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Faculty Development for Mid-Career Women in STEM: Cementing Career Success, Building Future Leaders

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Introduction

Despite many years of efforts, significant gender gaps persist in women's representation and advancement on STEM faculties of US academic institutions (NSF NCES, 2017). This trend is not only a concern for individual women striving to create meaningful and impactful careers in science, technology, engineering, and mathematics (STEM) fields; it is also an issue of broad national import. The problems facing the country and world today are complicated, messy, and often seemingly intransigent. In the face of such daunting challenges, the full range of talent within the population is needed in order to contribute to advances in STEM that will help solve these problems. Systems that overlook, undervalue, or undermine the contributions of women jeopardize the interests of the nation and of humanity at large. Furthermore, factors that discourage or impede the recruitment and success of women in STEM fields not only affect those women scholars already prepared to make a contribution, but also have long-term impact on the future, since women scientists are the role models for the next generation of women considering STEM careers. Thus strategies for supporting the success of women STEM scholars have powerful implications for not only those women, but for their institutions, for future scholars, and for the country at large.

Within this context of interest, this chapter focuses on faculty development for mid-career women in science, technology, engineering, and mathematics (STEM) fields. We consider several models developed by institutional projects supported by the U.S. National Science Foundation's (NSF) ADVANCE Institutional Transformation (IT) program. Faculty development is one of several strategies used by ADVANCE IT projects as they seek to both assist individual women faculty members and improve the institutional environment for women STEM faculty as a group (Laursen & Austin, 2014). These strategies tend to focus on post-tenure career planning, including advancement from associate to full professor status, and leadership development. In some ways these programs share many goals and characteristics of other mid-career faculty development efforts, but they are also distinctive in their focus on issues that are salient or exacerbated for women in the STEM disciplines, and in how they support the broader transformational goals of ADVANCE to establish institutional environments that support the recruitment, retention and success of women STEM faculty.

In this chapter, we discuss the origin and rationale for such programs and why they focus on mid-career STEM women in particular. We describe the program models we have observed,

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including workshops and seminars; small grants; mentoring and coaching programs; and leadership development activities such as “internship” opportunities in college or university administration. Using data from our multi-institution study of organizational change strategies in ADVANCE IT projects, we offer vignettes of specific programs as well as research-based advice about the design, implementation and evaluation of such programs.

Context for the Research: ADVANCE Institutional Transformation Projects

The National Science Foundation’s ADVANCE program, in existence for more than a decade and a half, is designed to address the underrepresentation of women in STEM fields in academe. Much of the ADVANCE program’s work has occurred through its Institutional Transformation grants, designed “to catalyze change that will transform academic environments in ways that enhance participation and advancement of women in science and engineering” (NSF, 2001). Through multi-year grants awarded to institutions through a competitive funding process, ADVANCE IT projects focus on increasing the recruitment, retention, and success of academic women in STEM fields. The ADVANCE IT program is not oriented to a deficit model of “fixing women,” but rather seeks to address the embedded systemic issues that create gendered biases in institutional contexts and thus thwart the inclusion, advancement, and success of women scholars.

The ADVANCE program—as well as our research about strategies to create more inclusive academic environments—draws on extensive organizational theory and research. Key premises are that higher education institutions are complex organizations, and that efforts to effect significant change require a systemic and analytical approach (Kezar, 2001, 2014; Laursen, Austin, Soto, & Martinez, 2015). That is, developing effective approaches to organizational change goals requires carefully examining the institution as a system that includes its structures, culture and climate, determining what aspects of the organization must change, and then designing and implementing targeted interventions and change strategies. Systemic change plans need to take into account the levels of trust and collegiality within the institution; who is involved in decision making, in what ways, and to what extent; the levels of hierarchy within the organization; the values woven into institutional life; and the geographic and political context of the institution.

Furthermore, a systemic and analytical approach to improving the recruitment, retention, and success of women scholars in STEM fields must take into account such factors as the extent and expression of implicit bias about the capabilities of women academics, the opportunities or constraints for women’s visibility, mobility, and leadership within their disciplines and work units, and the policies and structures that enable or impede academics’ ability to manage both personal and professional responsibilities. Given the complexities of institutional contexts, successful approaches to change require using multiple levers to address the range of institutional factors that influence the environment within which women scholars seek to succeed. Typically, addressing just one or two elements of the culture within a higher education institution is insufficient for advancing significant change (Laursen, et al., 2015).

Our Study of Organizational Change and Gender Equity

Recognizing the importance of such systemic approaches, our research examined how universities can most effectively create environments that support the success of women STEM scholars. In our multi-year study, we took a cross-institutional, analytical approach to learn about specific organizational strategies that foster such change goals. We also sought to learn how the choice and impact of various interventions is related to organizational context. Our study involved document analysis, interviews, and selected case studies at 19 institutions funded in the first two rounds of ADVANCE IT awards (2001-2004), as well as additional data from IT institutions funded more recently.

Outcomes of our work have included traditional publications and the StratEGIC Toolkit (2014), a web-based resource for institutional leaders, faculty members, and scholars interested in approaches to institutional change to create more inclusive academic workplaces. The StratEGIC Toolkit provides descriptive and analytical Briefs about thirteen frequently used interventions for effecting organizational change, institutional case studies to show how change interventions can be used in strategic combinations within specific institutional contexts, and video statements offering insights about the processes of engaging in institutional change.

Research Methods

The analysis presented in this chapter draws on our experience as researchers and evaluators connected to NSF-funded ADVANCE IT projects across the US. The major source of data is that gathered for the organizational change study described above, including:

- some 150 documents (e.g., grant proposals, reports) from 19 IT institutions funded in the early years of ADVANCE
- 19 interviews with project leaders from these institutions
- 115 interviews and focus groups with 171 individuals, gathered from on-campus case studies of five institutions to understand these projects in depth and the processes by which they were developed, coordinated and sustained
- documents and interviews with leaders of a selected subset of 11 ADVANCE IT projects funded 2005-2012.

Our research team engaged in systematic content analysis of these data, using rubrics to guide document analysis, structured content coding of interviews, and attention to issues of consistency and interrater reliability. To aid our analytical process, we used the qualitative analysis software package *NVivo 10* to categorize data and identify themes.

From these data sets, we extract both “supply side” perspectives on the design, rationale, implementation and refinement of various mid-career faculty development programs and “demand side” perspectives on the outcomes of these programs for participating faculty. This chapter is also informed by our (separate) experiences as evaluators for ADVANCE IT projects at institutions other than those in our study. Based on these data sources, we discuss strengths and limitations of the different models and of different design choices within these models.

Rationales for Mid-Career Faculty Development Programs for STEM Women

Leaders of ADVANCE projects offered two main types of reasons for including faculty development in their institutional transformation portfolios. One set of reasons addressed the needs and opportunities of individual STEM women to take agency and thrive in their careers. For the academy to become more representative of society as a whole, it must ensure that women have the skills and capacities to succeed at the institution. Some of these skills and capacities are not taught formally but rather learned through informal socialization in networks from which women may be excluded (Fox, 2008). Particularly in work environments where women are in the minority, faculty development can help women make formal and informal connections across the institution that offer support, mentoring, and sponsorship. In addition, some faculty development strategies address work/life circumstances that are common for women because of the caregiver roles they may hold alongside their professional roles (Laursen & Rocque, 2009).

Some of these arguments apply equally well to women at all career stages, and many ADVANCE institutions did offer faculty development to pre-tenure STEM women as part of their change efforts. But many also discovered within their institutional data specific gender discrepancies for mid- and later-career faculty. On average, women spent longer at the associate professor rank and were less likely to advance to full professor at all (Misra, Lundquist, Holmes & Agiomavritis, 2011). Women ages 50-59 were more likely to leave the academy than their male peers (Marschke, Laursen, Nielsen & Rankin, 2007). In such a context, encouraging and enabling mid-career faculty was seen as a strategy to reduce inequities in opportunity and help women to plan beyond the tenure timeline for the full arc of a long and rewarding faculty career, and overall, to encourage agentic behavior to achieve long-term goals.

Other rationales emphasized benefits to the institution as a whole. Because the faculty is the heart of the institution, developing a more effective and satisfied faculty improves the quality of workplace interactions for everyone, in turn improving the institution's effectiveness as a whole (Laursen & Rocque, 2009). Such 'rising tide' theories often led institutions to pilot and refine faculty development programs for STEM women under ADVANCE, and later expand them to women and men across disciplines.

While women are underrepresented on STEM faculties as a whole, they are least well represented at senior levels (NSF NCEES, 2017), and in academic leadership roles for which seniority and institutional experience are prerequisite: department heads, chairs of major committees, deans and directors (Niemeier & González, 2004). Because implicit bias shapes ideas of who is a leader, senior women may not be tapped for these roles, nor attracted to them (Domenici, Fried & Zeger, 2009). Thus women represent a pool of untapped leadership talent. Nurturing their leadership ambitions and talents benefits the institution when well-prepared women step into formal leadership roles. Enlightened leadership may in turn help the institution to achieve other transformative goals, such as improving climate within departments, fostering inclusion, or building better systems for faculty rewards, recognition and work-life balance

(Laursen & Rocque, 2009). Finally, providing opportunities for leadership may also help the institution retain senior women.

Many of the concerns about failures to foster the career advancement and leadership potential of women apply also to other groups that are underrepresented on STEM faculties, including faculty of color, faculty with disabilities, and lesbian, gay, and transgender faculty members. As ADVANCE teams worked with STEM women, some learned about the complex and context-sensitive challenges for those who were members of multiple marginalized groups.

In their analysis of how ADVANCE IT projects supported STEM women from underrepresented groups (by race, ethnicity, disability status or sexual orientation), Armstrong and Jovanovic (2015, 2016) argue for an intersectional approach to establishing inclusive institutional environments. This approach acknowledges that people have multiple, intersecting identities, and therefore a person's full social location must be taken into account when seeking to foster her full participation in the institution or profession. So, for instance, when institutional programs are intentional and strategic in taking "both race and gender into account as a complexly integrated experience, women of color are more likely to experience a sense of institutional relevancy and to professionally flourish" (Armstrong & Jovanovic, 2016, p. 4). These authors acknowledge the difficulties of designing such programs, but identify faculty development initiatives as one area where ADVANCE institutions had made some progress in offering intersectionally aware programs, and highlight intersectional enabling factors useful to those seeking to make their programs fully inclusive.

Program Types: Advancing Women, Developing Leaders

As noted, two broad types of rationales predominated among the reasons offered for providing faculty development to mid-career STEM women as part of ADVANCE IT projects. In practice, we observed two broad types of programs, roughly aligned with these rationales.

Faculty development programs with a focus on *women's advancement* tended to focus on supporting individuals to advance in their careers, addressing one or both of two crucial career transitions for post-tenure faculty: the period immediately post-tenure, and promotion to full professor. In a study of faculty professional development needs (Laursen & Rocque, 2006), post-tenure faculty often expressed a sense of accomplishment and freedom to take risks or make changes in their career paths, but they also felt a sense of letdown after achieving the goal of tenure. Faculty were interested to hear from others who had made that transition and to think through their options for changes: shifting their workload among research, teaching and service; managing greater service or leadership expectations; mentoring younger colleagues while still wanting career advice themselves. These decisions also influence the timing and nature of the case that a faculty member will later be able to make for promotion to full professor. Women found this a vague and somewhat fraught process (Laursen & Rocque, 2006; Fox, 2015). As one interviewee put it,

I would probably be agitating for full promotion except that... I don't play the game quite the same way as my male colleagues do, I think. And maybe it's not necessarily fair to [assume that has] a gender basis, but... I don't publish as many papers as I think they think everyone should. I'm... interested in having a balanced life and not... making myself a slave to science. So, as a result, I don't bring in as many dollars as they do; I don't publish as many papers as they do.

Thus faculty development addressing career advancement of mid-career women may address broad questions about career trajectory, provide encouragement to pursue promotion, and offer information about the process for advancement to full professor.

Faculty development with an explicit focus on *leadership development* tended to be more directly framed in terms of the benefits to the institution at large. These programs recognized the crucial role of chairs and deans in setting a tone, establishing a positive climate, and nurturing faculty across career stages. Thus, some programs sought to improve the effectiveness and awareness of people already holding leadership roles, while others sought to foster interest and identify talent among women who were not yet considering such roles.

As the descriptions show, these two program types are not mutually exclusive. Women's personal career goals may include stepping into institutional leadership roles, and institutions can accommodate individual career goals as they support women who take on formal leadership. Leadership development thus overlaps with, but does not replace or subsume, faculty development for mid-career faculty.

Program Models: Career Advancement

In this section we describe some faculty development models that focus on mid-career advancement. Compared to programs for early-career faculty, these models tend to be more individualized, in a variety of interesting ways. The needs of early-career faculty tend to be well studied challenges of learning the job and making wise choices about their time and priorities (Austin, Sorcinelli, & McDaniels, 2007), while less is known about the needs of mid-career faculty; those needs that are documented focus on customizing a career path and overcoming challenges that may sap career vitality (Baldwin, DeZure, & Moretto, 2008). Research also suggests that the path to full professor is less well understood than the expectations for tenure; women in particular may wait to pursue promotion until they get a clear signal from colleagues—which may not be forthcoming (Fox & Colatrella, 2006; Gardner & Blackstone, 2013). Thus faculty development for mid-career women typically emphasized setting individualized career goals and supplying the collegial and financial resources needed to achieve those goals. We highlight here the ways that different models provided that customization.

Individualized resources. Small grants are the basis of one model for mid-career faculty support, providing faculty grantees with the resources needed to re-energize their scholarship and teaching interests at mid-career. The University of Colorado Boulder's ADVANCE IT project, known as LEAP (Leadership Education for Advancement and Promotion), began with an

emphasis on faculty development programs for early-career faculty. While LEAP's program for pre-tenure faculty was effective, a needs assessment study identified many unmet needs of tenured faculty (Laursen & Rocque, 2006). In response, LEAP chose small grants to individual faculty as a way to support mid-career faculty members seeking to expand their career horizons, change research directions, strengthen diversity or enhance work-life balance. LEAP's "Individual Growth" awards targeted faculty making career transitions, beginning new scholarly or creative activities, or restarting scholarly work after a period of substantial university service. Most grants were awarded to associate professors, in amounts of \$1500-10,000, which faculty used to acquire a course release, travel to exhibits, libraries, conferences, or field sites, purchase equipment, books or research materials, or pay for student assistants.

Qualitative analysis of grantees' reports (Laursen, 2008) showed that the program addressed the identified needs and generated a high level of scholarly and creative activity. Over 90% of grantees produced manuscripts, presentations or performances, and over 60% wrote new grant proposals. Participants also reported many professional benefits to their research, teaching, leadership skills, and scholarly networks, and positive impacts on their confidence, morale, and motivation to pursue further scholarly work. In the stereotypically dispassionate world of academe, these affective benefits stood out, demonstrating the importance to faculty of feeling valued by the institution, supported and energized to do their professional work. Wrote one grantee,

There are many uncertainties that come with a major shift in research focus and practice, including the fear that one is making an enormous mistake! For me, the LEAP grant provided a tremendous boost to my confidence that I am on the right path. The grant signifies that my colleagues appreciate the difficulty of significantly changing course and that there is institutional support for such career development.

As a result, the university chose to continue this program after the ADVANCE award ended, seeing this as a low-cost, high-return investment in mid-career faculty development (LEAP, n.d.). The program is supported by the Provost's office and represents increased institutional support for faculty career development as an outcome of the ADVANCE project. Running the grant program requires no elaborate infrastructure, and the mechanism of competitive grants is consistent with faculty culture at this and other institutions.

Individualized mentoring. Mentoring is another model for individual career development. At Kansas State University (KSU), ADVANCE leaders developed the Career Advancement Program (CAP) for senior women, which combined the small grant approach with active, formalized mentoring. The program emerged from evidence that women remained longer at the associate professor rank, and that they felt frustrated by high service burdens, perceptions of male colleagues that they lacked ability or commitment, and values they did not see as shared by their departments. CAP sought to help tenured women advance to full professor or leadership roles. Women wrote a proposal to define their career goals and selected mentors on or off campus who could help them achieve these goals; this relationship was formalized through a

letter signed by both parties, so that the relationship was given time and attention. As on-campus mentors, recipients chose distinguished scholars or skilled administrators who could help them advance their research or investigate potential professional paths. Their off-campus mentors were often people with whom they wished to establish a research collaboration. For example, one interviewee described visiting her off-campus mentor's laboratory to give a talk and check out the laboratory environment and interactions with the mentor before developing a collaborative project to pursue on her sabbatical. In addition to the mentoring relationships, CAP awardees received \$20,000 in funds to support professional activities, such as lab technician assistance or research travel.

Because the number of STEM women eligible for CAP was small, a sizable fraction of KSU women were supported by the program. The project documented outcomes such as promotion to full professor and successful competition for administrative roles on campus. One interviewee described the link between her CAP award and her promotion:

I went up [for full professor] while I was expecting our daughter. I'm not sure I could've done that without the funding and the support from the CAP award. ...For me, the timing was really just very critical: ...Instead of, you know, stalling, I was able to keep some important things going during those few months when my daughter was really young, and at the end of my pregnancy. [I was] able to hire a really capable person [in the lab], and if I hadn't had that, things would've just kind of come to a halt and [I'd have had to] come back maybe a half a year or a year later and rebuild.

Examples like this speak to the need for support that can be customized to the specific circumstances of mid-career faculty, enabling them to pursue the professional goals that make sense to them and benefit the institution.

Lehigh University's ADVANCE IT project used the language of leadership to offer individualized career development. Like KSU's CAP, Lehigh's program combined an individual mentoring plan with financial support for its implementation; the awards were smaller, \$3000 per year for up to two years. The program was based on evidence that women remained longer at the associate professor rank, and thus it targeted recently tenured STEM women. The program's design explicitly acknowledged data showing that Lehigh's STEM women

do not equate the achievement of leadership solely with assuming a university administrative position. Rather, they subscribe to a broader interpretation of leadership that includes the attainment of prominence in research, scholarship, teaching and service within their professional disciplines. (Lehigh University ADVANCE, 2017)

Proving popular at Lehigh, the program was expanded to a regional consortium through a later ADVANCE award that included a research study to examine the program's outcomes and adaptation to different contexts. The consortial program, known as MAPWISEly (Mentor Associate Professors Wisely) also included peer mentoring among women across institutions in order to reduce isolation, offer outside perspectives, encourage collaboration, and establish

accountability to one another. Together, these examples from a public research institution, a much smaller private university, and diverse consortial partners, suggest that this model is adaptable to a variety of institutional contexts.

Collective support for individualized work. Jackson State University's (JSU) ADVANCE IT project developed a summer writing retreat that sought to strengthen the publishing and grant-writing productivity of women faculty in STEM and social and behavioral sciences (SBS) disciplines. The program originated in institutional data showing that its women faculty were concentrated at the associate professor rank. Recognizing that mentoring, writing, and collegial connections were central activities of JSU's most successful male full professors, JSU ADVANCE leaders sought to offer women faculty opportunities to develop the same skills and relationships that had led male senior faculty to success. The program was strategic in supporting JSU's ongoing evolution into a research institution in a manner consistent with its historical commitments as a Historically Black institution. As ADVANCE director Loretta Moore (2016) put it, "The balancing act for faculty, for administrators, for the institution, is to staying true to the mission of serving those who have been underserved in our communities, while at the same time advancing our institution with a strong focus on research."

The summer writing retreat was open to both tenured and pre-tenure faculty, but it targeted associate professors, seeking to help them strengthen their publication records and grant success in preparation for promotion. Many women faculty were isolated in their departments, so the program also sought to build collegial networks. Participants focused on their writing during a week-long retreat in a relaxing rural setting, away from the pressure of everyday campus, family and personal life. They shared work with each other, reported weekly on their writing progress, and committed to produce an article, book chapter, or grant proposal by the end of the program. In this way, the retreat "encouraged a cohesive community of scholarly writers and promoted the self-discipline of daily writing" (JSU ADVANCE, n.d.). Building on local success, JSU now leads a multi-campus network to expand this model to other Historically Black and Hispanic-Serving institutions. The network supports writing retreats and builds professional connections among STEM and SBS women of color.

The model has also been extended to scholars across the JSU campus. The Academy for Research and Scholarly Engagement is a year-long program to increase faculty effort and competitiveness in obtaining extramural funding for their scholarly work. It seeks to build grant-writing skills, increase understanding of foundations and federal agencies, and foster connections that may lead to multi-disciplinary collaboration. About 20 Academy Scholars each year take part in face-to-face workshops, self-paced instruction, coaching and review of drafts by experienced principal investigators, and interact with program officers from private and federal funders. Formal opening and closing celebrations elevate faculty grant-writing efforts as adding value to the institution, and scholars present their work to each other at year-end, helping to build a cross-disciplinary culture of scholarly excellence. The institution has documented at least \$1.2 million in new grant awards obtained by the first cohorts of Scholars. JSU also offers a variety of

other supports for scholarly writers, including accountability groups, peer review teams, virtual writing circles, and writing workshops.

Program Models: Leadership Development

Within the ADVANCE projects we studied, leadership development was seen in part as a means to foster career success of individual women in STEM fields, like the career advancement programs discussed above. But it was also one of several essential tools to change the culture of the institution (Kezar, 2014). Both female and male leaders must understand the importance of inclusive environments, recognize the barriers to creating and sustaining such environments, and know how to guide change processes to the benefit of all. Because women are underrepresented in the leadership of many higher education institutions (Niemeier & González, 2004), women's advancement into these roles can demonstrate the benefits of a diverse leadership group and enable them to serve as models for others. The program models we observed reflect different mixes of encouraging women into leadership roles and enhancing existing leaders' effectiveness.

Bolstering current and emerging leaders. One model for leadership development comes from the University of Washington's (UW) ADVANCE project. Recognizing the crucial role of departments in widespread institutional change, and the crucial role of chairs in guiding change at the department level, ADVANCE leaders sought to help chairs to be more effective in running their departments and in creating better departmental climates for all faculty. Current chairs and emerging leaders—women and men—were invited to what became known as “chair school,” a quarterly series of half-day workshops. A hallmark of these workshops was the use of peer presenters who reflected on and shared their own experiences, and who became resources for other participants. ADVANCE leaders felt this model encouraged participants to consider real-world applications and alternative approaches; hearing from peers in one's own institutional context gave the information credibility. Diversity was woven into all workshop topics where it was natural—for instance, when discussing chairs' roles in recruiting new faculty, evaluating faculty for tenure and promotion, or implementing family-friendly policies. The model was popular with UW chairs in the STEM departments—average attendance was 75% of invited chairs—and it was extended by the provost to include department chairs from other schools. Many practical details about the workshops are offered by Yen et al. (2004).

While UW initially developed the workshops to enhance leadership on their campus, they extended this nationally via two models. First, the Leadership Excellence for Academic Diversity (LEAD) workshops offered department chairs, deans and emerging leaders tools and strategies for improving departmental and institutional cultures (LEAD, 2011). Using speakers, discussions, and role-play scenarios, the two-day, in-person workshop addressed areas of chairs' leadership responsibilities, such as faculty development, recruitment, evaluation, mentoring, and work-life balance, and leadership skills such as strategic planning and communication. Some 60-70 participants attended each year for three years. To share their long experience with leadership training even more widely, UW leaders developed an online resource called Lead-it-Yourself!, capturing their materials and insights in an online toolkit. Institutional leaders can use the Lead-

it-Yourself! content resources and planning tools to prepare their own local workshops to advance STEM faculty diversity and inclusion (LiY, n.d.). As of 2017, UW was working with five institutions to pilot the toolkit.

Connecting and inspiring future leaders. A different leadership development strategy focused on increasing women's interest in leadership. In addition to its workshops for current chairs, UW ADVANCE hosted a monthly lunch series for experienced women faculty called Mentoring for Leadership. The lunches were designed to expose women to a variety of career leadership paths and help women envision themselves in leadership roles. A featured speaker offered a short talk highlighting personal stories of career decision-making, career obstacles and successes, or balancing strategies. While most speakers held formal institutional leadership roles, others represented research leadership or informal leadership. Speakers appreciated the chance to reflect on their accomplishments and consider how gender influenced their successes. In turn, participants learned what it was like to hold a particular leadership position and what strategies other women leaders used to navigate their responsibilities, perhaps inspiring them to consider being leaders themselves.

Designed with the feel of a “dinner party,” these events connected women across departments to reduce their sense of isolation and increase their sense of belonging. Evaluation results showed that the group mentoring model was effective for most of the women who attended; in providing multiple models of leadership, the lunches made leadership roles seem “more accessible” to participants (Yen, et al., 2007). At least one-fourth of participants reported they had taken on new responsibilities in their department, the university, or their professional society since they had attended one or more lunches.

Trying on the role. Another model of leadership development took this a step further by recruiting and preparing women for formal institutional leadership through direct experience of an administrative role. These “internship” programs allowed faculty to step temporarily into a part-time administrative role, typically at the level of associate dean or special faculty assistant to a provost or vice chancellor. In this way, such programs enabled tenured faculty to try out an administrative leadership role for a year, without losing the option to return to their current faculty work (Laursen & Rocque, 2006). As one interviewee put it,

I'm excited about experimenting with some kind of administrative job. ...And maybe I'll try it and it'll be awful, and I'll just want to go back to teaching and doing research. But I guess I'm optimistic that it'll go well. And maybe I'll end up as a dean or a vice chancellor or something—that would be interesting, I think.

Working in an administrative office, women could participate in the everyday work and obtain advice from experienced administrators on how to do the work and how to make choices that would prepare them for this possible career change. Often the faculty participant also undertook a special project for her host office. For the institution, these programs helped to increase the visibility of women among administrative leaders and to change mental models of who can be an administrator.

Programs that enable women to try out administrative roles can have some shortcomings, such as unclear expectations, and inadequate opportunities for the faculty member to develop deep and meaningful relationships with experienced but busy administrators (Laursen & Rocque, 2006). The ADVANCE Center at Texas A&M University-College Station (TAMU-CS) solved some of these problems in its year-long Administrative Fellow program. One key improvement was articulating and formalizing expectations on both sides up front. Senior leaders from academic and research administration submitted a position description specifying the Fellow's duties and responsibilities, the areas where she would have budgetary, management or decision-making responsibility, and planned mentoring mechanisms. Tenured faculty from STEM departments could apply, with the explicit support of their department; if selected, they remained involved in research, teaching and service in their home department but negotiated specific changes to their teaching and service duties to accommodate the administrative work. The ADVANCE Center coordinated positions and applications and provided a course buy-out that gave Fellows time to take part. Fellows committed to one year and might stay on for a second year by mutual agreement. TAMU's program also fostered specific networking and professional development activities for the ADVANCE Administrative Fellows, participants in a similar leadership development program offered through the university's athletic conference, and current administrators. The program has been successful in moving women into formal leadership in the campus administration (Jean, Walker & Bergman, 2015), and several TAMU offices planned to continue hosting an Administrative Fellow after ADVANCE funding ended.

Coaching women leaders. Case Western Reserve's ADVANCE project, known as ACES (Academic Careers in Engineering and Science), focused on strengthening the skills and effectiveness of its leaders, rather than on recruiting new women into leadership roles. Based on data showing that chairs were key influencers of the academic climate experienced by faculty women, ACES offered "executive coaching" to STEM deans and chairs, both women and men, who were instrumental in leading faculty development and cultural change efforts (Bilimoria, Hopkins, O'Neil & Perry, 2007). Executive coaching was also offered to STEM women faculty; here we focus on the coaching of deans and chairs.

An executive coach provides performance- and career-related advice, helping the participant to specify her career and leadership vision, goals, and plans, and offering advice, resources, and feedback on how to best accomplish that vision. Compared to mentoring, coaching is less mutually developmental and more one-way; it is "targeted, finite, and focused on improving current performance and thinking strategically for the long term" (Bilimoria et al., 2007). For ACES, the goals were both individual and institutional: enhance the leader's self-awareness, confidence, and sense of empowerment; assist strategic thinking about career development, both for short-term effectiveness and long-term contributions; and develop leaders who can catalyze constructive institutional change. This combination resulted in what one interviewee called "a big payoff to the individuals as well as the institution."

Chairs and deans took part in 8-10 coaching meetings that were individually driven but guided by a sequence of recommended topics, starting with identifying the leader's vision and goals. At other sessions, the pair might discuss critical competencies of emotionally intelligent leadership, strategies for increasing leadership impact, or ways to build a broader repertoire of interpersonal skills. They completed preparatory and follow-up assignments: reading, reflection, data collection and analysis. Leaders were encouraged to administer a 360-degree assessment to gather feedback from supervisors, peers, and subordinates, and discuss the feedback with the coach—a process not for the faint of heart:

Evaluation of the executive coaching program showed very positive responses and growth in measures of self-efficacy, confidence, and agency. We heard many stories about how chairs had applied what they had gained from coaching, as in this example from a chair.

One of the things that I learned about leadership styles... is the hazards of avoidance behavior. In earlier years I would have avoided the conflict with the retired chair, and he has an avoidance style himself, and it would have just perpetuated for years. But instead I handled [the incident] very directly, and it did not in any way disrupt our relationship because it was done in a cordial way: 'These are the patterns, and this is the consequence, and it's a problem that we both have.'

Across the ADVANCE IT projects, structured mentoring and coaching programs had mixed success; ACES' executive coaching program was one of the more effective ones we observed. Skilled, well-trained coaches were crucial, as was careful messaging to dispel the impression that coaching was a form of remediation. A few leaders were immediately receptive, seeing the coaching as a signal of higher-level support, but others were initially reluctant:

When I was assigned a coach, I didn't take to it very well to begin with. ...It's like, you know, 'I'm not the problem, I don't need to be fixed. It's everything around me that's a problem.' ...But as I met with my coach, I began to realize the value.... I think my department chair also felt that way... was like, you know, 'I've been a department chair for ten years, what am I gonna learn from this kinda thing?'

She went on to point out, however, the chair's eventual positive reaction and resulting benefits for the department as the chair gained "perspective on not just women and minorities in the workplace, but how one should interact with people." Another leader articulated how executive coaching benefited the institution more broadly, including "giving people the tools and the confidence, and making it okay to have [important] conversation" and to "step out in a constructive way...to solve problems and to recognize problems." In this way, the interview data provided evidence to support ACES' hypothesis that strengthening individual chairs would lead to institution-wide benefits.

Implications

Our analysis of mid-career faculty development programs from ADVANCE Institutional Transformation projects shows several lessons.

First, individualizing programs is important, even essential, for them to be well-received by mid-career and senior faculty. Many of the programs we studied began and remained focused on individuals' career goals and the varied paths by which they might pursue them. Even programs directed toward groups, such as UW's workshops for chairs, were locally customized by using peers as local experts. Furthermore, effective programs often included active learning methods—discussion, role-playing—as well as ample opportunity for cross-department networking.

Second, individualization works best when balanced by accountability. Multiple work demands on tenured faculty—higher service loads, expectations to maintain established research programs, changing family expectations from maturing children or aging parents—are often exacerbated for women. This means that mentoring, networking, and learning from peers should not be left to chance or to good intent. The most successful programs formalized roles and expectations so that all involved took their participation seriously.

Third, programs were most effective when they were custom-built not only for the individual but for the local context—that is, when they were grounded in local data on the specific issues experienced by women at mid-career and in specific institutional needs, traditions, and values. Indeed, some ADVANCE institutions' programs for mid-career STEM women emerged only after initial efforts had failed, or after leaders discovered gaps in their offerings on campus. Programs were strengthened when leaders listened to participants, incorporated feedback, and made iterative adjustments. And continuity of support for productive careers was enhanced when these programs for mid-career women were situated within a broader faculty development portfolio that covers the full career span, not as stand-alone efforts.

Finally, and perhaps most importantly, the strongest programs were keenly strategic in offering value to both individuals and the institution. Institutional investment in faculty development will be most impactful and sustainable when the institution's interests overlap well with those of the faculty themselves. To identify these areas of mutual benefit, strategic planning and data gathering are needed to ensure that design decisions about programs address individual and institutional interests. From this perspective, faculty development serves as one of several strategically implemented strategies for supporting faculty; other strategies may address cultural issues such as climate and collegiality, or the structures for evaluating and rewarding faculty. This kind of thoughtful assessment and planning optimizes the use of faculty development as a strategic choice to advance both individual and institutional priorities.

Even as we have presented evidence of ways to use faculty development as a powerful and strategic lever for supporting women at mid-career and advancing institutional priorities, we also recognize the need for more research on the mid-career experience. The research in this area is not extensive, and is even more modest on women and STEM in particular. Important questions pertain to the experiences of faculty in handling diverse responsibilities at mid-career, the evolution of their identities as scholars and leaders, and the particularities of the challenges faced by faculty in underrepresented groups. Research is particularly needed on the gendered issues for mid-career faculty and the relationship of disciplinary context to those issues. Efforts to support

individual opportunity and institutional context, informed by thorough research findings, enhance the careers of women faculty and support the talent needed to address national priorities and attract the next generation of talented scholars.

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Bios

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Laursen has also worked as an outreach scientist, college chemistry instructor, and atmospheric science researcher. She has led professional development activities for educators and scientists on topics in Earth and physical science and inquiry-based teaching. In addition to her research publications, she has written chemistry and Earth science curriculum resources, co-directed a documentary film, and recorded a CD with Resonance Women's Chorus. Laursen holds a Ph.D. in chemistry from the University of California at Berkeley and B.A.s in chemistry and French from Grinnell College.

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