career development; faculty of color; promotion and retention; STEM; tenure; underrepresented minority faculty; Women

Despite significant investments in efforts to broaden participation through programs such as the National Science Foundation’s ADVANCE program in the United States and Athena Swan in the UK, the number of female science, technology, engineering, and mathematics (STEM) scientists – especially women of color – who leave the academy is disheartening. Across the globe, there is significant underrepresentation of female faculty across all STEM fields relative to those eligible to be STEM faculty, especially as compared to the ratio of eligible male STEM faculty and men (Mitchneck, Smith, & Latimer, 2016). Worse, compared with white and Asian women, who hold approximately 34% of academic positions in STEM, underrepresented minority (URM) women average a participation rate of less than 5%. Further, of that 5%, only half of these women hold tenured or tenure track positions (National Science Foundation, 2017). These disparities reflect a number of systemic factors including bias in recruitment, selection, and promotion systems; the absence of inclusive policies and practices that disproportionately disadvantage women with eldercare or childcare responsibilities; and male-dominated networks that inhibit women advancing into leadership roles or receiving formal recognition through awards and fellowships (De Welde & Stepnick, 2015; Roos & Gatta, 2009; Rosser, 2004).

What is clear from our own research, from peer institutions, and from the literature on broadening participation is that efforts to recruit and hire underrepresented faculty far outnumber efforts to continuously evolve the practices and policies necessary to retain such faculty and ensure career satisfaction and success. This failure necessitates a deeper investigation and understanding of the ways in which women’s professional identities and pathways are either inhibited or enabled within a department or institution, and the degree to which those academic identities and career trajectories fit within the larger definition of the respective fields themselves. In other words, broadening participation requires more than simply creating a critical mass of women and women of color as faculty; it also requires fundamental changes in the departmental and institutional culture to ensure retention and career advancement for all faculty (Etzkowitz, Kemelgor, & Uzzi, 2000). To this end, we present a data-driven model of career development that attempts to address retention issues in a novel way by integrating traditional notions of career advancement (e.g., obtaining tenure) with a more nuanced understanding of the needs, values, and aspirations of women and URM faculty in STEM. In the following we present (1) a theoretical background, (2) the data-informed development of our intervention, and (3) the content and process of our value-driven faculty development program.
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THEORETICAL BACKGROUND

Academic Identity

Grounded in the tenets of structural symbolic interactionism (Stryker, 1980), identity theory explains how social structures (e.g., academic disciplines and the academy) impact the identity of individuals operating within those structures, and how this identity simultaneously impacts social behaviors. Within a given social structure, all individuals have roles they are expected to fulfill. Individuals’ specific roles reflect their identities, which are organized in a hierarchy based upon their relative importance to the individual at any given time.

With respect to the academy, we know faculty do not come into their roles as blank slates. Through training and past experiences, they develop an understanding of the role of “faculty member,” and within their institutions, gain awareness of more specific expectations for how they allocate their time, the types of research they conduct, the funding they pursue, and the teaching and service activities expect. Likewise, cultures exist within academic disciplines based on the content and method of study within that discipline. These cultures, which Becher and Trowler (2001) labeled “academic tribes,” reflect norms and values developed and internalized over time that govern how faculty in those disciplines interact, allocate their time, and evaluate success.

At the same time, faculty also come to their institutions as individuals with unique definitions of self. These identities shape the expectations they have for their faculty roles. For instance, if a faculty member identifies strongly as a feminist scholar or as a Black scientist, the salience of those identities might influence the types of research, service roles, or teaching assignments she pursues. She might choose, for instance, to serve on a university-wide committee designed to address minority representation in academic leadership positions or to engage in research that explore issues that impact members of the Black community (e.g., health disparities).

Role/Identity Alignment

Alignment between the social role and one’s self-identity is important in order to validate one’s sense of self; moreover, it is vital that others recognize one’s authentic, true identity, not an externally oriented persona or a false version of oneself (e.g., Cable & Kay, 2012; Swann, Johnson, & Bosson, 2009). Alignment also provides a sense of predictability and control over one’s environment (Swann, 1983, 1987; Swann et al., 2009). It is therefore not surprising that identity congruence in the workplace is linked to higher levels of creativity, retention, performance, satisfaction, and the quality of interpersonal relationships (e.g., Polzer, Milton, & Swann, 2002; Swann, Milton, & Polzer, 2000).

In contrast, misalignment occurs when there is a discrepancy between what one believes the organization wants from a role and what the individual envisions for that role. Misalignment can result in a number of different motivational and behavioral outcomes, depending upon the salience and commitment associated with the identities (Burke, 1991; Riley & Burke, 1995). For instance, if a faculty
member’s identity as a community-based scholar is extremely salient and she is highly committed to that identity, but community-based work is not viewed as central to the faculty role at her institution, then her community-based identity will likely diminish in the quest to fulfill the faculty role (e.g., to be tenured or promoted). But, subrogation of the community-based identity can be detrimental to the individual as it may invoke personal confusion, self-questioning, and uncertainty (e.g., Burke & Stets, 1999; Stryker & Burke, 2000).

**Academic “Fit”**

Faculty enter the academy with specific research ambitions, instructional aims, and career aspirations that reflect personally important ideals and beliefs. However, these can be at odds with the prototypical academic identity and “traditional” academic career trajectory. For example, women place less importance on “power-related” goals, like becoming a department chair (Gino, Wilmuth, & Brooks, 2015). Conversely, underrepresented faculty often place more value and thus often engage in more informal mentoring of minority students, despite the fact that these efforts are often less important in achieving tenure or promotion goals. Unfortunately, strong departmental and institutional climates and deeply entrenched disciplinary norms often reinforce prototypical academic identities (Aguirre, 2000; Menges & Exum, 1983; O’Meara, 2002). Hence, despite local efforts to create more inclusive climates and redefine norms for performance and success, male-dominated fields still tend to reflect gendered ideologies of ability, potential for success, and standards for evaluation (e.g., Heilman & Eagly, 2008; Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012; Ridgeway, 2011). Consider, for instance, female faculty in STEM are more likely than men to report they do not believe they “fit” in their departments (Hill et al., 2010), while women of color in STEM are more likely to feel undervalued and invisible (Carter-Sowell & Zimmerman, 2015).

Research has already demonstrated how a lack of fit can have negative consequences for individuals within organizations. In particular, person–environment (PE) fit theory (Edwards, Caplan, & Harrison, 1998), grounded in the concept of cognitive appraisal (e.g., Edwards, 1991; French, Caplan, & Harrison, 1982), defines stress as a perceived mismatch between the environment and an individual’s values, desires, or goals (Harrison, 1978). Accordingly, a perceived match between the person and environment is beneficial to mental and physical well-being, whereas a perceived mismatch signifies stress, produces mental and physical strain, damages well-being, and stimulates efforts to resolve the lack of fit (French et al., 1982). Furthermore, a broad literature demonstrates that perceptions of fit between individuals and the environment in which they are interacting are associated with a greater sense of belonging and career success (e.g., see Cheryan, Plaut, Davies, & Steele, 2009; Cohen & Garcia, 2008).

More specific to our concerns, studies in PE fit distinguish between different types, including person–job fit, person–team fit, and person–organization (PO) fit (Kristof-Brown, Zimmerman, & Johnson, 2005). PO fit occurs when the employee’s personality, goals, and values are congruent with those of the
organization. To this end, most PO fit studies use needs and values as attributes of comparison between persons and organizations, with values being a particularly important attribute for establishing fit. This robust literature demonstrates that when employees perceive a greater sense of fit between their values and their organizations, they are more likely to be satisfied with their jobs, identify with the organization, and seek to maintain the employment relationship (Kristof, 1996; Kristof-Brown et al., 2005; Meglino & Ravlin, 1998; Verquer, Beehr, & Wagner, 2003).

In the context of the academy, most faculty know that there are behaviors, tasks, and expectations relating to research, service, and teaching. Depending on the type of institution, one or more of these broad categories is generally perceived by the institution as most important. For instance, research universities place greater value on research than do liberal arts colleges, while regional institutions place primary importance on undergraduate instruction. Yet, even within those categories, there are more specific faculty activities that institutions and faculty may value to differing degrees. Examples might include an emphasis on basic versus applied research, or grant-funding versus publication. To the extent that the institution values each of these activities differently than the individual faculty member, perceptions of misfit are likely to form. Therefore, alignment between faculty members’ work values and their department’s or institution’s values has important motivational and behavioral outcomes.

Alignment, Fit, and Faculty Development Programming

Notions of identity and fit inform our program of faculty career development in an important way. Specifically, a successful faculty development program should allow participants to obtain the knowledge, skills, and supports needed to advance their careers in ways that both demonstrate impact on their field (e.g., through publications, teaching, or influence on policy) and in ways that truly reflect who they are, what they value, and what they can uniquely contribute to the institution, their students, their communities, and disciplines. Doing so requires they trust their department (and departmental leadership) share those values and will encourage and support them to pursue their goals even when they challenge conventional models of success.

We conclude that programs for faculty career development and mentoring that promote rigid conformity to traditional performance expectations, and reinforce narrow departmental norms regarding markers of success, are doomed to fail at retaining URM STEM faculty. Specifically, we propose a program of career development grounded by what we see as two complementary and mutually reinforcing forces. First, faculty members’ academic identities and core values not only influence their own behavior, but also how they perceive and respond to the work environment. Second, the immediate work environment itself is a reflection of the collective values of the department and the institution. Accordingly, we propose that departments and faculty together become change agents. Below, we discuss data that informed our program of faculty development, describe the program, and provide preliminary evidence of some successes.
INSTITUTIONAL DATA USED TO INFORM CAREER DEVELOPMENT PROGRAM

Attrition and Promotion Data

Our institutional data regarding attrition and promotion rates for STEM faculty reveal inconsistent patterns in the trajectory of junior-level and mid-career faculty. First, as shown in Fig. 1, significantly more women (71%) than men (63%) hired as tenure-track assistant professors in STEM units stay to obtain tenure within eight years. And, more men (36%) than women (30%) leave the institution within the same time period. These departure data contrast with national averages that see more women than men leaving pre-tenure (Mason & Goulden, 2002; Preston, 2004).

For faculty who achieve tenure, mobility patterns for men and women shift dramatically. As shown in Fig. 2, 38% of women compared to 54% of men advance to full within 10 years. In contrast, 32% of women promoted to associate professor (compared to 16% of men) leave their tenure-track position before promotion to full. An additional 3% of women move off their tenured line into teaching or non-faculty roles.

Importantly, our data do not suggest that turnover is driven by performance concerns. Productivity rates for women faculty who leave the university pre-tenure, as measured by publication, citation counts, and h-indices, are comparable to those who remain and have successful careers. Further, productivity rates for women promoted to full professor exceed those of men promoted to full (Furst-Holloway et al., 2017). Thus, performance on what is arguably the most important criterion for advancement does not appear to drive turnover among women in STEM. In fact, less than 10% of women in STEM who leave the university cite performance concerns as a critical factor in their decision to leave.

Fig. 1. Outcomes from Men and Women Hired as Untenured Assistant Professors in STEM
and data from our 2016 climate survey indicate women in STEM are equally as confident as men in their ability to be successful.

**Key Factors Influencing Faculty Turnover Decisions**

As we describe next, other data collected from former and current faculty suggest advancement and retention rates reflect two factors: an inhospitable or non-inclusive climate for women and URM faculty in STEM and poor perceived fit between faculty and departmental values. These findings are consistent with extant research showing experiences within one’s home department can impact faculty perceptions of their work and career (e.g., Settles, Cortina, Malley, & Stewart, 2006; Settles, Cortina, Stewart, & Malley, 2007).

**A Non-inclusive Climate for Women and URM Faculty**

For the *Survey of Former Faculty*, we emailed nearly 500 faculty who left the university between 1999 and 2014. These faculty were invited to participate in an online survey asking them to report job satisfaction at time of departure, reasons for leaving, and where they went after leaving the university. A total of 202 faculty completed the survey with 78 respondents (39%) being STEM faculty.

For the 25 participants self-identified as STEM women faculty, the primary reasons for leaving related to departmental experiences. Specifically, 56% of these women cited poor departmental fit as a “very” or “critically” important factor in their departure. Other reasons included departmental politics (46%), quality of colleagues (41%), issues with immediate supervisor (38%), and lack of collaborators at the university (38%).

A university-wide climate survey of 698 faculty (a 30% response rate) in 2016 showed women STEM faculty in departments are significantly less likely than men STEM faculty to agree their departmental colleagues are “committed to helping women faculty” (mean = 2.45 vs 3.10 on a 5-point Likert scale) and “minority faculty” (2.50 vs 3.07) succeed. Results for URM versus non-URM faculty in STEM are nearly identical.
Perceptions of an unsupportive environment results in lower job satisfaction and productivity (Callister, 2006; Etzkowitz, et al., 2000; Settles et al., 2007; Wachs & Nemiro, 2007) and may also create “confidence gaps” (Kay & Shipman, 2014) for underrepresented faculty in the academy. Women’s self-efficacy is often shaped by interactions with others and events that signal whether they can be successful (Zeldin, Britner, & Pajares, 2008). If interactions (or exclusion) with departmental colleagues signal a lack of support, being undervalued, or being an outsider, then women’s perceptions regarding their prospects for a satisfying and successful career may wane despite confidence in their innate abilities as scholars.

Our findings suggest this may be happening in many ways. The climate survey revealed women STEM faculty were significantly less likely than men to agree their colleagues “speak out in response to sexist, racist, or other discriminatory behaviors that they witness or are made aware of” (2.27 vs 2.79 on a 5-point scale) and “strive to counter the effects of implicit biases on decision-making” (2.12 vs 2.74). Women were also far more likely than men to report having negative work experiences, including being the recipient of dismissive attitudes (47% vs 15%), being held to a different standard (49% vs 13%), and feeling excluded (36% vs 7%). Again, many of these data mirror results for URM faculty, indicating a lack of inclusiveness in departmental climates in many STEM units.

**Misalignment with Faculty Values**

In addition to challenges in the work environment, much data suggest disconnects among the values of women and URM faculty, the work that they are doing, and the perceived values of their departments. For instance, Johnson, Mack, and Furst-Holloway (2016) revealed evidence that STEM faculty of color are more likely to perceive their work-related values (measured in terms of the activities they believe are most important to their role as faculty members) do not match what they perceive the values of their departments to be. In particular, URM faculty placed more value than their departments on informal mentoring and service to their community. This gap may be especially problematic given the levels of informal (and formal) mentoring responsibilities that many faculty of color undertake on behalf of students in need. To the extent that this personally meaningful work is undervalued, faculty may question their place in the department. It is therefore unsurprising that over the past two years, the university has lost several URM STEM women faculty specifically due to feeling disconnected to the department or institution.

Our climate data also suggest gender effects in service-related work (e.g., committee work, mentoring, and advising students). Women reported they were disproportionately assigned time-consuming service activities that would otherwise be dedicated toward their scholarship. This work, which women expressed was often stereotyped (as “women’s work”) and undervalued, is associated with greater job dissatisfaction because women view these workload assignments as inconsistent with criteria for promotion and tenure. O’Meara, Kuvaeva, and Nyunt (2017) note a clear paradox where on the one hand, gendered divisions of labor are associated with lower retention rates, longer time to promotion to full
professor, and greater career dissatisfaction for women faculty, but service can be a way to gain more power, and visibility in the institution and a source of satisfaction for those not recognized in other ways. Our data clearly suggest the need to make the service contributions of women and URM faculty more valuable in terms of their career development and more valued by the department.

Another source of values misalignment reflects challenges of balancing work and home demands. In particular, results from the climate survey revealed that 29% of women STEM faculty, compared to 9% of men view the ability to balance work and home responsibilities as critically important to their jobs. Yet, women were far less likely than men (mean = 2.92 vs 3.35) to agree that they were happy with the balance they have achieved in work–life integration.

Collectively, we draw three conclusions from these data and the challenges they reveal regarding the need to create a more inclusive work environment and to address issues of values misalignment. First, underrepresented faculty can be successful in “traditional” academic settings without having to sacrifice their own personal beliefs, values, or aims. The challenge is to develop and implement realistic career plans that both meet departmental and institutional goals and remain personally fulfilling. Second, as faculty develop, departmental leadership and the work environment need to evolve to reflect the explicit values of their faculty in ways that ensure individual and collective success. Third, and perhaps most important, institutional change in academia is not a matter of training leadership, nor is it a matter of “fixing” the faculty, but it is an interactive process. True sustainability comes from those who remain at the institution long enough to effect deep changes in climate and practice – the faculty themselves. It is with these conclusions in mind that created our program of faculty career development.

**FACULTY CAREER DEVELOPMENT: A VALUES-DRIVEN PROGRAM**

Our developmental approach is two-pronged, focusing concurrently on the values, needs, and goals of individual faculty and the values-in-use and climate within their home departments. Fig. 3 illustrates the interdependent nature of the approach.

*Developing the Individual Faculty Member*

Traditional practices in academic career development begin by asking faculty to identify gaps between their current skills and performance (e.g., research productivity and teaching excellence) and what they need accomplish to obtain tenure or a promotion (*Sorcinelli, Austin, Eddy, & Beach, 2006*). Once these gaps are identified, faculty develop action plans outlining the activities they will undertake in order to resolve those gaps. Ideally, these development plans are shared with department leadership, senior colleagues, or mentors who can then provide advice and discuss progress. However, such an approach assumes a very narrow
definition of success and prevents departments from evolving in ways that reflect an increasingly diverse faculty.

**Articulating Your Academic Identity**

Adopting a different perspective, our program calls for faculty to begin by reflecting on their values and academy identity. Academic identity encompasses how faculty members understand themselves, how they interpret their professional experiences, how they present themselves and wish to be perceived by others, and how they are recognized by the broader academic and non-academic communities (Gee, 2001). Academic identity is integral in the motivation, satisfaction, and productivity of faculty as it provides the standard by which they assess their work environment, career satisfaction, and progress (Quigley, 2010). And there is a broad literature demonstrating that faculty who leave the academy feel that their academic identity is inconsistent with the expectations of traditional faculty roles (Powell, 2012; Trubek, 2013).

In the first workshop, faculty participants discuss the concept of academic identity and how they believe one’s identity influences their work and their perceptions of the work environment and try to describe their own academic identity – that is, how they view themselves and wish others to view them as a scholar. Participants also reflect on the people, events, circumstances, beliefs, or values that they believe have influenced or continue to influence their identity.

Participants then consider how well their activities and products align with or are consistent with their academic identities. In addition to “rating” the degree of alignment, they consider: (1) how they invested their time (i.e., did they spend more time on research or teaching? More time at work versus at home?); and (2) their level of satisfaction or fulfillment in the work they are doing (i.e., Was their time allotted in ways consistent with helping them achieve their personal
Finally, participants consider whether their identity statements and associated activities are reflected in the career development plans (CDPs) they drafted in advance of the workshop. Consistent with traditional faculty development models, the CDP requires faculty to identify short and long-term goals associated with their research, teaching, and service responsibilities, and the action steps needed to obtain those goals. They compare the identity statement they drafted with the goals and plans they outlined in their CDPs to identify points of convergence and divergence. For those points that misalign with their academic identity, faculty identify ways that they might alter their CDP to increase alignment.

Promoting Your Academic Identity

Next, our program focuses more specifically on the ways faculty may actively market their work and themselves as scientists. This process requires that women faculty overcome concerns they may have with self-promotion (see Smith & Huntoon, 2013). The aim is to help participants reframe self-promotion of academic identity in more positive terms, as a way to take control of how colleagues, reviewers, department heads, and consumers see them, allowing them to tell the story they want to tell about themselves, their scholarship, and their leadership. Thus, the program creates an opportunity for faculty to develop a coherent version of themselves to share online, at conferences, and in face-to-face interactions.

Participants next reflect on how the promotion of their academic identity connects to their now refined CDP. They consider the relevant internal and external audiences for their work, including potential collaborators (e.g., colleagues within or outside the institution; funding agencies), potential users of their research (e.g., other authors, industry), or policymakers. They then identify the appropriate vehicle(s) for communicating their work to those audiences and how they might measure impact.

At the end of the program, faculty should be able to describe the values that drive their behavior, articulate their academic identities, and verify that their CDPs (including their goals and developmental activities) align with their identities. They should understand their priorities clearly and be willing and able to engage in the activities that will improve, boost, or reimagine their scholarship, teaching, and service in ways that are personally satisfying and professionally efficacious.

Developing Supportive and Inclusive Departments

For faculty to fully enact these plans and engage in the on-going developmental activities, they need support from their departments. Whether it is approved time to spend in an on-campus writing circle, support to meet with a program officer from a funding agency, help connecting to a senior scholar in the faculty’s area of
research, or spending time away from campus developing relationships with community partners, these resources are critical. Equally important are the subtle and overt signals that demonstrate departmental support for faculty efforts to grow and develop in personally meaningful ways.

Institutional support comes in two forms. First, broad and public support for the CDP process is necessary. With administrators’ public acceptance of faculty CDPs, faculty members now have explicit assurances that the work stemming from their plans meets departmental and university expectations. Second, department leaders and senior faculty must be privy not only to the specific goals and activities that women and URM faculty members have articulated but also to the reasons why faculty members have prioritized those particular goals and activities. Thus, training is likely needed for departments to learn how to support faculty in this way and to have conversations that move beyond traditional performance appraisal discussions to future-oriented conversations that recognize and affirm academic identities. We believe these conversations are critical to begin shifting departmental barriers (e.g., poor fit or values alignment).

**Departmental Workshop**
Concurrent with efforts to develop individual faculty members, our program also calls for efforts that create more inclusive and supportive departmental climates. As departmental documentation and procedures often lag considerably behind current faculty activities and expectations we have designed a departmental workshop that encourages faculty collectively to consider their department’s values and how those values are enacted in departmental programming, policies, and practices.

Dovetailing with the climate survey results, our experience indicates strong faculty support for departmental and system change. Discussions regarding the need to modify or simply better articulate RPT guidelines and how to better address work-life balance have occurred in many departments. Further, the dean’s office has developed a new policy concerning how the college understands and values interdisciplinary research, community engagement, family leave, service activities, and student mentoring.

**CONCLUSION**
Broadening participation requires more than an increase in the number of women and women of color faculty; it requires a fundamental culture change that ensures retention and career advancement for all faculty. Such a change requires that we reconsider how we mentor and develop faculty and whether their work environment values and supports their work. While we have seen some early successes with the proposed program of faculty development, more work is needed to evaluate the short- and long-term outcomes of this effort. While the ultimate goal is to improve advancement and retention, it is equally important to capture whether these gains are achieved in ways that allow women and URM faculty to
be successful in ways that reflect their own values and identities rather than in ways that reflect parochial and narrow definitions of faculty success. To this end, monitoring job satisfaction among women and URM faculty in STEM will be important. Other outcomes of interest will be assessments of fit, whether faculty feel valued and supported, whether they believe their work is valued and that their departmental climate is inclusive and supportive of various forms of scholarship.

REFERENCES


