AC 2011-198: CREATING A CULTURE OF SUCCESS FOR WOMEN IN STEM - THE ADVANCEING FACULTY PROGRAM AT LOUISIANA TECH UNIVERSITY

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Creating a Culture of Success for Women in STEM - the ADVANCEing Faculty Program at Louisiana Tech University

The ADVANCEing Faculty Program in the College of Engineering and Science at Louisiana Tech University is a four-year NSF ADVANCE PAID project that utilizes a college-wide, systematic, sustainable approach for advancing women faculty in STEM. The Program aims to educate all faculty and specifically enable women faculty to participate in a supportive and nurturing work environment, thus enhancing job satisfaction, research productivity, and retention. It utilizes Social Cognitive Career Theory (SCCT [1]) as an underlying theoretical framework, which suggests that self-efficacious beliefs strongly influence a person's job performance and career persistence and are shaped by 1) personal success experiences, 2) exposure to successful role models, 3) social and verbal persuasive communication, and 4) maintaining a positive work environment. Based on this theoretical framework, an analysis of institutional data and a detailed climate survey, the goals of the ADVANCEing Faculty program are to:

1) strengthen the gender-neutrality of the **climate** by reducing isolation of women faculty and instituting faculty training through monthly Faculty Lunches, a Mentoring Program and new productivity-enhancing Worklife Policies;
2) increase the **retention** of women faculty through implementation of a Grant Writing Program, Career Networking Awards and exposure to role-models through a Distinguished Lectureship Program;
3) enhance **promotion and leadership** opportunities for female faculty in through an Executive Coaching Program, Career Development Workshops and a Mentoring Awards Banquet.

The Office for the Advancement of Women in Science and Engineering has been established to provide the administrative framework for the project. Unique aspects of this project include opening up programs to male and female audiences, efforts to institutionalize programs from the beginning, and seeking opportunities to build early on-campus partnerships. This paper will review successes and lessons learned as the project nears its halfway point, including feedback from formative assessments, as well as plans and adjustments for years two through four. In addition, the paper contains recommendations on aspects of the program that can be adopted by other institutions.

Background

Louisiana Tech University is a medium-sized state university with an increased emphasis on high-quality interdisciplinary research in key focal areas over the last 20 years. The College of Engineering and Science emphasizes and utilizes an interdisciplinary, team-based model in all aspects of administration, education, and research [2], [3]. The college incorporates engineering, engineering technology, computer science, math, chemistry, and physics in a single administrative structure, which emphasizes collaboration and removes many traditional systematic hurdles. The practical structure of the college demonstrates a more collaborative, versus competitive, work environment than many institutions. The leadership is somewhat familiar with gender issues as they relate to undergraduate education, faculty retention and success. The college has been successful with a number of relevant programs, employing for approximately a dozen years an integrated model for the first two years of undergraduate

engineering education [4], [5], [6], [7], [8], and [9]. These efforts have reaped significant rewards in student success, retention, and satisfaction.

Specific Barriers to Women's Advancement at Louisiana Tech University

An analysis of data from the years 2000-2008 suggested several barriers to the advancement of women faculty in STEM in the college. Discrepancies in terms of salary, resources, and other measures of compensation do not appear to be issues at Louisiana Tech University. Salary data at the assistant professor level was identical for men and women in both engineering and science; at the associate and full professor level, salary data in the sciences was statistically similar. An analysis of start-up packages showed women received 22% larger packages (in terms of dollar value) than their male counterparts. While there has been and continues to be a negative disparity in the total number of women in STEM fields in the college, the college leadership has exerted concerted efforts over this time period to address this problem which have yielded significant gains increasing both the total number (+57%) of tenure-track women faculty and the number of disciplines (from 18% to 45%) which have at least one tenure track female faculty member. Only two women have held formal leadership roles in the college during this time period.

A faculty survey adapted from similar ADVANCE surveys at University of Wisconsin-Madison and University of Rhode Island identified several areas for potential improvement, including overall job satisfaction related to working **climate**, **retention**, and **promotion**. Most positive climate characteristics rated lower for women and negative climate dimensions rated significantly higher for women. Thus, women experience a less welcoming and more demanding work environment. This situation is of particular concern as research shows these issues have the greatest apparent impact on women, who often under-represent or altogether deny experiences of discrimination. [10]

The ADVANCE project has implemented a concerted systematic approach to address the issues of climate, retention/promotion and professional development, with the overall goal of implementing programs which will increase employee satisfaction of both sexes and enhance retention rates, with a focus on performance and sustainability.

Theoretical Framework

Social Cognitive Theory [11] and the extension of this theory to career development [1] and work satisfaction [12], [13] provide the conceptual framework for this project. At the foundation of this theoretically-derived framework is the belief that a person is both an interpreter of contextually-bound experiences and agent in changing those experiences. As such, one's context or environment plays a central role in moderating one's career choices and goals, and ultimately, work satisfaction. Bakken, et al, proposed [14] that research career development in the medical field be studied from a social cognitive perspective [1], [11] that considers the multiple environments central to one's life and work. Relevant to this project, the authors advocated that attention be given to the multiple environments of research, academia and home/family life that create numerous and often competing expectations and demands on one's work life. These multiple environments interact with personal characteristics (e.g. gender, race) to influence career behaviors, confidence in one's ability to do research (research self-efficacy), and the outcomes one expects from a research career (career self-efficacy). These factors, in turn, predict

one's initial or sustained interest in a research career pathway. This theoretical framework is important because it recognizes the role of personal agency and personal characteristics in the career development process. The authors suggested that interventions to increase the number and effectiveness of researchers in an academic environment be focused on 1) reducing role conflicts imposed by multiple environments, 2) providing continuity of training efforts, 3) creating a positive and rewarding mentoring culture, 4) and incorporating and evaluating efforts to increase one's research self-efficacy beliefs.

Not only must a person be interested in a career pathway and provided with the optimal conditions to pursue a career pathway, she or he must be supported in their work environments to achieve and maintain a satisfying work life. Lent and Brown [13] initially proposed a model for work satisfaction that extends their scholarship on Social Cognitive Career Theory [1]. In this process model, the authors posit that work satisfaction is influenced by 1) one's affective traits, 2) participation in goal-directed activities, 3) environmental supports and resources, 4) work self-efficacy and 5) both expected and received works conditions and outcomes. The relationship between environmental supports and resources and work satisfaction is both direct and indirect. Indirect factors include one's participation in and progress toward goal-directed activities as mediated by work self-efficacy and work conditions and outcomes. The advantage of this work satisfaction model is that it acknowledges both subjective and psychological forms of well-being along with social and cognitive factors that influence work satisfaction. In other words, it acknowledges one's satisfaction toward life and negative or positive feelings in concert with one's desire for self-actualization, meaning and purpose in life within the context of the work environment. These forms of well being are necessary for creating salience between a woman's personal goals and identities and her roles within the work environment. Goal-relevant supports and resources within the work environment, therefore, are important for promoting work-life balance and job satisfaction [13], [14]. Lent and Brown [13] proposed that interventions be targeted to those that are likely to impact work satisfaction, such as helping an employee overcome perceived obstacles to and make progress toward achieving her goals, implementing strategies to foster self-efficacious beliefs, creating salience between work roles and work goals, and enhancing the meaning-making potential of one's work.

Considering these various influences on work satisfaction and the intervening areas suggested by Bakken, et al, [14] and Lent and Brown [13], our project is focusing on interventions that will most likely result in work satisfaction and ultimately influence the retention of women in STEM fields. More specifically, based on a baseline focus group survey of faculty, our ADVANCE initiatives target climate issues, mentoring, and education as means of providing environmental supports and resources to promote work satisfaction and retention of women and men in the college. A concerted development of formal mentoring programs, professional/leadership development programs and institutional policies for life transitions should yield gains in women's satisfaction and therefore, retention and promotion. As an ADVANCE PAID (Partnerships for Adaptation, Implementation, and Dissemination) project, we are required to adapt best practices in each of these areas (climate issues, mentoring, professional/leadership development for faculty and administrators, institutional policies) from funded ADVANCE Institutional Transformation projects as the means of achieving the goal of enhancing work satisfaction and retention.

Program Overview

The project established the Office for the Advancement of Women in Science and Engineering (OWISE) to provide the administrative framework to oversee the various ADVANCE programs. Additional duties include obtaining tracking data to monitor the overall success of the program, and providing a formal network to provide review for any needed changes on a yearly basis. The Office is advised by both and Internal and External Advisory Board which meet several times per year to review and provide direction on issues, initiatives, assessment findings and progress toward project goals and outcomes. Based on the type of interventions suggested previously [15] (reducing role conflicts, providing continuity of training, creating a positive and rewarding mentoring culture and incorporating efforts to increase one's self-efficacy beliefs) and feedback from the required NSF pre-proposal survey (which suggested a focus was needed on climate, retention and promotion/leadership), the project elected to focus on programs that would build personal success experiences, exposure to successful role models, social and verbal persuasive communication, and maintaining a positive work environment. After a thorough review of existing ADVANCE projects and programs that matched these criteria, our ADVANCE Project has implemented the following programs to address the issues of climate, retention and promotion/leadership. To address **Climate**: i) Monthly Faculty Lunches provide opportunities for networking, communication about program initiatives and professional development training; ii) Training for Administrators and Faculty educate about climate issues and effective approaches for successfully addressing these issues; iii) a Mentoring Program provides one-on-one mentoring for tenure-track and recently tenured faculty by a mentor outside the faculty member's department; the Program offers initial and on-going training and support for mentors and mentees along with general program oversight; and iv) a study of campus Worklife Policies to support life transitions involving faculty from across campus charged with selecting policies that would be of the greatest value for our campus and faculty. Under the heading of **Retention**: i) a Grant Writing Program features specific training and grant writing support for a variety of federal programs; ii) Career Networking Awards support research-related activities such as visiting potential collaborators, travel to gain additional training or conduct experiment, other research activities for which it is difficult to obtain funding and which support the development of successful grant proposals and overall project development; and iii) a Distinguished Lectureship Program brings in external women in STEM role models to interact with women faculty and students, talk to faculty and administrators, and advance overall project goals. Under **Promotion and Leadership**: i) an Executive Coaching Program provides a yearlong personalized program of goal setting and career planning for mid-career faculty; ii) Career Development Workshops provide more in-depth professional development training on key topics to advance the careers of women faculty; and iii) an annual Mentoring Awards Banquet provides an opportunity for women faculty to recognize both formal and informal mentors who have made a difference in their career success.

Unique Features of the Program

One goal of the OWISE Office has been to 1) leverage the professional development and training resources of the program to increase employee satisfaction of both sexes and enhance retention rates, with a focus on performance and sustainability; and 2) encourage a supportive and accepting environment for the project and its programs. To achieve these aims, the ADVANCE project has sought to make its activities as inclusive as possible, while abiding by the rules and requirements of the funding agency. The approach has been to develop programs that address

the issues for female faculty and then open those programs to all faculty inside the college, as well as faculty outside the college, where appropriate. Research supports the notion that including male faculty in some of the programs should i) increase participation of female faculty by decreasing the perception that they need "special help" in order to be successful, and ii) decrease the perception that female faculty had access to special assistance which was not available to everyone [18]. While we anticipate that both male and female faculty will benefit from these programs, based on the data analysis, we anticipate that female faculty will likely benefit most. By expanding some programs to faculty outside the college, we hope to educate the larger campus community about climate issues facing women in STEM, as well as forge long-term partnerships with other groups on campus who are interested in issues addressed by the project. Specific examples of this approach include inviting non tenure-track women inside the college and tenure-track/tenured women faculty outside the college to attend monthly Faculty Lunches (funding is provided by the college, not from grant funds) where professional development modules are delivered. These modules are often repackaged and delivered to women graduate students, as part of the twice monthly OWISE Graduate Seminars. The Mentoring Program and a three-part NSF webinar series (part of the Grant Writing Training Program) were opened to all faculty in the college (given that there is no cost involved in adding these participants). NSF Day held in Fall 2010, also part of the Grant Writing Training Program, was open to all interested faculty in the state and region and consequently drew over 200 attendees (no grant funds were expended for non-ADVANCE faculty; the program was co-sponsored by the university research office and NSF covers the participation costs of their personnel).

The ADVANCE Program is also seeking ways to institutionalize as many of its programs as possible, in order to help ensure that they remain after the funding is concluded. By establishing the OWISE Office at the beginning of the project and assigning it administrative responsibility for the ADVANCE Programs, permanent administrative oversight is built-in. While not all programs can be funded from the modest OWISE budget at the conclusion of the project, some of the programs and modified versions of others should be able to be supported in the long-term in this fashion. In addition, efforts are being made to grow the OWISE budget each year of the project to assist in sustaining activities for the long-term. Examples include the Mentoring Program, periodic Faculty Lunches, and professional development training seminars, as well as some of the workshops (by partnering with other groups on campus).

Lastly, the ADVANCE Project is seeking to partner with other projects and organizations on campus to co-sponsor some of its programs and initiatives. Examples include NSF Day; inviting experts from around the campus to deliver professional development training in areas of their expertise; and partnering with other centers, grants and/or endowed projects to sponsor Distinguished Lecturers. Future efforts include offering specific segments of Career Development Workshops to wider audiences on campus, where appropriate, and delivering professional development modules to broader campus audiences as part of existing university professional development seminar series. All of these efforts will provide professional development training to broader campus audiences which should in turn assist in improving campus climate and awareness of gender-related issues. In all instances, no grant funds will be spent on non-eligible participants or activities.

Assessment Overview from Year 1

A mixture of quantitative and qualitative measures were used to collect baseline data during the first year. They focused on evaluation planning efforts during the first year of the grant; findings from a survey and interviews administered to college faculty and administrators; and institutional data related to the goals of the Program. Because the program recently began, data are not yet available regarding its impact on college faculty and administrators.

Baseline data suggest that female and male faculty generally had similar (very positive) attitudes and opinions about their experiences in the college as the program was getting underway, although some differences emerged. Survey results suggest that most female and male faculty appear to have similar levels of job self-efficacy (i.e., no statistical differences were found between men and women either on individual items or in their mean scale scores). This finding was not anticipated, but may be related to the fact that eighty percent of women faculty are either tenure-track or tenured for less than three years. Research suggests that the cumulative effect over time of gender bias (accumulation of disadvantage) results in increasing discrepancies between male and female faculty over time [19]. Other research suggests that women who have progressed into more senor leadership roles do experience more bias [20]. Additional tracking of job-related self-efficacy over time may reveal additional insight.

Similarly female and male faculty indicated similar levels of job satisfaction (including overall job satisfaction; satisfaction with specific elements of their job such as the opportunity to collaborate with other faculty and the amount of social interaction with members of their program) and were equally likely to report that if they had to do it over again, they would accept their current position. Female faculty were slightly less likely (55% versus 68%) to strongly recommend their program as a place to work than male faculty. However, very few respondents (either male or female faculty) did not recommend their program as a place to work. As a group, female faculty were less likely (67% to 80%) than male faculty to report being very or somewhat satisfied with the level of intellectual stimulation in day-to-day contacts with colleagues.

Other baseline data from Year 1 shows that female faculty were less likely than their male colleagues to i) collaborate on research with colleagues on-campus (55% versus 72%); ii) agree that they had the equipment (36% versus 67%) and space (36% versus 59%) that they needed to conduct their research adequately; iii) be involved in decision-making for the program (50% versus 73%); iv) hold a leadership position within the college (women serve on 1.25 committees on average versus 2.17 for men); or v) obtain research grants (19% versus 27% in the most recent year) although women applied for larger grant amounts than men and the grants they received were larger, on average ($60,381 versus $15,470 for the most recent year). Many of these are directly related to climate issues which showed a difference for women in the pre-proposal survey. These findings suggest that the programs related to climate (Monthly Faculty Lunches, Training for Administrators and Faculty, and the Mentoring Program) are particularly important. While the Faculty Lunches and Mentoring Programs were rolled out in Year 1, the Training for Administrators and Faculty are largely being rolled out Year 2 of the project. One concern is participation, by both female faculty in the Lunches (over the long term) and administrators and faculty in the Training programs. Participation by female faculty in monthly lunches has slightly decreased from Year 1 (50%) to Year 2 (46%). Participation and engagement by administrators in training sessions has been low (18% thus far in Year 2). In

order for these programs to be effective, both audiences must be persuaded to participate and engage. Faculty Lunches which have featured external (non-ADVANCE Program) speakers appear to increase attendance in Year 2 (53% of female faculty attend programs by external speakers versus 46% for internal speakers). The Faculty Lunch program will continue this strategy. Data were gathered at the end of Year 1 on topics of interested for the Faculty Lunches. Additional suggestions have arisen from those participating in the mentoring program. Focusing Faculty Lunches on these topics may also help increase attendance. Secondly, modeled after the successful NSF Day Workshop (which attracted approximately 200 attendees from across the region, including 80% of ADVANCE faculty), well-respected external experts will be used to deliver Training for Administrators and Faculty in Year 2 and the workshops will be heavily promoted. In order to increase interest and participation, the workshops are seeking to partner with other interested audiences on campus, where appropriate, as co-sponsors of the workshops. Reading groups for both faculty and administrators will also be offered which examine, on a rotating basis by group members, key papers and book chapters focusing on climate and other issues raised by the Year 1 assessment report. Early anecdotal feedback suggests that this approach may hold promise for engaging and reaching administrators. This approach has been successfully used with other ADVANCE projects for administrator and faculty training. Lastly, stronger support and involvement of the college leadership will also be sought for these efforts. Feedback from the project External Advisory Board suggests that involving college leadership more fully in the process is key to getting departments and faculty to take climate issues seriously.

Lastly, Year 1 assessment also found that female faculty were more likely to report having fewer (4.58 versus 5.58) and different career goals (including improve worklife balance and apply for a federal grant for the first time, versus apply for a larger federal grant or a non-federal grant) than male faculty. Female faculty were also more likely to report challenges balancing their personal and professional lives (58% versus 27% reported having to forgo professional activities because of personal responsibilities and 58% versus 20% reported that personal responsibilities have slowed down their career progression). Most female faculty are participating in either the mentoring program or the executive coaching program (both of which began at the end of Year 1). Both programs focus on assisting female faculty with goal setting and suggestions for worklife balance. Assessment in additional years could shed light on the effectiveness of these programs in addressing these issues over time.

Based on the assessment of Year 1, the Mentoring Program, Faculty Lunches and workshops appear to be achieving their goals. Slightly over half (55%) of female faculty elected to participate in the Mentoring Program in Year 1 (note 55% of female tenure or tenure-track faculty are tenured). Male faculty also participated in the program. Although the Mentoring Program had only been in existence for a few months, a survey was conducted with female mentees and their mentors and almost all were enthusiastic about the program. A few mentees reported that they had already benefited from participation, citing specific examples related to funding, collaborations, negotiating various barriers, strategies for getting tenure, and having a strong advocate. All participants reported that they have or look forward to soliciting advice about obtaining tenure, proposal writing, networking, time management and teaching.

Most tenured or tenure-track female faculty (83%) attended at least one of the monthly Faculty Lunches and reported that they appreciated both the collegiality at the lunches and content of the professional development presentations. Most of the female faculty (75%) reported having attended one or more career development workshops and were most interested in learning more about topics such as applying for grants, leadership styles, professional self-promotion, problem-solving and gender issues. In comparing interest in career development topics, some key differences were noted between male and female faculty, including interest in worklife policies (17% of women versus 28% of men – the only topic on which more men expressed an interest than women). One possible explanation for this difference might be related to the participation of many female faculty in a previous exercise which solicited input on priorities for worklife policy development on campus. Alternately, it may be that most women already understand campus worklife policies currently in place or do not believe that they will need to use or can use such policies. Other differences in topic interest were noted with respect to interest in learning more about gender issues (50% of women versus 13% of men) and enhancing program climate (42% of women versus 17% of men).

The survey from Year 1 provided some specific recommendations from participants for the project: i) continue to promote the program to faculty and administrators, as some faculty were unfamiliar with program activities or were confused about their eligibility to participate; ii) offer one or more Career Development Workshops on time management strategies with concrete, practical advice about how to manage time, prioritize goals and improve worklife balance; iii) consider hosting occasional group meetings for mentors and mentees, perhaps over lunch, to help the pairs stay on track; iv) provide assistance to support publication of journal articles; v) support initiatives to help faculty expand professional networks both on- and off-campus; vi) develop and propose worklife policies regarding tenure clock stoppage for all faculty on campus; and vii) identify and consider the feasibility of addressing other campus policies that present barriers to junior faculty. The program is working to develop strategies to address these recommendations. Program promotions will now include statements about who is eligible to participate. A Career Development Workshop on time management strategies will be offered in Year 3 (Year 2 workshops are already scheduled). Year 2 of the mentoring program (which starts in spring 2011) will include quarterly lunches for mentors and mentees at the campus faculty center. A Career Development Workshop featuring a national-level worklife policy expert has been scheduled for spring 2011 to present a workshop on campus which focuses on the importance of worklife policies. A worklife policies group that has been studying the possibility of enhancing on-campus early childhood education has been successful in engaging enthusiastic participation from a wide spectrum of campus partners and has good prospects for external funding. Future faculty Lunches and Career Development Workshops will focus on time management and networking. Plans are underway to investigate the feasibility of providing staff support for grant preparation and submission.

Aspects that Can be Adapted by Other Institutions

There are aspects of this and other ADVANCE projects that can be adopted and adapted by a wide variety of institutions interesting in addressing similar issues on their campus. Low cost/high impact projects are always good candidates for adaptation. Given the abundance of excellent mentoring materials developed by ADVANCE Programs, a formal mentoring program is one that other institutions should seriously consider if it is not already in place. The primary

need is for someone to oversee and monitor the program. The wealth of materials provides adequate training for oversight, mentors and mentees. Our mentoring resources (which include a general overview of mentoring, specific training materials for mentors and mentees, assessment tools, and monthly e-newsletters featuring resources and ideas to enhance mentoring relationships) can be found on our website at http://www.advance.latech.edu. Our materials were primarily adapted from those at the University of Rhode Island.

There are any number of professional presentations and related resources targeting issues commonly facing women faculty which have been developed by ADVANCE projects and others. These cover topics such as stereotype threat, implicit bias, networking, negotiation, double bind, evaluation bias, and more. These resources can be utilized in a variety of formats, including lunchtime seminars or reading groups. Maximizing impact by including as broad an audience as possible in such activities and re-packaging activities for related audiences (such as non tenure-track women and women graduate students) also makes sense. Our ADVANCE Faculty Lunch at the Ropp series features a number of presentations on these topics (http://www.advance.latech.edu) and our OWISE Graduate Student Seminars focus on re-packaging these resources for a graduate student audience (http://www.latech.edu/coes/owise_seminar).

In addition to the materials developed for this project, there are other excellent resources. These include the ADVANCE Portal (www.portal.advance.vt.edu), which contains materials developed by and posted on ADVANCE project websites across the country, and the WEPAN Knowledge Center (http://www.wepanknowledgecenter.org), another excellent source of material, research reports, initiatives and organizations pertinent to women in STEM. The National Academy of Engineering's Center for the Advancement of Engineering Education (CASEE), in conjunction with the Society of Women Engineers (SWE)'s Assessing Women in Engineering (AWE) Project, is producing its Advancing Research into Practice (ARP) series, which translates research findings on many these issues into practical recommendations for use in the classroom (http://www.engr.psu.edu/awe/ARPResources.aspx).

Conclusion

The ADVANCE Project at Louisiana Tech University is approximately half-way through a four-year NSF ADVANCE PAID, utilizing a college-wide, systematic, sustainable approach for increasing the impact and presence of women faculty in STEM. As suggested by initial focus group surveys, the project is focusing on the issues of climate, retention and promotion/leadership, using a theoretical framework suggested by Social Cognitive Career Theory. Namely, a concerted development of formal mentoring programs, professional/leadership development programs and institutional policies for life transitions should yield gains in women's satisfaction and therefore, retention and promotion. Based on a detailed assessment of Year 1, the Mentoring Program, Faculty Lunches and workshops appear to be achieving their goals. Climate issues and training for administrators and faculty are the largest issues to be addressed in the remaining years of the program. Strategies to institutionalize programs by opening them to wider audiences and partnering with other campus groups can be used by other institutions interested in implementing programs to address gender issues. In particular, aspects of the program that are good candidates for implementation at other institutions include a mentoring program and professional development seminars, utilizing

ADVANCE materials from this project, as well as other ADVANCE and similar projects around the country.

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