AC 2011-1486: RECRUITMENT STRATEGIES FOR GENDER EQUITY: LESSONS FROM COHORT 1 AND COHORT 2 ADVANCE INSTITUTIONS

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Recruitment Strategies for Gender Equity: Lessons from Cohort 1 ADVANCE Institutions

Abstract

The NSF ADVANCE program represents one of the most far reaching gender equity efforts implemented jointly by a government agency and institutions of higher education. Focusing on science, technology, engineering, and mathematics (STEM) disciplines, in 2001, an inaugural group of universities received NSF ADVANCE Institutional Transformation (IT) awards to increase the representation of women faculty in science and engineering. To date, a total of five cohorts of 44 institutions of higher education have received the award, and the 19 institutions comprising the 2001 and 2003 cohorts have completed their five-year projects.

In this paper, we examine the effectiveness of recruitment programs and practices developed by Cohort 1 ADVANCE institutions in an effort to increase the representation of women faculty. Towards this end, we focus on changes in the number of women faculty at the assistant professor rank in colleges of engineering at seven Cohort 1 ADVANCE institutions. We examine performance during both the 2001-2006 grant period, and the sustained impact of ADVANCE by examining the trajectory of colleges of engineering up through the three years following receipt of the grant (2006-2009). Using these changes as an indicator of the effectiveness of recruitment programs, we determine which colleges of engineering associated with Cohort 1 universities show stronger performance. Subsequently, we compare the key components of recruitment programs initiated at both stronger and weaker performing institutions during the ADVANCE grant period.

Our analysis of changes during the grant period reveals that four out of seven colleges of engineering added between four and seven women to the faculty at the assistant professor rank, and two institutions added one female assistant professor each. Georgia Tech's College of Engineering, where the number of female assistant professors fell by four, constitutes an exception to this overall trend. A longer term view (2001-2009) reveals that all colleges of engineering showed net positive changes, with Georgia Tech increasing the number of female faculty and the University of Washington showing a decline in the three years after the grant ended (2006-2009).

Our comparative analysis of recruitment efforts suggests that, with the exception of the University of Colorado at Boulder, the hallmark of the stronger performers is the comprehensive nature and integration of recruitment programs into the overarching institutional transformation strategies. In contrast, the weaker performers had programs that a) focused on select aspects of recruitment, b) did not have a pre-ADVANCE history of recruitment efforts, and 3) did not develop mechanisms to facilitate connections across different institutional transformation initiatives. Importantly, in the outlying case of Georgia Tech, recruitment was not an ADVANCE objective; instead the main focus of the grant was on building women's leadership capacity. While the net loss of female faculty at junior level may indicate a weakness in recruitment efforts during the 2001-2006 period, it does not imply a major weakness in the overall institutional transformation strategy which may yield very promising results in the long term.

Introduction

For over 20 years, the US government has invested in the development and implementation of gender equity programs in Science, Technology, Engineering, and Mathematics (STEM). The economic, technological, and educational benefits of creating a more diverse science and engineering workforce provide the impetus behind these equity efforts.[1] Integral to the success of gender equity programs is the growth of the number of women obtaining STEM doctoral degrees and entering the academic workplace as faculty members. Although recent statistics indicate a substantial increase in the number of women receiving doctorates in STEM disciplines, the number of women STEM faculty fails to reflect this change.[2]

Social science research documents disproportionate attrition of women in STEM disciplines at critical transition points such as receiving a Ph.D. degree, entering the assistant professor position, receiving tenure and promotion to associate rank, and receiving promotion to full professor.[2] Among factors accounting for this phenomenon, especially in the areas of recruitment and advancement of women faculty, are biases and weaknesses in recruitment strategies (University Leadership Council 2008) as well as institutional climate, including a sense of isolation,[3] lack of role models,[4] and lack of women in key academic leadership positions.[5]

In this context, the NSF ADVANCE program represents one of the most far reaching faculty-focused gender equity efforts in STEM disciplines undertaken by the US government. The cornerstone of the NSF ADVANCE program is the issue of *institutional* inclusion and transformation. According to the first NSF ADVANCE program director, Alice Hogan, the program tried to elicit new approaches to addressing the complexity of institutional transformation by encouraging the institutions of higher education to develop systematic and comprehensive programs and transformational strategies.[6] To date, a total of five cohorts at 44 institutions of higher education have received NSF ADVANCE IT awards, with the 19 institutions in the 2001 and 2003 cohorts having completed their five-year projects.[7]

Based on our review of existing literature on gender equity efforts undertaken under the auspices of the NSF ADVANCE program, we categorized the ADVANCE scholarship into four types: 1) cross-institutional and institutional-level ADVANCE evaluation research;[8-12] 2) case studies assessing the implementation and outcomes of specific ADVANCE initiatives undertaken by individual institutions;[13-19] 3) historical overviews comparing and assessing the value of different approaches to advancing women in science and engineering;[20-22] and 4) reflective accounts of ADVANCE-related politics and challenges.[23] Since we examine this literature elsewhere, here we limit our review to Fox's[10] study of ADVANCE initiatives. Building on Fox's ideas, our goal is to contribute to a more in-depth understanding of what distinguishes stronger recruitment strategies from weaker ones in the context of broader ADVANCE efforts. After discussing Fox's findings below, we focus on the colleges of engineering associated with the first cohort of ADVANCE institutions. We emphasize the importance of on-going recruitment of women into the academic pipeline as an important element in sustained institutional change. Accordingly, we assess changes in the number of women faculty at the assistant professor rank in colleges of engineering at seven Cohort 1 ADVANCE institutions (2001-2006). In addition, we consider the continued performance at colleges of engineering by including three years after the grant period in our analysis (2001-2009), indicating changes during the immediate post-ADVANCE period

(2006-2009). We consider these changes as an indicator of the effectiveness of ADVANCE-related recruitment programs. Subsequently, we compare the key components of recruitment programs initiated during the ADVANCE grant period at both stronger and weaker performing institutions.

ADVANCE IT Programs: Range, Emphasis and Examples

In her 2008 article, Fox[10] connects the continued advancement of women in science and engineering to the efforts at institutional transformation of the academic workplace. To understand the meaning of "institutional transformation" in the context of higher education, Fox[10] conducted a case study of institutional transformation strategies implemented by the 19 institutions that received NSF ADVANCE funding in 2001 and 2003. Using the information included on the websites of those 19 institutions, Fox[10] coded "the central initiatives undertaken in the past five to six years." In her analysis, she focused on five broader categories of transformation: 1) fundamental structures (leadership, work-family arrangements, tenure and promotion); (2) faculty composition (recruitment, retention); (3) internal networks of education, communication, networking, and material resources (for faculty; for departments); (4) other internal networks; and (5) networks of external supporters."

According to Fox (see Figure 1),[10] in terms of transforming fundamental structures, 84% of institutions studied implemented different types of leadership initiatives including ADVANCE professorships and chairs, and leadership development for senior women faculty. Forty-two percent of the institutions focused on work-family nexus. The examples of such initiatives include, "modified academic duties," dual-partner hiring programs, and funds for release time during critical transitions in life. Initiatives addressing promotion and tenure were developed only in four (21%) of the institutions.

With regard to faculty composition-related initiatives, Fox,[10] observes that 79% of the Cohort 1 (2001-2006) and Cohort 2 (2003-2008) ADVANCE institutions implemented such initiatives. Examples of such initiatives include using ADVANCE funding to hire new faculty, support for equity-advisors, funding of supplemental start-up packages, and training of recruitment committees. Fox emphasizes that the majority of faculty composition initiatives have explicitly focused on hiring women faculty; only two institutions implemented initiatives explicitly targeting retention of women faculty.
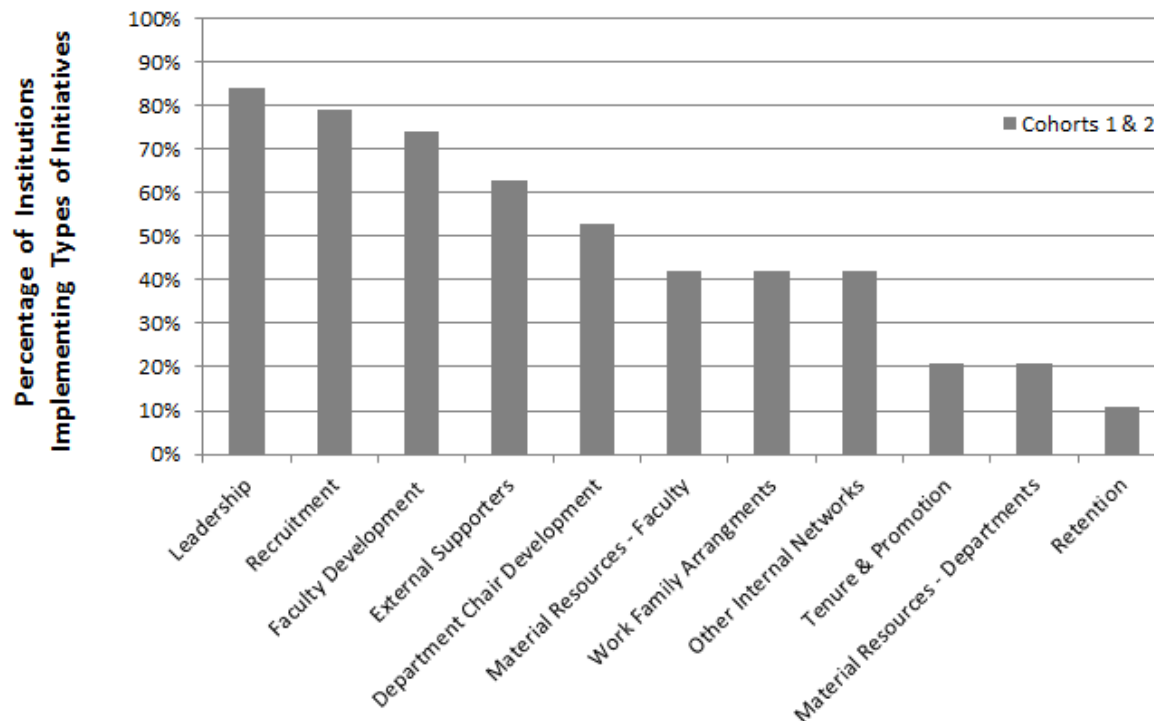
Figure 1. Types of institutional transformation initiatives implemented by Cohort 1 (2001-2006) and Cohort 2 (2003-2008) ADVANCE institutions.

Internal networks of education, communication, and mentoring are the third most widespread type of ADVANCE strategy. For instance, seventy-four percent of the institutions developed strategies focusing on faculty development for women. These strategies include research enhancement through developing women's social capital (sponsors, networks and mentors). Some institutions (42%) also provide material support for faculty development.[10] Among the first two cohorts, 42% implemented campus-levels education and networking initiatives. These initiatives included conferences, retreats, lunches and symposia.[10] Importantly, since departments are a critical site where important equity and inclusion decisions are made, several ADVANCE institutions focused their interventions on departments and department chairs. According to Fox,[10] 53% of ADVANCE institutions implemented educational and communication initiatives at departmental level. While some of these initiatives focused on department chairs, others also included faculty members. In some instances (21% of institutions), departments received material support (grants and/or awards) to identify and address climate issues.

Fox[10] emphasizes that her intent is not to assess the initiatives, but rather to describe "the patterns of the ADVANCE initiatives, and ways that they correspond to what is known about key dimensions and facilitating factors of transformation in higher education." Accordingly, we turn to Britton[24] who identifies three aspects of gender-related inequities in organizations: 1) internal bureaucratic procedures and practices, 2) occupational composition (hierarchical and vertical), and 3) ideological/discursive gendering of occupations and organizations. Among these three aspects of gender inequality, the gender composition of occupations, both horizontal and vertical,

has far reaching implications. For instance, with respect to horizontal composition, in male dominated occupations, the recruitment of women employees into entry-level positions may contribute to the creation of a critical mass of women employees. While such change by itself does not ensure gender equity, the increased presence of women in a male-dominated occupation does raise the likelihood of women being able to overcome isolation, become important role models, and move into leadership positions. With regard to changes in who occupies positions of authority, i.e., the vertical hierarchy, the presence of women in entry-level positions increases the women's long-term chances to move up.[24] Thus, an on-going recruitment of women into the academic pipeline is an essential element of sustained institutional change. Accordingly, in this work, we concentrate on recruitment, one of the main areas of ADVANCE initiatives.

Building on Fox's[10] study of ADVANCE initiatives, we assess the changes in the number of women faculty at the assistant professor rank in the colleges of engineering at select Cohort 1 (2001-2006) ADVANCE institutions. Using these changes as an indicator of faculty recruitment outcomes, we determined that some colleges of engineering at Cohort 1 universities performed better than others. Subsequently, we compare the key components of recruitment programs at both stronger performing and weaker performing institutions during the ADVANCE-grant period. We also include and comment on the more extended 2001-2009 time frame, as well as the shorter post-ADVANCE period (2006-2009).

Scope of Study

To date 44 institutions received major ADVANCE grants and 19 institutions completed their programs. Given our focus on recruitment outcomes in the colleges of engineering associated with ADVANCE institutions, and in contrast to Fox, we limited our analysis to select Cohort 1 (2001-2006) universities as shown in Table 1. This decision was dictated by our reliance on absolute numbers as indicators of recruitment efforts, which would make any cross-cohort comparisons difficult to interpret. Also, since the scope of the ADVANCE program varies across institutions, with some institutions implementing the program in a few select departments and some also including social sciences, it is not always feasible to compare outcomes across entire institutions.[12] Finally, disciplinary fields differ considerably with regard to the number of available women with Ph.D. degrees or on the faculty. Thus, in order to ensure a degree of discipline-related uniformity, we decided to focus on engineering colleges only, as shown in Table 1.

Table 1. Institutions of ADVANCE Cohort 1.

Cohort 1 Institutions (2001-2006)
Georgia Institute of Technology
New Mexico State University
University of California - Irvine
University of Colorado at Boulder
University of Michigan (Ann Arbor)
University of Washington
University of Wisconsin, Madison
Cohort 1 Institutions Not Considered in this Study
Hunter College of the City University of New York*
University of Puerto Rico, Humacao*

*Institution does not offer B.S., M.S., or Ph.D. engineering degrees.

Data

Given that a main goal of the NSF ADVANCE Institutional Transformation Program is to increase the representation of women in STEM, we examined changes in the number of full-time tenure-track engineering women faculty at assistant professor rank using data from the Profiles of Engineering and Engineering Technology Colleges[25] published by American Society for Engineering Education (ASEE). Since we did not have access to faculty turnover data, including voluntary departures, tenure denials, or promotions to associate professor, we used these data as a proxy indicator of recruitment outcomes.

In addition to data regarding the changes in the absolute numbers of full-time tenure-track female faculty in engineering colleges, we examined ADVANCE grant proposals and final reports submitted by the seven institutions to the National Science Foundation. Our examination of these data sources focused on establishing the scope and the nature of ADVANCE-related recruitment programs. Unfortunately, and this is an important limitation of our analysis, we were not able to access ADVANCE data sources describing the more specific efforts developed to recruit and hire more engineering women faculty. As a result, our analysis is based on the review of university-level recruitment programs. In addition to reviewing ADVANCE proposals and reports, we also consulted the ADVANCE Portal Website to find information regarding various ADVANCE initiatives listed under the heading of "Departmental Recruitment" (see http://www.portal.advance.vt.edu/index.php/categories/initiatives/recruitment). For the purpose of interpretation, we also consulted the websites of the seven ADVANCE institutions in Table 1, including NSF mandated annual reports, climate surveys, site-visit reports, and final program evaluations.

Methods

We examine change according to the number of women on the faculty at ADVANCE schools during the grant period, and in the three years after completion of the grant. We note several important caveats to this approach. First, our analysis is based on the overall changes in the numbers of women faculty in the colleges of engineering during a relatively short, eight year, time span. Second, in our analysis, we decided to focus on the absolute numbers of female faculty at the assistant professor rank instead of using percentages. Increasing the overall recruitment and hiring of women faculty is an important aspect of institutional transformation as it enables the diversification of engineering faculty,[i] and ensures the flow of women into the academic pipeline in engineering. Of course, we are aware that the increases in the numbers of junior women faculty will not change the gender composition of engineering faculty if the hiring of women still lags behind the hiring of male faculty members. However, our goal in this paper is not to examine changes in occupational composition, but instead we are interested in recruitment efforts targeting women faculty. Accordingly, absolute numbers provide valuable information about the relative success of the recruitment process. Third, we only include data for women faculty in full time tenure track assistant professor positions. Since we are interested in examining recruitment efforts, the exclusion of data for women at the associate and full professor ranks is dictated by the fact that the increase in the number of senior women faculty is just, as if not more likely, to be driven by promotions than recruitment, and we have no systematic way to disaggregate this information. Thus, although we cannot account for movement out of the assistant professor rank, changes in the number of junior women added to the faculty appears to provide the best available proxy of recruitment efforts that ensure the flow of women into the academic pipeline.

With regard to our analysis of recruitment initiatives, we used the following criteria to classify a given initiative as a recruitment program: 1) the initiative was listed under "recruitment" or "hiring" heading; 2) the initiative's name included the term "recruitment" or "hiring"; or 3) the initiative's description explicitly targeted "recruitment" or "hiring" efforts.

The initial selection of all recruitment initiatives was conducted by one of the team members, a former graduate student, under the supervision of the first author. The final analysis of recruitment initiatives was conducted independently by three social science faculty. Each faculty member reviewed all initially selected recruitment initiatives and assigned them to one of the following categories: Family-Friendly; Dual Career; Creating a Diverse Pool of Applicants; Training/Workshops for Search Committees; Workshops for Search Committees on Bias in the Applicant Review Processes; Networking/Collaborations; Facilitating Recruitment and Campus Visits; Mentoring; Start-up Funding; and the Development of Faculty Recruitment Toolkits. Subsequently, the three social science faculty members met to discuss their individual analyses and developed the final list of recruitment programs. The final list of programs and their classification was developed via consensus. With one exception, there was an agreement in the choices of recruitment programs and their classification. The exception was whether those initiatives that could potentially be used as a recruitment tool, i.e. flexible tenure policies, should be included among recruitment programs. After an extensive discussion of the role such initiatives may play in job candidate's decision-making process, we decided to exclude those initiatives that were not explicitly linked to recruitment.

Analysis

Figure 2 shows the eight year changes in the number of full-time tenure-track women faculty at assistant professor rank for Cohort 1 ADVANCE institutions. For the purpose of our analysis, we divided the eight year changes into three distinct periods: a) the ADVANCE period (2001-2006); b) the extended period (2001-2009), which shows the net difference between 2001 and 2009; and c) the post-ADVANCE period (2006-2009). With regard to the ADVANCE period, with the exception of Georgia Tech which had 21 women faculty, Cohort 1 institutions had very similar starting points with the number of women faculty ranging from three to eight. At the end of ADVANCE period, four of these institutions added between four and seven women at the assistant professor level, and two institutions added one woman each to their faculty. Georgia Tech, where the total number of female assistant professors declined by four during the ADVANCE years, constitutes an exception to the overall trend.

Importantly, our analysis of the extended 2001-2009 period reveals that all colleges of engineering, including Georgia Tech, show positive changes, with the University of Michigan and University of Wisconsin showing the greatest gains, nine and eight junior women faculty respectively. Also, with the overall gain of seven tenure track women to the faculty, the University of Colorado at Boulder moves ahead of the University of Washington, which ends the period with a net gain of two junior female faculty. A comparison of the changes that took place during the short post-ADVANCE period only (2006-2009) shows mixed results, with Georgia Tech increasing the number of junior female faculty by six and the University of Washington showing a decline by three. Also, while the University of Wisconsin appears to have lost some of its earlier pace of growth,[ii] the remaining colleges either continue to increase the number of female junior faculty members, i.e., the University of Michigan and University of Colorado at Boulder, or show no change, i.e., the University of California - Irvine and the New Mexico State University.
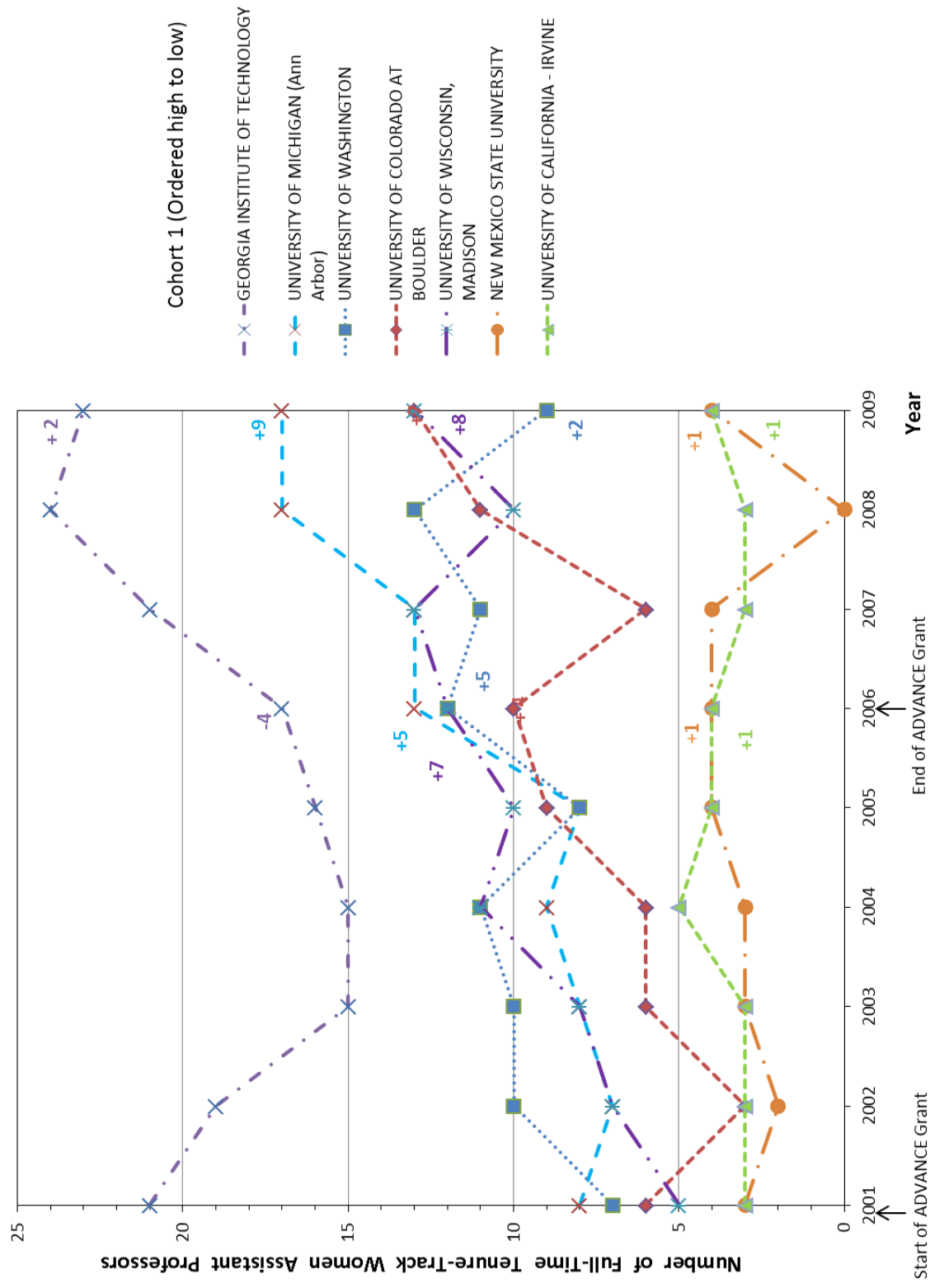
Figure 2: Changes in the number of full-time tenure track women Assistant Professors in the Colleges of Engineering, 2001-2009.

Given NSF ADVANCE's stated goal of increasing the number of women faculty, we focused our analysis on the scope and nature of recruitment programs developed at the institutions with the most dramatic changes in the number of women on the engineering faculty, and comparing these institutions to those that did not make as much progress. For reasons discussed above, we treat the case of Georgia Tech as an outlier and discuss it separately.

Interpretation

Table 2 summarizes recruitment programs developed by Cohort 1 ADVANCE institutions. Based on our analysis, it appears that, with the exception of the University of Colorado at Boulder, the institutions showing a greater increase in the absolute numbers of the female faculty at assistant professor rank during the ADVANCE period developed a more comprehensive approach to recruitment. Specifically, the University of Michigan, the University of Wisconsin, and the University of Washington developed programs in almost all recruitment-related areas. Importantly, two of these institutions, the University of Michigan and the University of Wisconsin, continued their positive trend past the 2001-2006 ADVANCE period. In contrast, the University of California - Irvine and New Mexico State University, institutions showing weaker recruitment trends both during and after the ADVANCE period, focused on more specific programs addressing only select aspects of recruitment.

Table 2. Summary of recruitment programs developed by Cohort 1 ADVANCE institutions.*

School	Family-Friendly	Dual Career	Search Committee Training - Diverse Pool	Search Committee Bias in Review Process	Networking/ Collaborations	Mentoring	Start-up/ Funding	Net TT FT Female Faculty Gain/Loss 2001-2006	Net TT FT Female Faculty Gain/Loss 2006-2009	Net TT FT Female Faculty Gain/Loss 2001-2009
University of Wisconsin		▓	▓	▓	▓	▓		7	1	8
University of Michigan			▓	▓	▓	▓	▓	5	4	9
University of Washington			▓	▓	▓	▓	▓	5	-3	2
University of Colorado at Boulder				▓				4	3	7
University of California - Irvine		▓	▓	▓				1	0	1
New Mexico State University		▓	▓				▓	1	0	1
Georgia Institute of Technology								-4	6	2

* Cells highlighted in gray indicate which recruitment programs were developed at each of the seven institutions analyzed

In addition to analyzing the scope of recruitment programs at each institution, we examined other aspects of the ADVANCE programs, including the integration of recruitment into the overall institutional transformation framework.   In what follows, we highlight the main characteristics of the stronger and weaker performers, and also provide some possible reasons for why the University of Colorado at Boulder appears to show the results that diverge from what would be expected based on the scope of its recruitment initiatives.

First, the more successful ADVANCE institutions used a combination of initiatives creating a more comprehensive approach to recruitment. For instance, the University of Michigan created a set of strategies that included the creation of a faculty committee referred to as Science and Technology Recruiting to Improve Diversity and Excellence (STRIDE) in 2002 to address the underrepresentation of women faculty in engineering and science.[18] The main functions of the committee, which consisted of senior faculty from sciences and engineering, included the dissemination of information and advice regarding the implementation of the most successful recruitment, retention, and promotion practices. Since, similar to other ADVANCE programs, Michigan's approach to institutional transformation was multi-pronged, the effects of STRIDE cannot be assessed independent of other initiatives. However, in a web-based assessment of STRIDE activities, including presentations to departments, over 60% of the respondents found them to be very effective. Stewart et al.[18] also note that 41% of faculty surveyed responded that STRIDE had a positive influence on departmental searches and that the number of women hired during the first year of STRIDE was statistically significant even though hiring practices were also influenced by other strategies. Importantly, Michigan's approach also involved expansion of the initial ADVANCE program to include the recruitment and retention of underrepresented faculty of both genders across all disciplines. Since the ADVANCE guidelines restrict the program to women faculty, the UM had to use its own institutional funding to accomplish this expansion.[18]

Similarly, the University of Wisconsin, Madison developed a comprehensive approach to recruitment under the Women in Science and Engineering Leadership Institute (WSELI) with the ultimate goal of making "the gender of the faculty, chairs, and deans reflect the gender of the student body at UW-Madison."[26] Recruitment practices include attention to the needs of dual career couples, mentoring and networking programs and hiring workshops for departmental committees, chairs and deans that develop specific strategies for recruiting a diverse pool of applicants. For example, UW-Madison's Searching for Excellence and Diversity workshops, implemented by WSELI as part of ADVANCE, continues to be run campus wide, and has been presented at numerous campuses nationally and internationally as "Train the Trainer" workshops.[26] Furthermore, Wisconsin's program emphasizes identifying and countering unconscious bias not only in the hiring process, but also throughout the career of UW-Madison faculty members. The emphasis on climate issues reinforces the wide-ranging nature of Wisconsin's ADVANCE program, and how specific recruitment initiatives are tied into wider goals for institutional change.

The University of Washington (UW) represents an interesting case because the equity and inclusion efforts at the UW College of Engineering predate the implementation of the ADVANCE program. For instance, towards the end of the 1990s, the College of Engineering at the UW developed a Faculty Recruitment Toolkit that was subsequently adopted university-

wide, as well as by other institutions, including MIT, UC-Berkley, and Texas A&M. Despite this and the comprehensive nature of the faculty recruitment programs, it appears that although, between 2001 and 2009, the College of Engineering at the University of Washington experienced a net increase in the number of junior women faculty, during the post-ADVANCE period, this number declined. Importantly, based on the information contained on the University's website, in 2008, the College hired six new female faculty members, four at the assistant professor and two at associate professor rank (http://www.engr.washington.edu/facresearch/newfaculty2008.html). In 2009, four new women faculty joined the college, including two assistant professors and two associate professors (http://www.engr.washington.edu/facresearch/newfaculty2009.html). Given this, the reasons underlying the decline in the immediate post-ADVANCE period may be more a result of faculty turnover rather than unsuccessful recruitment efforts.

In the context of the Cohort 1 institutions, the University of Colorado at Boulder represents the most interesting case. Similar to UW, the University of Colorado at Boulder had recruitment efforts in place before they received the ADVANCE grant, but in contrast to other strong performers, its ADVANCE program did not contain any comprehensive set of recruitment initiatives. Specifically, in 2001, Colorado reported on the efforts of their Faculty Recruitment and Retention task force (http://www.colorado.edu/academicaffairs/fac_recruit/findings4.html). Further, in 2003, Colorado's engineering college implemented a *Strategic Plan for Excellence,* which included efforts to "hire outstanding and diverse candidates through targeted recruitment, competitive salaries and startup packages, and compelling opportunities to participate in excellent research and educational programs."[27] The ADVANCE strategy at Colorado thus complemented existing recruitment efforts by cultivating the careers of existing faculty members through a program of Leadership Education for Advancement and Promotion (LEAP). Therefore, although Colorado's ADVANCE program was narrowly focused on bias in recruitment, this was put in place within the broader context of recruitment strategies outside of ADVANCE, and LEAP efforts to developing existing faculty members and help them strategize around work-family balance issues and problems of dual career couples.

Weaker performers, such as University of California - Irvine (UC at Irvine), developed approaches that focused on select aspects of recruitment. UC at Irvine, for instance, created an innovative, and subsequently highly praised, recruitment oversight program involving the appointment of "equity advisors," whose role was to work with search committees to develop proactive search strategies and to oversee hiring practices.[17] Importantly, some UC at Irvine faculty were critical of the equity advisors initiative. Although this ADVANCE-related project "may have helped avoid gender bias and cut down on the impact of old-boy network," it also took the women faculty, who served in this capacity, away from their research activities.[28] At the same time, however, the equity advisors initiative has become one of the ADVANCE signature projects emulated by other ADVANCE institutions, including the Wright State University.

The developments at UC at Irvine bring two factors to our attention. First, based on our review of the data available at the UC at Irvine website (http://advance.uci.edu/images/data/Engr.pdf), it appears that the number of women faculty in associate ranks declined from five to one between 2001 and 2006. This implies that a weak performance at UC at Irvine with regard to recruitment

cannot be attributed to women's promotions to associate level. Second, the situation at the UC at Irvine suggests the importance of the broader context. The relative lack of progress in hiring women engineering faculty may be better understood by examining broader trends in the State of California.[12] In 1995, the UC regents abolished affirmative action within the UC system. A year later, California passed Proposition 209, a state-wide anti-affirmative action initiative. According to West,[29] Proposition 209 had a detrimental effect on hiring women faculty in the California state system. While in 1995-96, women accounted for 36% of the new faculty hires, in 1999-2000, this number declined to 25% before increasing again during the 2005-06 academic year. Although during the 2000 – 2004 period, UC at Irvine actually out-performed the rest universities in the system with regard to hiring women,[12] it is possible that the anti-affirmative action climate stalled progress. Thus, while the implementation of the ADVANCE program at the UC at Irvine may have helped its overall performance relative to the rest of the system, it did not help the UC at Irvine to maintain their top position among its institutional peers, nor did it help to outperform the national average.[30]

With regard to New Mexico State University (NMSU), Bilimoria et al.[8] notes that NMSU lacked professional development programs, mechanisms for disseminating information about the ADVANCE program, and collaboration across university units. All these factors hindered the effectiveness of the ADVANCE program. In a 2003 report, the NMSU ADVANCE team mentions other factors inhibiting institutional transformation, including a college-level decentralized decision-making structure, wherein deans assume a "hand's off" approach in departmental governance. The authors[6] of the report also note that "When individuals leave for other, even perhaps better, positions, it may be said that they have not lost as individuals, but the University is weakened rather than strengthened." Since one goal of the ADVANCE is strengthen the University through building a critical mass of women scientists, when they leave this goal of ADVANCE is not met. Importantly, as a testament to the long-term character of institutional change, in 2009, three new women faculty members were hired by the College, including the first woman ever in the 100 year history of the Department of Mechanical and Aerospace Engineering.[31]

Georgia Tech, which is an outlier among the Cohort 1 institutions, did not emphasize recruitment among its main objectives. Given Georgia Tech's relatively high proportion of women on the faculty at the beginning of the ADVANCE grant, their focus on building women's leadership capacity seems to be a logical strategy. Accordingly, Georgia Tech implemented family friendly policies and practices, and developed strategies aimed at elimination of subtle gender, racial, and other biases in promotion and tenure decisions,[16,32] which of course can be seen as an important recruitment tool. In the short term of the ADVANCE project, the result was a net loss of women on the engineering faculty at Georgia Tech. However, the impact over the longer term appears promising.

Indeed, for outcomes past the five-year ADVANCE period, Georgia Tech was able to reverse its negative trend by increasing the overall number of women faculty from 21 in 2001 to 23 in 2009. Conversely, in the post-ADVANCE period, NMSU and the UC at Irvine continued lagging behind their ADVANCE peers. Interestingly, the positive gains at the University of Washington almost disappeared during the post-ADVANCE period. Specifically, after increasing the number of woman assistant professors from seven in 2001 to twelve in 2006, the college of engineering

experienced a decline to nine women faculty members in 2009. Only three Cohort 1 institutions, University of Michigan, University of Wisconsin, and University of Colorado at Boulder, continued their overall positive trend by building on ADVANCE gains and doubling the number of women assistant professors as compared to the start of ADVANCE efforts.

Recruitment Initiatives: Defining and Measuring Success

In this paper, we conducted a comparative analysis of recruitment efforts at seven public universities with Ph.D. granting colleges of engineering that implemented the ADVANCE IT programs between 2001 and 2006. We used the changes in the absolute numbers of full-time tenure-track women faculty in the engineering colleges as an indicator of recruitment outcomes. Based on this initial assessment we divided the ADVANCE institutions into two groups: the institutions that showed stronger performance and those that performed weaker with regard to the number of women faculty at assistant professor rank. Below, we summarize our main findings, provide an initial interpretation of the observed changes, and suggest directions for future research.

Our major finding is that recruitment efforts appear to have the strongest outcomes when they are adopted as an explicit part of an overarching strategy for institutional transformation. This is a major impetus behind the ADVANCE program, and one that bears out at the institutional level. Drawing on Fox,[10] we find that the various strategies adopted by most ADVANCE schools are interrelated, and are most successful when implemented as such. Indeed, being able to integrate strategies for recruitment directly with those aspects of institutions that make women more likely to succeed appears to be both appealing to job candidates, and more likely to produce overall change in both the retention of women faculty and the likelihood that women will continue on to leadership positions.[33] Accordingly, we suggest that successful ADVANCE programs are both comprehensive and take into account institutional context in all initiatives pursued as part of the ADVANCE program. In this respect, it is quite possible that less visible aspects of recruitment, such as departmental reputation and climate, undoubtedly play an important role in the success of ADVANCE programs.

Second, it seems clear that institutional change has to be both an on-going effort, and one that has the support of institutional leadership as well as members of the faculty. Institutional change is a slow process, and one that requires constant attention and monitoring. Part of this process includes having on-going support for ADVANCE projects, having the ability to develop and disseminate comprehensive information across the university and within the larger STEM community, and having faculty members work "on the ground" shaping and cultivating diversity. This is apparent not only among those schools that implemented comprehensive strategies under ADVANCE, and/or had programs in place prior to the start of their NSF grant, but also with respect to the number of women on the faculty at ADVANCE schools in the aftermath of the grant period.

We believe that in order to understand why some ADVANCE institutions appear to be more successful than others in recruiting women engineers, future studies focusing on recruitment of junior faculty should 1) account for the faculty turnover due to promotions as well as voluntary and involuntary departures; and 2) evaluate and compare recruitment initiatives and outcomes

over a longer time frame. Moreover, future studies should also provide us with a better understanding of the specific recruitment strategies and initiatives, including whether some initiatives work better in some disciplines than others. Finally, in comparing various initiatives, future research should also explore some additional factors that may play an important role in recruitment efforts, including the school's reputation for promoting diversity, being family friendly, and aligning its recruitment, retention, and promotion efforts across various institutional levels, starting with highest levels of administration and going all the way down to the day-to-day operations of academic departments.

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Endnotes

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i The concept of critical mass is related to the gender-ratio indicator. In her pioneering work Kanter[34] distinguished

ii Based on our analysis of the 2006-2009 supplementary recruitment data available at the UW-Madison website, this slower growth does not mean a decline in recruitment efforts. In fact, seven junior women faculty accepted job offers at the College of Engineering during the post-ADVANCE period.[35] Thus, in this case, the lack of growth may reflect a balance between recruitment efforts and faculty turnover, including both voluntary and involuntary departures as well as promotions to associate.