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Faculty Gender Balance: Best Practices for Undergraduate Institutions

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ABSTRACT

Recruiting and retaining women in the STEM faculty ranks has been a US national priority for many years. Recent research, sponsored by the NSF ADVANCE program, was performed mostly by doctoral institutions. However, for small undergraduate universities, the resulting challenges and decision frameworks are likely to be different. The prevalent recommendations need to be re-evaluated and re-interpreted for relevance and applicability.

Multiple change agents have been identified; however, the primary success factors are a set of formalized processes in: (1) teaching, scholarship and service; (2) mentoring; and, (3) leadership. There is also a strong connection between gender progress on the faculty side and improving the pipeline of female students. To effectively intervene on the supply side, it is important to have networking, mentoring and role modeling processes that match student demographics and global sociological conditions.

This paper describes our best practices in the context of an undergraduate institution. We have demonstrated that even with limited resources and no external funding, it is possible to improve the community culture and climate. Tangible strategies and initiatives aimed at enhancing the climate are presented: (1) administrative leadership commitment; (2) grants and endowments; (3) faculty development resources; (4) workshops that mirror industry successes; (5) early and mid-career planning; and, (6) recruiting and retention of female faculty.

KEYWORDS

Gender balance; female faculty; recruiting; student retention

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INTRODUCTION

Recruiting and retaining women in the science, technology, engineering and mathematics (STEM) faculty ranks has been a US priority for many years. The National Academy of Engineering (Cady, 2008), the National Research Council (2006) and the American Council on Education (Eckel, 2001) have led strategic initiatives in areas such as recruitment, transformation and metrics. Institutional transformation grants have been supported by the National Science Foundation's (NSF) Advancement of Women in Academic Science and Engineering Careers (ADVANCE) program (Constant, 2008; Posey and Renner-Martinez, 2006; Layne, 2005). In addition, other work, funded largely from internal sources (Hawkes et. al., 2007; Schrader et. al., 2006; Hopkins, 2006), has also been reported. The grantees pool, sponsored by NSF ADVANCE (2010), is comprised largely of doctoral and top tier institutions. Research on the findings from these efforts is well-published. As opposed to top tier doctoral institutions, for many undergraduate universities, the resulting challenges and decision frameworks are likely to be different. Hence, adoption of best practices needs to be re-evaluated and re-interpreted for relevance and applicability.

The University of Hartford is a small undergraduate institution that relies almost exclusively on income from students in the form of tuition fees. Therefore, there is a need for managed growth and improved retention by fostering unique and distinctive degree programs. Cultivating and supporting a vibrant community of academic scholars is an important element of this strategy particularly in the STEM area.

The STEM-related offerings are primarily concentrated in the College of Engineering, Technology, and Architecture (CETA) and the College of Arts & Sciences (A&S). CETA supports ten STEM-related degree programs, while A&S has seven with 500 and 170 students, respectively. The size, demographics and gender diversity varies widely between programs; however, student gender mix parallels that of other US institutions offering similar degrees. While biology, chemistry, biomedical and environmental engineering feature healthy female-to-male ratios (22-65%), the female populations in electrical, mechanical and civil engineering as well as physics and computer science are below 15%.

The authors believe that gender progress on the faculty side can improve the future supply of female students. Hence, it is important to have faculty recruiting, networking, mentoring and role modeling processes that foster the desired change in student demographics. More specifically, this requires that the principal focus of faculty be undergraduate education, a challenge in STEM fields where the traditional emphasis is on research.

ADVANCE RESEARCH FINDINGS

The NSF ADVANCE program is a national strategy designed to broaden participation in the STEM workforce. The long-term goal is to advance the status of women in academic science and engineering, and NSF more specifically describes its objective as:

> '…to increase the representation and advancement of women in academic science and engineering careers, thereby contributing to the development of a more diverse science and engineering workforce. ADVANCE encourages institutions of higher education and the broader science, STEM community, including professional societies and other STEM-related not-for-profit organizations, to address various aspects of STEM academic culture and institutional structure that may differentially affect women faculty and academic administrators. Since 2001, the NSF has invested over $130M to support ADVANCE projects at more than one-hundred institutions of higher education and STEM-related not-for-profit organizations…'
> (NSF ADVANCE, 2010).

There are over 3,500 higher-education institutions in the US, most of which offer one or more STEM programs. Since the first cohort in 2001, NSF contracts have historically been concentrated in the Top 100 research universities. The one exception was 2003, which featured a number of smaller institutions.

The principal strategic activities undertaken by ADVANCE grantees were to: (1) improve workplace climate; (2) attract and retain female faculty/students; (3) transform departments; (4) stimulate partnerships in scholarship and teaching; (5) measure and report progress; and, (6) promote advocacy and active research collaboration. A comparison of the funded projects reveals many similarities structured along these lines:

- Comprehensive self-study
- Basic research on gender topics
- Visiting scholars
- Coaching constituencies
- Best practices training from industry
- Focused workshops and conferences
- Policy and procedure modification
- Collaborative research incentives
- Networking, mentoring and role modeling
- Department transformation
- Position funding (ADVANCE chairs)
- Leadership development
- In-house gender equity endowments
- Interventions for faculty
- Balance work-life issues
- Recruiting initiatives

While multiple change agents were identified, it was the departmental climate that most strongly correlated with successful institutional transformation. The leading departmental success factor appeared to be a set of formalized processes in: (1) teaching, scholarship and service; (2) mentoring; and, (3) leadership. A secondary

factor was a faculty support infrastructure capable of fostering collaborations and reducing isolation. The third factor is an introspective capability that broadens the understanding of issues affecting women expressed in the form of better policies and procedures.

Now that ADVANCE programs for the first cohort have been completed, researchers are beginning to assess the degree of transformation that is sustainable. Such transformations are likely to occur over a time span greater than five years (Eckel, 2001). For lasting results, some level of institutionalized funding will inevitably be required. This issue was addressed by Litzler *et al.* (2007) in which seven of the nine colleges and universities that received grants in 2001 were surveyed. The purpose of the work was to gauge the presence of stable financial support for one or more successful ADVANCE project elements. The three main findings were: (1) leadership change at the top decreased the likelihood of success (2) there was no direct correlation to the level of public funding, and (3) transformation varied depending on such factors as administrative support and advocacy by faculty leaders. We could not help but notice the success of some universities in the mid-range of financial assistance. The lower and upper tiers were unable to establish and maintain internal efforts. For smaller undergraduate institutions, it appears that financial constraints may inhibit progress even in the presence of perceived value and backing by top administrators.

UNIVERSITY OF HARTFORD EFFORTS

We now examine and contrast the above ADVANCE findings in light of the best practices developed at the University of Hartford. The tangible strategies and initiatives aimed at improving the climate are grouped into four areas: (1) recruiting and retention of female faculty; (2) funding options; (3) departmental climate; and, (4) university leadership.

Recruiting and Retention of Female Faculty

Within CETA STEM programs, 23 full-time faculty teach core engineering and technology courses. In 2005, there were three female faculty members, one in each of three departments. One was tenured and had achieved the rank of full professor. Two others were assistant professors and on tenure-track. The total number of faculty has remained relatively constant since 2005 and is not projected to increase. In support of the University's mission, values and strategic plan, the focus in STEM faculty diversity is to recruit and retain women as new positions and vacancies arise.

Since 2005, six faculty searches have taken place to fill open engineering positions. In three cases, CETA was successful in recruiting a woman. To date, all three have been retained as assistant professors and are progressing on tenure-track. Consequently, in the last five years, the number and percentage of female engineering faculty has doubled from 3 (13%) to 6 (26%). Meanwhile, of the two incumbent female faculty members, both have been tenured and promoted to the rank of associate professor with one appointed department chair. Table I summarizes the gender balance progress in CETA by contrasting AY 2005-06 with AY 2009-10.

Table I. Gender Progress in Faculty Ranks

Female Faculty (Total faculty = 23)	**Academic Year**	
	2005-06	
	No. of women	**Women as % of total**
Tenured/tenure-track	1/2	4/8
Rank: Assistant/Associate/Full	2/0/1	8/0/4
Chair: Civil/Electrical/Mechanical	0/0/0	0%
	2009-10	
Tenured/tenure-track	4/5	17/22
Rank: Assistant/Associate/Full	3/2/1	13/9/4
Chair: Civil/Electrical/Mechanical	0/0/1	33%

The recruitment of three female faculty from 2005-10 can be traced to three primary factors. First, the Provost's Office assisted the departments by paying for additional magazine advertisements to increase the number of women applicants. While the gender mix of the overall candidate pool was not known, women were finalists and granted campus interviews in five of six cases. In our opinion, the percentage of women who applied was higher than their representation in national undergraduate ranks owing to the growth in doctoral graduates who are temporary visa holders, many of whom desire to remain in the US. Of the last six women hired since 1992, five were international Ph.D. graduates who received their degree domestically. Secondly, the search committees focused on applicants who expressed a strong interest in teaching as well as research, which in retrospect seemed to favor women candidates. As a result, five women were finalists out of a total pool of fifteen. Third, a promising woman ended up second to another in one appointment process and would not have received an offer; however, the Provost agreed to create an additional position which enabled us to seize the opportunity. All of the recent female faculty hires serve as active role models in open house events and orientations. It is encouraging to note that since 2006, the number and percentage of female undergraduates entering the College has been increasing, altering a trend that was flat for many years.

Funding Options

To create a successful track record of scholarship, new engineering faculty need to establish a technical research focus including journal publications and a supporting network of peers and collaborators. Start-up packages, customarily offered by research institutions, are not provided; consequently, new faculty must aggressively pursue funding from internal and external sources. In a primarily undergraduate institution with heavy teaching loads, the most effective research strategy is to integrate and leverage grants that enable faculty to receive course

releases. To assist with the research, it is also important to cultivate a cadre of undergraduate and graduate students in a non-Ph.D. environment.

The University offers a number of internal research and pedagogical grants, fellowships and prizes. This pool of funding is an effective way for all faculty to initiate work prior to receiving support from external sources. While awards are for the most part modest and the work must be accomplished within one academic year, they have been persistent and stable line items in the budget. As shown in Table II, female engineering grantees have been successful in winning awards over the last eight years.

Table II. Internal Grants for Faculty

Name	Awards made to women	Description
Vincent B. Coffin grant	3	Offsets the loss of income for summer teaching
Summer stipend	2	Offsets loss of income for faculty from summer teaching
Faculty Center for Learning & Dev. Grant (not active)	3	Supports course re-design
Greenberg Junior Faculty grant	3	Supports scholarship for early career faculty
Belle K. Ribicoff Junior Faculty prize	0	Awarded to one junior faculty each AY with one of the awardees from the prior 3 years chosen to be Belle K. Ribicoff professor
Innovations in Teaching award	1	Recognizes innovative assignments that impact student learning
Engaged Learning Fellow	1	Supports engaged learning including service learning, problem-based learning, and learning communities
International Center Faculty grant	1	Supports internationalization of course content and professional development
WELFund grant	6	Supports initiatives to enhance women's education and leadership

The funding sources shown in Table II support the community as a whole with some emphasis on tenure-track faculty. An exception is the Women's Education and Leadership Fund (WELFund), which has evolved into the primary means for advancing gender-based initiatives irrespective of academic status. WELFund is one of a few organizations that provides direct financial support to faculty, staff and students. Since the Director reports directly to the University President, access to decision-makers and other people of influence is made easier. Established in 2006, its purpose is to: (1) enhance the education of women; (2) advance women as

scholars and as the subject of scholarship; (3) cultivate and sustain women's leadership skills; and, (4) increase awareness about women as individuals and in communities. In the four years since its founding, the program has funded 62 projects. Individual grants have ranged from $2,000 to $10,000, and any student, staff or faculty may apply, regardless of gender.

WELFund projects selected to date have been treated as experiments, receiving funding based on their perceived worth to both individuals and groups. In light of anecdotal and qualitative responses to particular grants, the WELFund board of directors and staff are becoming increasingly strategic in their investments. In the future, faculty partners will collaborate in designing measurements whereby outcomes and impact can be articulated through data.

The University community has come to rely on WELFund as demonstrated by the following projects. Three recent grants, each involving female undergraduates, supported engineering research by female faculty in the areas of acoustics, transportation, and microprocessors. For many students, this was their first opportunity to participate in funded research, write peer-reviewed content and network with professionals in the field.

Engineering faculty/staff have pursued WELFund monies for recruiting and retaining female students by creating experiential modules of various engineering specialties and supporting University-magnet high school collaboration. Female students received funding to create and sustain SWEET Day (Society of Women Engineers Educating for Tomorrow), which has been successful in encouraging prospective female students and their parents to consider engineering as a career.

A female engineering student was awarded two successive grants to support a collaborative project between the University, Engineers Without Borders (EWB), and the Indian village of Abheypur. A multidisciplinary team with two female students installed a solar-powered ground water pump and tanks. A follow-on project funded the design and implementation of a rooftop rainwater harvesting system that now provides a source of water during the monsoon season when the solar pump is not effective.

In another project, a series of associations and activities were funded that connect women students with staff, faculty, and alumnae, providing opportunities to discuss work/life balance, health, financial acumen, and more. An outside speaker series invited accomplished women scientists and engineers such as Jocelyn Bell Burnell**,** British astrophysicist, to present their experiences in preparing for a STEM career. In AY 2008-09, WELFund began a pilot program, the Laura Johnson Initiative for Women Leaders, and brought together fifteen faculty and staff for monthly professional development workshops.

Departmental Climate

As mentioned previously regarding ADVANCE findings, the departmental climate most strongly correlates with successful institutional transformation. The leading success factors are formalized processes in: (1) teaching, scholarship and service,

(2) mentoring, and (3) leadership. In CETA, new tenure-track professors are assigned a senior faculty whose role is to provide guidance and feedback on progress towards a successful tenure. Mentoring for leadership is not part of peer mentoring as we know it. Moreover, formal multiple mentors are never employed. The mentoring literature (Yen et.al., 2005) has shown that faculty can benefit from multiple mentors; therefore, a good mentoring process should create an environment where 'giving and receiving guidance are embedded in the values and norms of the organization (Sands et. al., 1991). WELFund supported a pilot initiative that included multiple mentoring as well as leadership and professional development for junior female faculty. The objective was to establish a more systemic approach to mentoring and foster a supportive climate.

New faculty members bring fresh perspectives to their respective programs, departments and colleges. They are typically well-suited to contribute in the following ways: currency in educational technology, developing new/improved courses, and integrating topical threads across the curriculum. While the benefits of strong educational leadership are apparent, faculty who contribute in this area often do not receive appropriate recognition. Contrary to this practice, supported junior faculty were successful in receiving internal grants to evaluate new classroom technology.

Supported junior faculty established a research focus including a track record of publications and a network of peers and collaborators. They were successful in obtaining research funds during the first academic year. One received an external grant, in part due to the mentoring by an assigned and motivated faculty member in the same program. Such proactive and quality mentoring is not common. Ownership of tenure-track success within any department is less than desired. The likely causes are heavy teaching and service loads, exacerbated by a mentor's need to sustain their own research area. Consequently, senior faculty exhibit insufficient professional interest in junior faculty development. This is somewhat buffered at the University level by a 'new faculty' first-year orientation. However, a mentoring gap continues to exist for junior faculty and associate professors.

A majority of engineering faculty do not seek opportunities in academic leadership. In contrast, the junior faculty have become quite active in open house events and first-year orientation sessions, and ultimately will have to decide what other role(s) to accept. For example, supported by targeted funds one went to leadership training while another attended a first-year student retention workshop.

University Leadership

Curricular evolution in doctoral institutions is typically driven by emerging trends and technological opportunities, while the needs of regional industries and local programs are more influential among primarily undergraduate institutions. As advanced degrees become a professional requirement, baccalaureate graduates will be expected to pursue advanced studies early in their career. Hence, more undergraduate STEM programs will serve as feeders to doctoral institutions. The future supply of graduate students and, ultimately, faculty will become more dependent on these teaching universities.

To this end, the University has taken steps to strategically address our emerging role in the graduate pipeline by formalizing a shared values statement 'Committed to Community':

> 'At the University, we are committed to community. We are an academic community that values integrity, curiosity, creativity, excellence, responsibility, and accomplishment. Enriched by our diversity and our engagement with one another, we take pride in our shared traditions and experiences. We are dedicated to building a culture that respects all of its members and celebrates their contributions as we work together to strengthen our community'
> (Harrison, 2009).

In the spirit of the above values, a presidential commission on the status of women was recently formed to expand the opportunities for all women and men on the faculty and staff. CETA is well positioned to meet this challenge with recent female faculty hires as well as a healthy array of student-oriented activities. We have demonstrated that even with limited resources and no external funding, the adoption of some best practices can improve the culture and climate. The recent increases in female engineering enrollment may be an indicator of future success provided in-house resources are sustained.

CONCLUSIONS

ADVANCE grants have funded five-year transformation efforts across four cohorts totaling 38 institutions with the majority of the funding being awarded to large research universities. While the efforts to measure the degree of positive transformation and post-award internal funding are just beginning to be published, more cohort cycles are required for a clearer picture to emerge.

In the absence of such external funding, significant progress has been made within the engineering disciplines of CETA to improve gender balance in the faculty ranks. During the past five years, two female faculty were promoted and tenured. In addition, three new female faculty were successfully hired, one in mechanical and two in electrical engineering, both areas that typically have low representation. On a broader front, our community has become effective in using modest internal grants such as the WELFund to support gender specific initiatives. The scope and breadth of efforts afforded by ADVANCE goes far beyond what we have been able to accomplish, and many best practices cannot be implemented at the University of Hartford given the resource constraints. However, it is likely that some incremental improvement in gender balance will continue to be made, and in some ways, our progress may be more sustainable because the motivation, ownership and investment came from within.

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