

Gender Differences in Pathways to Faculty Career Satisfaction

Dr. Heather Walling Doty, University of Delaware

Heather Doty is an assistant professor of mechanical engineering at the University of Delaware (UD). Dr. Doty teaches undergraduate courses in thermodynamics, statics, and dynamics, and conducts research on gender in the academic STEM workforce. She is co-PI on UD's NSF ADVANCE Institutional Transformation grant, which aims to recruit, retain, and advance women STEM faculty at UD. Dr. Doty is faculty advisor to UD's Women in Engineering Graduate Student steering committee and a past co-chair of UD's Women's Caucus.

Dr. Robin Andreasen, University of Delaware

Robin O. Andreasen (Ph.D. University of Wisconsin-Madison) is Associate Professor of Linguistics and Cognitive Science. She earned her PhD in philosophy and specializes in philosophy of science, philosophy of social science, and in science and policy. A race and gender scholar, Dr. Andreasen is research director and co-PI for UD's ADVANCE-IT grant.

Dandan Chen, University of Delaware

Dandan Chen is a doctoral student of Evaluation, Measurement and Statistics in the School of Education, University of Delaware, with research interest in school climate, measurement and STEM education.

Gender Differences in Pathways to Faculty Career Satisfaction

Abstract

Women engineers are underrepresented in the U.S. workforce and at all levels in academia – undergraduate, graduate, postdoctoral, and all faculty ranks. One strategy for increasing the number of women engineering students and professionals is to increase the number of women faculty who teach, advise, and mentor students. For this reason, programs like NSF ADVANCE devote resources to improve institutional climate with the goal of recruiting, retaining, and advancing to leadership women STEM faculty.

As part of an NSF ADVANCE grant (NSF HRD 1409472), the University of Delaware (UD) initiated a biannual faculty climate survey in the spring of 2014. Because faculty satisfaction has been linked to retention and advancement, one goal of this survey is to better understand the relative importance of different aspects of faculty work life on career satisfaction and potential gender differences therein.

Based on earlier research⁶ and on data from the UD faculty climate survey, we used path analysis to examine potential gender differences in pathways to career satisfaction. The variables that we explored were formal and informal mentoring, academic resources (e.g., lab space, research assistants), collegial support, effectiveness of the department chair, and transparency of policies and procedures (e.g., for promotion and tenure, family leave).

Introduction

Faculty members satisfied with their careers are more likely to stay at their institutions and advance through the academic ranks⁴. Institutions invest in programs to retain and develop faculty because turnover is expensive, time consuming, disruptive, and negatively impacts morale. In fields where women are underrepresented -- like engineering⁴⁶ and many of the sciences²⁹ -- it is especially important to understand the distinct processes that lead women faculty to job satisfaction. Literature on faculty satisfaction indicates that women are often less satisfied and more prone to departure than men^{2-4,6,12,15,17,31,32,35,38,39}. Dissatisfied faculty are more prone to burnout³⁷, which may partly explain why women faculty are more likely to experience slower career progression than men^{5,7,9,10,16,22,23,28,30}. Research into career satisfaction is an essential first step toward understanding how to improve retention and advancement of faculty.

Career satisfaction is a multifaceted construct that includes a number of possible factors such as: salary, workload, resources, access to networks and mentoring, collegial relationships and support, respectful treatment on the job, etc. But which factors are most important? How are they related? To explore these questions we conducted a study that builds upon the work of Bilimoria, et al.⁶. These researchers developed a conceptual model to understand career satisfaction for men and women faculty based on research indicating that perceptions of institutional leadership, institutional mentoring, internal academic resources, and internal relational supports are important factors.

Our study was conducted as part of UD's National Science Foundation ADVANCE grant. This five-year grant aims to recruit, retain, and advance into leadership positions women faculty in STEM and the social sciences. We chose to build off the work of Bilimoria, et al. because their model for faculty career satisfaction directly relates to two key elements of our ADVANCE program: formal faculty mentoring and activities and networking for department chairs. These elements are described in the following section.

Our investigation of faculty career satisfaction had two stages. First, we re-tested the model from the earlier study⁶ to explore how well their results would transfer across institutions. Second, we added a new dimension – transparency of policy and procedure – to the model and tested it for men and women faculty. Model constructs, methods, and prior experimental results are described in the following section.

Factors that contribute to faculty career satisfaction

Institutional leadership refers to the effectiveness of the department chair. Department chairs – as distributors of resources and shapers of climate – have significant influence on faculty job satisfaction^{1,3,4,6-8,11,34}. Research suggests that women are sometimes excluded from the inner circles of power within a department, and thus, may not benefit from chair leadership to the same extent as men. This factor is especially significant to our study because at our institution the ADVANCE team works with department chairs as a means of improving departmental microclimates to foster faculty job satisfaction. Department chairs receive little formal training as administrators⁴⁵ so it is understandable that they encounter situations (such as a pregnant faculty member) that they're not readily prepared to handle. Our primary aims through our department chair activities are (1) to provide information and case studies on policies and procedures that affect faculty work life and advancement, and (2) to provide space for discussion so that chairs may network and learn from each other's experiences.

Institutional mentoring, in this context, refers to formal (institutionalized with explicit policies and procedures) and informal (mentees choose their own mentors) mentoring found within a faculty member's primary unit, outside the primary unit but within the university, and outside the university. Numerous studies report the importance of mentoring – formal and informal – for objective and subjective career success, and that women tend to have fewer network connections, and, thus, fewer mentoring opportunities than men^{13,14,36,47}. At UD, formal faculty mentoring has been established in targeted STEM departments, including in the College of Engineering, through a prior NSF ADVANCE-PAID grant. The formal mentor is a senior faculty member assigned, with mutual agreement, by the department chair to an assistant professor. The role of the formal mentor is to assist the junior faculty member in accessing and navigating department, college, and university policies and procedures. The mentor and junior faculty member are encouraged to meet formally at least twice a semester. ADVANCE provides mentor training and a detailed checklist of topics to discuss during meetings to help guide the interactions.

Internal academic resources refer to the resources available within a primary academic unit (often the department), such as lab and office space, equipment, research and teaching assistants, technical/administrative support, and research-supportive workloads (e.g., course and/or service reductions). Perceptions of access to, and fairness of the distribution of, resources are important

factors in faculty career satisfaction^{19,38}. Several studies report gender disparities in lab/office space, teaching/service loads, and other types of research support^{19,27}.

Internal relational support refers to collegial relationships among departmental colleagues of a type that make a faculty member feel valued, included, supported, and respected by her peers. Such supports are important to career satisfaction, in part, because they provide opportunities for collaboration, assistance, and information. Perhaps due to low representation, women faculty report feelings of isolation and, thus, may not receive the same internal relational supports as men^{3,4,12,15,24,25,27,35,39}. Yet, collegial exchange may be even more important for women than for men in finding job satisfaction^{4,12}.

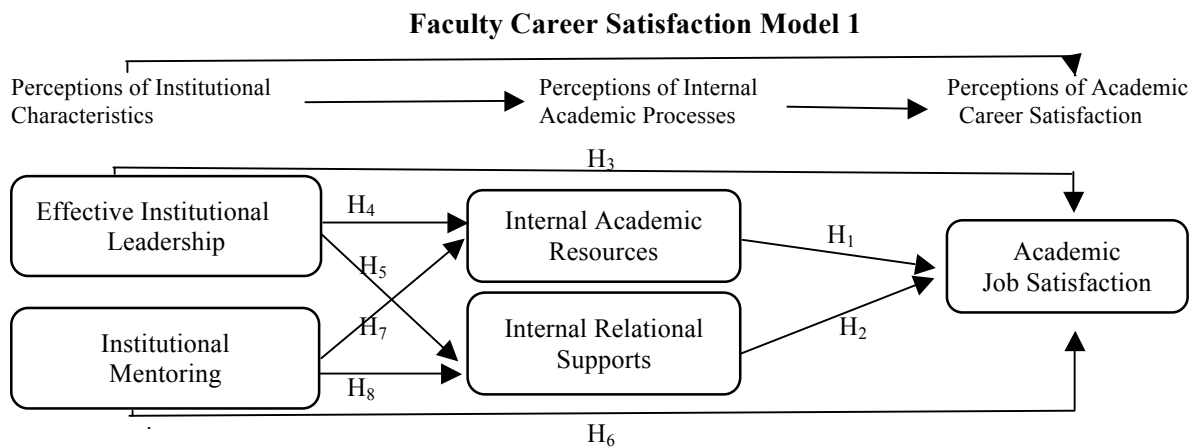


Figure 1 Bilimoria's (2006) hypothesized model (Model 1)

Based on the above background, Bilimoria, et al. propose hypotheses (H₁-H₈) that aim to spell out potential pathways to career satisfaction (Figure 1).

- H₁: Perceptions of internal academic resources will be positively related to ratings of job satisfaction.
- H₂: Perceptions of internal relational supports will be positively related to ratings of job satisfaction.
- H₃, H₄, and H₅: Perceptions of institutional leadership will be positively related to ratings of job satisfaction (H₃), internal academic resources (H₄), and internal relational supports (H₅).
- H₆, H₇, and H₈: Perceptions of institutional mentoring will be positively related to internal academic resources (H₇), and internal relational supports (H₈), and ratings of academic job satisfaction (H₆).

Bilimoria, et al. also propose the following gender-related hypotheses:

- H₉: The path coefficients from perception of institutional leadership to academic resources (H₄) and from there to job satisfaction (H₁), will be smaller for female than for male faculty.
- H₁₀: The path coefficients from perceptions of leadership and from mentoring to internal relational supports (H₅, H₈) and from there to job satisfaction (H₂), will be larger for female than for male faculty.

To test their hypotheses, Bilimoria et al. used data from a faculty climate survey at a private, research-intensive Midwestern university. The faculty population whose responses were used in the study was the university's full-time, non-medical-school faculty (N=248; response rate 39%). The sample's gender distribution was 100 female (17 professors, 31 associate professors, 30 assistant professors, 18 instructors, 4 lecturers) and 148 male (79 professors, 33 associate professors, 28 assistant professors, 5 instructors, 3 lecturers). Bilimoria et al. note that although the sample indicates a large difference in rank between the genders, it is representative of the university faculty at large. They used a path analytic approach to test the model shown in Fig. 1, as well as the gender-related hypotheses 9 and 10.

Bilimoria and colleagues found that both men and women view leadership and mentoring as influencing job satisfaction, with internal academic resources and internal relational supports as mediators (H₁, H₂, H₄, H₅, H₈ were confirmed.) They found no direct relationship between leadership and job satisfaction (H₃), or between mentoring and satisfaction (H₆). While they did find a connection between perceptions of mentoring and perceptions of internal relational supports (H₈), there was no significant relationship between mentoring and internal academic resources (H₇). As predicted, the following gender effects were supported by the data. The path coefficients from leadership to resources to job satisfaction was smaller for women than for men (H₉). The path coefficients from leadership to job satisfaction, as mediated by relational supports, were larger for women than for men (H₁₀).

Current Study

The current study includes two models of faculty satisfaction. Model 1 is the hypothesized model of Bilimoria, et al. (Fig. 1). We re-tested their model with the goal of identifying the extent to which it would generalize to a different type of institution. It is important to know which experiences of faculty life pertain to a broad range of institutions and which are associated with local policies, practices, and climate. When conducting quantitative studies of academic life it can be difficult to achieve large sample sizes (as Bilimoria et al. note as a limitation of their study). Identifying contexts where data may be aggregated meaningfully across institutions can lead to larger sample sizes and more robust results.

Model 2 explores factors and processes not considered in the original study. We added a new dimension to the faculty-satisfaction model – transparency of policies and procedures. Local data indicate that all faculty groups, regardless of race, gender, or discipline, are concerned about lack of transparency in policies and procedures⁴¹. Transparency occurs when policies and procedures (promotion and tenure documents, workload policies, family-friendly policies, etc.) are clearly stated, readily available, and uniformly communicated⁴⁴. Our conceptual framework is centered upon the idea that the roles of department chairs and institutional mentors are similar with respect to communication of policies and procedures. Department chairs interpret and implement policies within the department; institutional mentors assist colleagues in acquiring policy descriptions and understanding how they work in practice^{14,44,47}.

Based on this background, we hypothesized relationships between transparency and each existing model construct (Fig. 2). Research has shown that retention, advancement, and satisfaction of faculty are positively associated with transparency^{4,32,47}. Transparency can make a difference in resource distribution, such as teaching and research assistants, adjusted workloads,

and other types of support^{4,30,32}. Policies and procedures, especially the elements that are implicit or not clearly stated, are often communicated through internal relational supports^{42,47}.

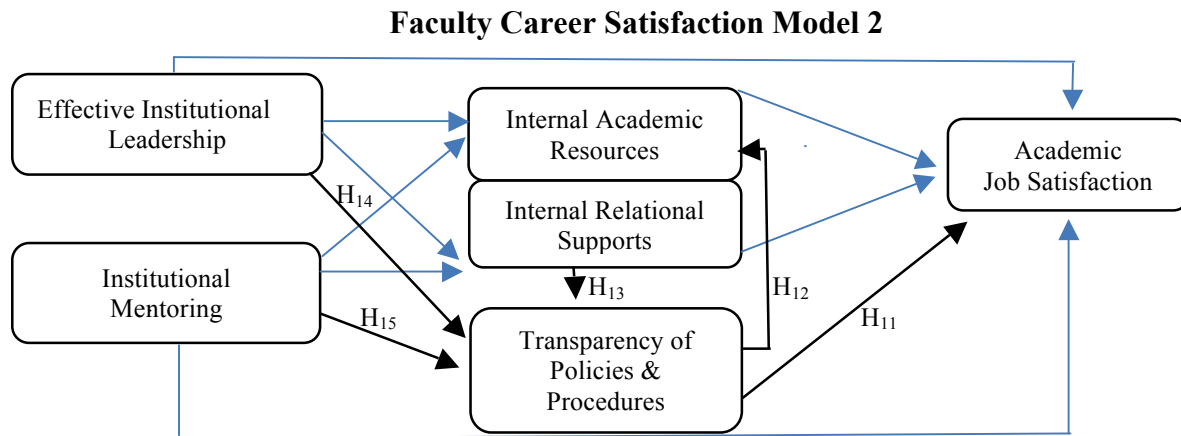


Figure 2 Hypothesized Model of Academic Job Satisfaction (Model 2). This figure shows proposed expansions to Bilimoria, et al.'s model, with their original hypotheses in light blue. New hypotheses (11-15), which involve the transparency of policies and procedures, are labeled.

- H₁₁, H₁₂: Perceptions of transparency will be positively related to career satisfaction ratings (H₁₁) and to perceptions of internal academic resources (H₁₂).
- H₁₃: Perceptions of internal relational supports will be positively related to perceptions of transparency.
- H₁₄: Perceptions of effective leadership will be positively related to perceptions of transparency.
- H₁₅: Perceptions of institutional mentoring will be positively related to perceptions of transparency.

Research shows that men often have greater access to the internal power structures within a department (e.g., chairs), mentoring, and internal relational supports than women^{4,32,42,47}. We expect that the relationship between leadership, mentoring, and internal relational supports, on one hand, and transparency, on the other, will be greater for men than for women. Due to these lower levels of perceived transparency for women, the impact of transparency on internal relational supports will also be smaller. Assuming H₁₁ – H₁₅, men are, thus, more likely than women to view policies and procedures as transparent.

- H₁₆: The path coefficients from institutional leadership, institutional mentoring, and internal relational supports to perceived transparency (H₁₃, H₁₄, H₁₅) will be smaller for women than for men.
- H₁₇: The path coefficient from transparency of policies and procedures to internal academic resources (H₁₂), will be smaller for women than for men.

Methodology

Participants

We conducted the study at our home institution, the University of Delaware (UD). UD is a research-intensive, suburban, land-grant university with a private charter located on the east

coast. Data were collected via a faculty climate survey in spring 2014. The survey was developed using faculty climate surveys tested and implemented at the University of Wisconsin-Madison and at the Rochester Institute of Technology. Some questions were taken directly from Bilimoria, et al.'s survey to reproduce their work with a high degree of fidelity. Finally, questions were added and refined to reflect the specific climate and history at our institution.

The original sample consisted of 644 full-time faculty members on and off the tenure track. Because the professional experiences of faculty off the tenure track vary considerably with college and workload assignment, we limited our final sample to tenured or tenure-track faculty. Likewise, because the focus of the study is on differences between the perceptions of male and female faculty, those who did not indicate gender were not included in the final sample. Finally, after dropping respondents who did not answer all study questions, the sample consisted of 260 faculty. Among the 114 women in the final sample, 30 were assistant professors, 48 were associate professors, and 36 were full professors. Among the 146 men in the final sample, 23 were assistant professors, 49 were associate professors, and 74 were full professors. The rank and gender distribution in the final sample is very close to representative of the full faculty in 2014. With respect to race and ethnicity, the sample was predominantly white (83%). Other subsamples were too small to allow for study of differences between races or ethnicities.

Measures

Tables 1 and 2 list all questionnaire items used to study models 1 and 2, respectively. Responses were given on a four-point Likert scale. Items under the headings “Academic job satisfaction,” “Effective Institutional leadership,” “Institutional mentoring,” “Internal academic resources,” and “Internal relational supports” are almost identical to the questions used by Bilimoria, et al. to enable comparison between the two studies.

Model 2 adds to model 1 factors associated with transparency of work policies and procedures, as shown in Figure 2. Table 3 lists questionnaire items used in the study to measure transparency of policies and procedures, along with confirmatory factor analysis parameters. Fourteen questions were grouped into four subscales: work and policies, departmental merit-pay policies, sabbatical policies, and parental and family policies. Participants responded to the items using a 4-point scale, from 1 = not at all clearly to 4 = very clearly. The reliability of the survey was measured by Cronbach’s alpha coefficient = .87. Because these items were new to our study, we examined the construct validity using confirmatory factor analysis (CFA). The analysis conducted on the sample supported the survey as four-factor model, yielding good fit indices: $\chi^2 = 117.39$ (70, N=260), $p < .001$; CFI = .99, RMSEA = .075, and WRMR = .83.

Table 1: Questionnaire items used in the study, Model 1

Academic job satisfaction
<i>Please indicate how satisfied you are with each of the following dimensions of your professional life (1 very dissatisfied, 2 dissatisfied, 3 satisfied, 4 very satisfied).</i>
Overall experience of community at this university
Overall experience of collegiality in your primary unit
Overall experience of being a faculty member in your primary unit
Teaching load
Teaching and research balance
Effective institutional leadership
<i>Please indicate your level of agreement with the following statements regarding the head/chair of your department or primary unit (1 strongly disagree, 2 disagree, 3 agree, 4, strongly agree).</i>
Is an effective administrator

Helps me obtain the resources I need
Articulates a clear vision for the department
Provides teaching-development opportunities
Shares resources/opportunities fairly
Involves me in important decision-making processes
Institutional mentoring
<i>Please indicate your level of agreement with the following statements regarding mentoring you receive. Mentoring is defined as formal or informal advocacy aimed at your career advancement and development (1 strongly disagree, 2 disagree, 3 agree, 4 strongly agree).</i>
To what extent do you receive <u>formal</u> mentoring within your primary unit?
To what extent do you receive <u>informal</u> mentoring within your primary unit?
To what extent do you receive <u>formal</u> mentoring outside your primary unit, but within UD?
To what extent do you receive <u>informal</u> mentoring outside your primary unit, but within UD?
To what extent do you receive <u>formal</u> mentoring outside UD?
To what extent do you receive <u>informal</u> mentoring outside UD?
Internal academic resources
<i>Please indicate your level of satisfaction with the availability of the following resources within your department (1 very dissatisfied, 2 dissatisfied, 3 satisfied, 4 very satisfied).</i>
Support for professional development (including, but not limited to, travel funds)
Computers/equipment and technical support
Clerical, secretarial support
Adjustments to/reductions in teaching load
Adjustments to/reductions in student advising responsibilities
Adjustments to/reductions in service/committee assignments
Internal relational supports
<i>Please indicate your level of agreement with the following statements about your department or primary unit (1 strongly disagree, 2 disagree, 3 agree, 4, strongly agree).</i>
Colleagues in my department or primary unit value my work.
Colleagues in my department or primary unit can be trusted.
Colleagues in my department or primary unit provide me feedback about research/scholarly issues.
Colleagues in my department or primary unit solicit my opinions about scholarly issues.
Colleagues in my department or primary unit solicit my opinions about professional activities.
I feel professionally welcome and included by colleagues in my department or primary unit.

Table 2 Questionnaire items and confirmatory factor analysis of the Transparency of Policies & Procedures Scale, Model 2

Factor and Items	Loading	SE	z
Factor 1: How clearly are your departmental workload policies communicated ...			
1.1 ... in departmental documents?	.927	.015	61.875
1.2 ... by your department chair?	.966	.015	65.704
1.3 ... by other faculty in your department?	.807	.027	30.262
Factor 2: How clearly are your departmental merit pay policies communicated ...			
2.1 ... in departmental documents?	.934	.016	57.298
2.2 ... by your department chair?	.976	.013	75.268
2.3 ... by other faculty in your department?	.857	.025	33.807
Factor 3: How clearly have university's sabbatical policies and procedures been communicated to you ...			
3.1 ... in writing (faculty handbook, collective bargaining agreement, etc.)?	.813	.029	28.021
3.2 ... by your department chair?	.943	.015	62.675
3.3 ... by other faculty in your department?	.912	.018	49.903
3.4 ... by other sources within UD	.793	.029	27.533
Factor 4: How clearly is UD's parental and family leave communicated to faculty ...			
4.1 ... in writing (faculty handbook, collective bargaining agreement, etc.)?	.791	.031	25.778
4.2 ... by your department chair?	.978	.012	81.373
4.3 ... by other faculty in your department?	.933	.012	57.096
4.4 ... by other sources within university	.854	.026	32.603

Note. Loading = standardized factor loading; SE = standard error; z = robust z score.

Data analysis

We used path analysis to investigate the hypothesized relationships between all the variables as well as to evaluate the overall model fit of the hypothesized model. To test the gender differences in the hypothesized models, we conducted path analysis separately for male and female faculty. We used Mplus 7.3 to examine the factor structure with robust weighted least squares (WLSMV) estimator and the proposed model with full information maximum likelihood (ML) estimator. We employed four indices to evaluate the model fit: chi-square value, Comparative Fit Index (CFI), the Root Mean-Square Error of Approximation (RMSEA), and the Standardized Root Mean-Square Residual (SRMR).

As commonly used in the research literature^{20,26}, we used a criterion of greater than or equal to .95 for comparative fit index (CFI). In addition, a model is viewed as have “good” fit if the root mean square error of approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR) values are less than or equal to .08, respectively¹⁸.

Results

Descriptive statistics, correlations, and Cronbach’s alpha are presented in Table 3. Because the current study focuses on gender differences, we used T-tests to look for differences in how female and male faculty perceived communication of policies and procedures, academic resources, effective institutional leadership, institutional mentoring, internal relational support, and job satisfaction. T-test results are presented in Table 4. We find only one significant difference: female faculty perceive receiving institutional mentoring to a greater extent than do male faculty. Bilimoria, et al. report a similar result, which they explain by the predominance of full professors among the male faculty in their sample. Our sample is similar in that it includes a large number of male full professors compared to female. Full professors generally receive less mentoring than junior faculty, so within our sample one might expect the male subsample to perceive receiving less mentoring than the female. We tested for gender differences within rank subsamples (assistant professors, associate professors, full professors) and indeed found no significant gender differences. This result suggests that Bilimoria, et al. are correct in interpreting their observed gender difference as related to rank.

Bilimoria, et al. observe differences between male and female faculty with respect to effective institutional leadership, internal relational supports, and job satisfaction. That we don’t may suggest that institution-specific factors affect these measures.

Table 3 Descriptive statistics, correlations, and Chronbach’s alpha

Factor scores	Mean	SD	1	2	3	4	5	6
1. Policies and procedures	2.33	.71	(.90)					
2. Academic resources	2.72	.61	.47**	(.80)				
3. Institutional leadership	2.88	.72	.49**	.51**	(.92)			
4. Relational support	2.78	.69	.45**	.30**	.34**	(.87)		
5. Institutional mentoring	2.10	.63	.21**	.14**	.27**	.31**	(.80)	
6. Job satisfaction	2.89	.59	.50**	.61**	.54**	.55**	.24**	(.86)

Note. ** $p < .001$. Values in parentheses are coefficients of internal consistency (Cronbach's alpha) for each subscale.

Table 4 T-test of gender differences

Variables	Male	Female	T value
	Mean (SD)	Mean (SD)	
Policies and procedures	2.35 (.72)	2.32 (.68)	.38
Academic resources	2.77 (.60)	2.65 (.62)	1.61
Leadership	2.90 (.72)	2.83 (.74)	.75
Academic Support	2.80 (.68)	2.76 (.70)	.44
Mentoring	2.01 (.60)	2.20 (.65)	-2.46*
Job satisfaction	2.92 (.60)	2.84 (.56)	.95

Note. * $p < .05$.

Model 1 Results Figure 3 shows the results of the path analysis for model 1. The top figure (a) shows results for the female subsample and the bottom figure (b) shows results for the male subsample. Only significant paths are included in the figures.

Figure 3a: Model 1 Results -- Significant Path Coefficients, Female Faculty

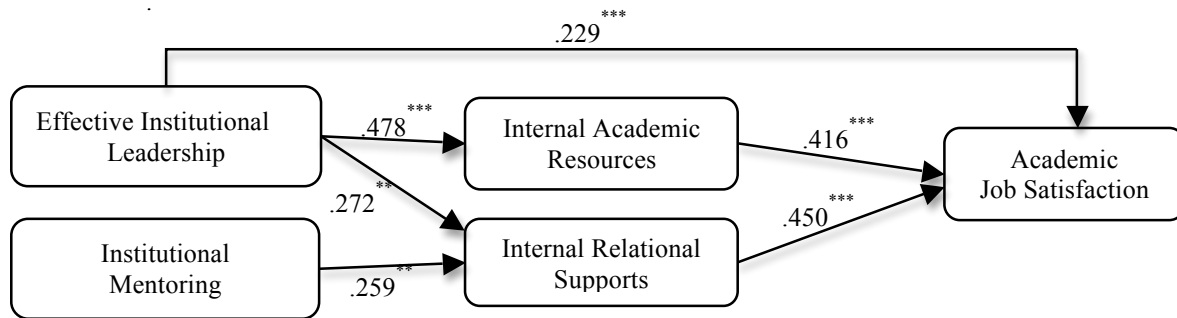


Figure 3b: Model 1 Results -- Significant Path Coefficients, Male Faculty

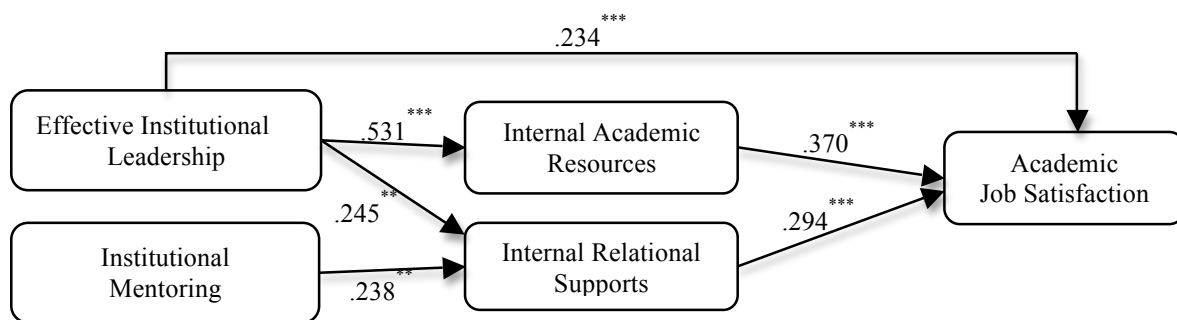


Figure 3 (a) Significant path coefficients for female faculty for model 1. Note, *** $p < .001$, ** $p < .01$. Fit statistics for the model are $\chi^2 = 4.493$, $df = 3$, CFI = .992, SRMR = .040, RMSEA = .065. (b) Significant path coefficients for male faculty for model 1. Note, *** $p < .001$, ** $p < .01$. Fit statistics for the model are $\chi^2 = 7.494$, $df = 3$, CFI = .972, SRMR = .047, RMSEA = .102.

Our results are similar to those of Bilimoria, et al. in many respects. Like the earlier study, we find that women and men both view leadership and mentoring as influencing job satisfaction, with internal academic resources and internal relational supports as mediators (H₁, H₂, H₄, H₅, H₈.) We find no direct relationship between mentoring and satisfaction (H₆). We find a significant relationship between perceptions of mentoring and perceptions of internal relational

supports (H₈), but not between mentoring and internal academic resources (H₇). With respect to the predicted gender effects, like Bilimoria, et al., we find path coefficients from leadership to job satisfaction, as mediated by relational supports, are larger for women than for men (H₁₀). However, with respect to H₉, our results are mixed. The path coefficient from leadership to resources is smaller for women than for men, as predicted. However, the path coefficient from resources to job satisfaction is larger for women. We determine a total path coefficient by multiplying coefficients of the sub-paths²¹. For women the total path coefficient from leadership to job satisfaction through internal academic resources is $.478 * .416 = .1988$. For men it is $.531 * .396 = .209$. Therefore, unlike the earlier study, our data do not fully support H₉.

Our results also differ from the earlier study in that we observe a direct relationship between effective institutional leadership and job satisfaction (H₃). This finding is significant because it suggests that the emphasis we place on working with department chairs through our ADVANCE grant is well placed. See conclusions, below, for details.

Model 2 Results Figure 4 shows significant path coefficients for (a) women faculty and (b) men faculty. Compared to model 1, model 2 results indicate more differences between how male and female faculty arrive at job satisfaction.

Figure 4a: Model 2 Results -- Significant Path Coefficients, Female Faculty

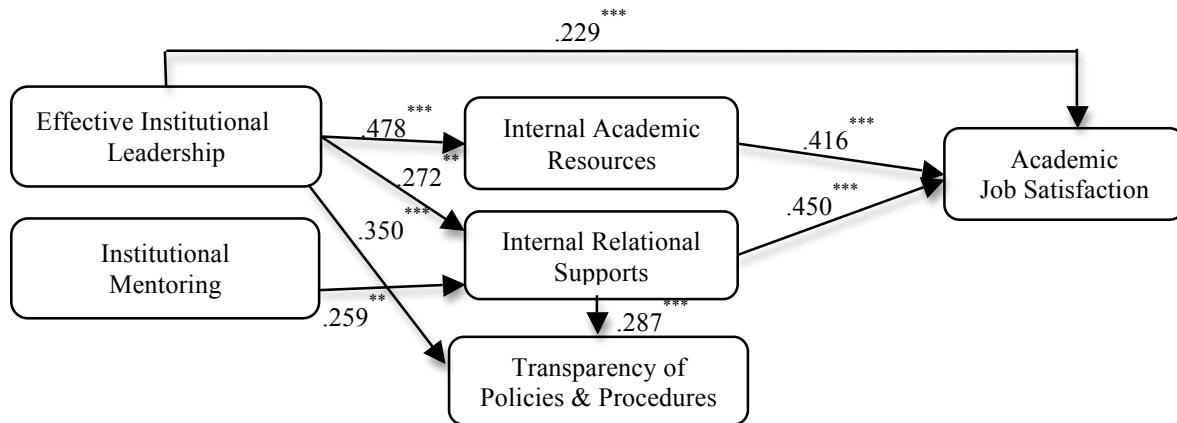


Figure 4b: Model 2 Results -- Significant Path Coefficients, Male Faculty

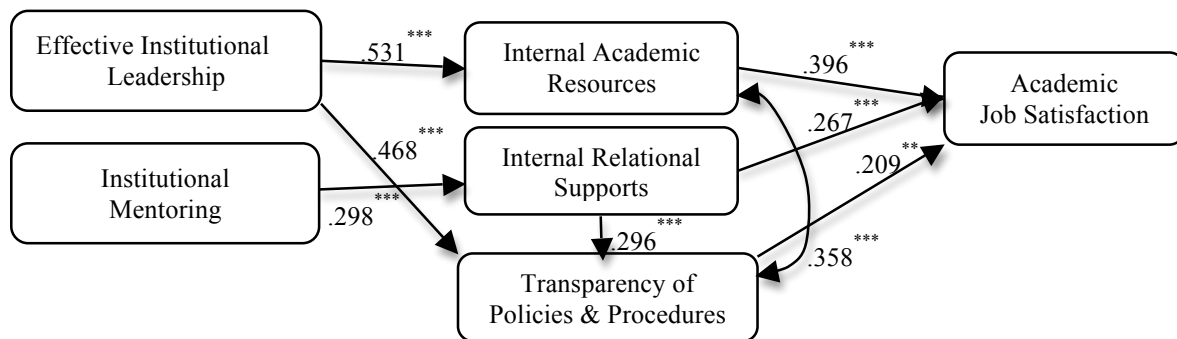


Figure 4 (a) Significant path coefficients for female faculty for model 2. Note, *** $p < .001$, ** $p < .01$, * $p < .05$. Fit statistics for the model are $\chi^2 = 8.770$, $df = 6$, $CFI = .987$, $SRMR = .047$, $RMSEA = .063$. (b) Significant path coefficients for male faculty for model 2. Note, *** $p < .001$, ** $p < .01$. Fit statistics for the model are $\chi^2 = 26.671$, $df = 6$, $CFI = .918$, $SRMR = .109$, $RMSEA = .155$.

Starting with effective institutional leadership, both women and men view leadership as influencing job satisfaction with internal academic resources as a mediator (H₁, H₄). Women see a pathway to career satisfaction directly from leadership (H₃) as well as indirectly from leadership through internal relational supports (H₅). For women there is a pathway from leadership to transparency of policies and procedures (H₁₆), but it does not continue on to job satisfaction (H₁₁). In contrast, men see an indirect pathway from effective leadership to job satisfaction through transparency of policies and procedures (H₁₆, H₁₃), but not through internal relational supports. H₁₄ -- a positive relationship between mentoring and internal academic resources -- is not supported by the data for men or for women.

Both women and men view mentoring as influencing job satisfaction with internal relational supports as mediator (H₂, H₈). For women, this is the only significant relationship between mentoring and job satisfaction. Neither men nor women see a direct pathway from institutional mentoring to clarity of policies and procedures (H₁₅). However, men find an indirect pathway from mentoring to job satisfaction through internal relational supports (H₈) to transparency of policies and procedures (H₁₃), and on to academic job satisfaction (H₁₁). We find no significant direct path from mentoring to job satisfaction for women or men (H₆). Neither men nor women see mentoring as related to internal academic resources (H₇).

We hypothesized that clarity of policies and procedures would be positively related to internal academic resources for men and women (H₁₂). The double-headed arrow in Figure 4b indicates a significantly positive association between these two variables for men. The data do not support a relationship between these two variables for women.

Turning to the gender-related hypotheses, as above with model 1, we see that the path coefficients from leadership and mentoring to internal relational supports and on to job satisfaction are larger for women than for men, as predicted (H₉). Results for H₁₀ are once again mixed. The path coefficient from leadership to internal academic resources is smaller for women than for men, as predicted. However, the path coefficient from internal academic resources to job satisfaction is larger for women than for men. The data therefore do not fully support the hypothesis, but it is the case that the *total* path coefficient for men ($.531 * .396 = .2103$) is greater than for women ($.478 * .416 = .1988$).

With respect to the gender-related hypotheses, the data support H₁₆ but not H₁₇. The path coefficients from institutional leadership, institutional mentoring, and internal relational supports to perceived transparency are smaller for women than for men (H₁₆). Indeed, for women there is no significant relationship between mentoring or internal relational supports to perceived transparency. The data do not support H₁₇ because there is no significant path from transparency of policies and procedures to internal academic resources for either men or women.

Conclusions

Our study elucidates pathways to job satisfaction for men and women faculty members at a research-intensive ADVANCE institution. We compare our results to similar earlier work and find a number of consistencies. Both studies show that effective institutional leadership (department chair) and institutional mentoring influence job satisfaction for men and women

faculty with internal academic resources and internal relational supports as mediating processes. In both studies women place more weight on the pathways from leadership and from mentoring to job satisfaction through internal relational supports than men do. This result reinforces the importance of inclusive and respectful interactions among colleagues in academic departments. It is especially important in fields where women are underrepresented, for example, in many science and engineering disciplines or humanities such as philosophy³³.

Our results diverge from the earlier work in two key ways. First, we see a direct path from leadership to job satisfaction for women and men that Bilimoria, et al. do not. This result suggests that at our institution it is important to focus on chair development directly. Second, our data do not support the hypothesis that pathways to job satisfaction through internal academic resources are stronger for men than for women. Thus, improving faculty access to resources such as professional-development funding or reduced teaching or service loads at UD may improve job satisfaction for both men and women faculty. These differences between our results and those of Bilimoria, et al. suggest that elements of faculty satisfaction depend on local factors. It may not be straightforward to aggregate data sets across institutions.

Impact on ADVANCE work

Focusing on model 2, our results show that departmental leaders influence job satisfaction differently for men and women. Women in our study arrive at job satisfaction from leadership through three pathways – directly, through internal academic resources, and through internal relational supports. Men have two pathways – through internal academic resources and through clarity of policies and procedures.

This difference has implications for our ADVANCE work with department chairs in a number of ways. First, model 2 results reinforce the above suggestion that strengthening chairs' skills as effective leaders will increase women faculty's job satisfaction. This may present an opportunity for our ADVANCE team to collaborate with other campus units who work with chairs on building skills directly related to administration and leadership. Second, chairs should be encouraged and enabled to demonstrate and establish the expectation of collegiality and inclusion in their departments. This message could be delivered to chairs in a number of ways: e.g., in our ADVANCE chair activities, from deans, and from the provost. Third, chairs should be encouraged to pursue equitable distribution of departmental resources to support faculty careers. Finally, our study suggests that men derive career satisfaction from transparency of policies and procedures more than women do. We will continue to work with chairs (and upper administrators) on clarifying the intentions and uses of these policies.

Model 2 results also have implications for our formal mentoring program. As described above, its intention is to increase junior faculty's familiarity with policies and procedures to help them navigate and advance through their careers. However, our results suggest that for women, mentoring is more related to collegiality within a department than to transparency of policies and procedures. However, the study questions grouped together formal and informal mentoring, and additional analysis of the climate survey reveal that women faculty perceive higher levels of informal mentoring than formal. Moreover, at our institution formal mentoring is supported primarily in STEM departments, where women faculty are underrepresented at UD. Therefore, Model 2 results are likely primarily reflective of women's perception of *informal* mentoring.

UD's ADVANCE team is working with the deans and the faculty senate to extend formal mentoring to all departments at UD. It would be instructive to repeat this study in the future – when more faculty, especially women, have experienced formal mentoring – to see if pathways from mentoring to transparency of policies and procedures (and on to career satisfaction) are established for women.

Limitations and Future Work

Our study was limited in many of the same ways as the earlier work. Specifically, our sample was relatively small and unevenly distributed among the academic ranks. It would be preferable to study male and female subpopulations controlled by rank. Because the focus of our ADVANCE work is to increase the recruitment, retention, and advancement of women STEM and social science faculty, we would like to disaggregate the male and female subsamples by academic discipline. Because path analysis requires a relatively large sample size, to do so would require a much higher survey response rate. Path analysis may not be the best method to study these more detailed questions within a single small or mid-sized institution; large universities may fare better. We have also shown that there may be pitfalls associated with aggregating data sets across institutions to increase sample size. However, it may be possible to identify and collaborate with institutions similar enough to study together. In the meantime, to compile a more comprehensive picture of the faculty experience on our campus, we complement our quantitative research with qualitative studies, including write-in answers on surveys, faculty interviews⁴³ and exit interviews.

This research was supported by NSF grant number 1409472.

References

1. Ackelsberg, Martha, Jeni L. Hart, Naomi J. Miller, Kate Queeney, Susan Van Dyne. 2009. "Faculty Microclimate Change at Smith College," in *Doing Diversity in Higher Education: Faculty Leaders Share Challenges and Strategies*, Winnifred R. Brown-Glaud (ed.): Rutgers University Press.
2. Aguirre, Adalberto. 2000. *Women and Minority Faculty in the Academic Workplace: Recruitment, Retention, and Academic Culture*. San Francisco, CA: Jossey-Bass.
3. Ambrose, Susan, Therese Huston, Marie Norman. 2005. "A Qualitative Method for Assessing Faculty Satisfaction." *Research in Higher Education*. 46(7): 803-830.
4. August, Louise and Jean Waltman. 2004. "Culture, Climate, and Contribution: Career Satisfaction among Female Faculty." *Research in Higher Education* 45(2): 177-191.
5. Baldwin, Roger, Deborah DeZure, Allyn Shaw, and Kristin Moretto. 2008. "Mapping the Terrain of Mid-Career Faculty at a Research University: Implications for Faculty and Academic Leaders." *Change* 40: 46-55.
6. Bilimoria, Diana, Susan Perry, Xiangfen Liang, Eleanor Palo Stoller, Patricia Higgins, Cyrus Taylor. 2006. "How Do Female and Male Faculty Members Construct Job Satisfaction? The Roles of Perceived Institutional Leadership and Mentoring and the Mediating Processes." *Journal of Technology Transfer* 31: 355-365.
7. Bilimoria, Diana, Joy Simy, and Xianfen Liang. 2008. "Breaking Barriers and Creating Inclusiveness: Lessons of Organizational Transformation to Advance Women Faculty in Academic Science and Engineering." *Human Resources Management* 47(3): 423-441.

8. Bilimoria, Diana and Xiangfen Liang. 2012. *Gender Equity in Science and Engineering: Advancing Change in Higher Education*. New York, NY: Routledge.
9. Britton, Dana. 2010. "Engendering the University through Policy and Practice: Barriers to Promotion to Full Professor for Women in the Science, Engineering, and Math Disciplines." In Birgit Riegraf, Brigitte Aulenbacher, Edit Kirsch-Auwärter, and Ursula Müller (Eds), *Gender Change in Academia: Re-Mapping the Fields of Work, Knowledge, and Politics from a Gender Perspective*: 15-26, VS Verlag für Sozialwissenschaften.
10. Buch, Kimberly, Yvette Huet, Audrey Rorrer and Lynn Roberson. 2011. "Removing the Barriers to Full Professor: A Mentoring Program for Associate Professors." *Change: The Magazine of Higher Learning* 46: 38-45.
11. Bystydzienski, Jill, Thomas, Nicle, Howe, Samantha and Desai, Anand. 2016. "The leadership role of college deans and department chairs in academic culture change." *Studies in Higher Education*: 1-15.
12. Callister, Ronda R. 2006. "The Impact of Gender and Department Climate on Job Satisfaction and Intentions to Quit for Faculty in Science and Engineering Fields." *Journal of Technology Transfer* 31: 367-375.
13. De Janasz, S. C., S.E. Sullivan, and V. Whitting. 2003. "Mentor Networks and Career Success: Lessons for Turbulent Times." *Academy of Management Executive* 17(4): 78-91.
14. Fagenson, Ellen A. 1989. "The Mentor Advantage: Perceived Career/Job Experiences of Protégés Versus Non-Protégés." *Journal of Organizational Behavior* 10(4): 309-320.
15. Gardner, Susan K. 2012. "I Couldn't Wait to Leave the Toxic Environment: A Mixed Methods Study of Women Faculty Satisfaction and Departure from One Research Institution." *NASPA Journal About Women in Higher Education* 5(1): 71-95.
16. Geisler, Cheryl, Debbie Kaminski, Robyn Berkeley. 2007. "The 13+ Club: An Index for Understanding, Documenting, and Resisting Patterns of Non-Promotion to Full Professor." *Feminist Formations* 19(3): 145-162.
17. Ginther, Donna, and Shulamit Kahn. 2012. "Education and Academic Career Outcomes for Women of Color in Science and Engineering." Paper presented at the conference for the Committee on Women in Science, Engineering, and Medicine, Washington, DC, June 7, 2012.
18. Hu, Li-tze, and Peter M. Bentler. 1998. "Fit Indices in Covariance Structure Modeling: Sensitivity to Underparameterized Model Misspecification." *Psychological Methods*, 2(4): 424.
19. Huston, Therese and Carol L. Weaver. 2008. "Peer Coaching: Professional Development for Experienced Faculty." *Innovative Higher Education* 33(1): 5-20.
20. Kenny, David A., and D. Betsy McCoach. 2003. "Effect of the number of variables on measures of fit in structural equation modeling." *Structural Equation Modeling*, 10: 333-351.
21. Kline, R.B. 2005. *Principles and Practice of Structural Equation Modeling*, Second Edition. In *Methodology in the Social Sciences*, David A. Kenny, Series Editor. New York, NY: Guilford Press
22. LeBoy, Phoebe S. 2008. "Fixing the Leaky Pipeline: Why Aren't There More Women in Top Spots in Academia?" *The Scientist* 22: 67- 73.

23. Lincoln, Anne E., Stephanie Pincus, Janet Bandows Koster, and Phoebe S. LeBoy. 2012. "The Matilda Effect in Science: Awards and Prizes in the US, 1990s and 2000s." *Social Studies of Science* 42: 307-320.
24. Malcom, Shirley, Paula Hall, and Janet Brown. 1976. "The Double Bind: The Price of Being a Minority Woman in Science." Washington DC: American Association for the Advancement of Science.
25. Malcom, Lindsey and Shirley Malcom 2011. "The Double Bind: The Next Generation." *Harvard Educational Review* 81(2): 162-171. URL, Retrieved on 2/8/17: <http://web.mit.edu/cortiz/www/Diversity/1975-DoubleBind.pdf>
26. Marsh, Herbert W., Kit-Tai Hau, and Zhonglin Wen. 2004. "In search of golden rules: Comment on hypothesis-testing approaches to setting cutoff values for fit indices and dangers in overgeneralizing Hu & Bentler's (1999) findings." *Structural Equation Modeling*, 11: 320–341.
27. MIT. 2010. "Report on the Initiative for Faculty Race and Diversity." URL, Retrieved on 2/8/17: <http://web.mit.edu/provost/raceinitiative/report.pdf>
28. Modern Language Association. 2009. "Standing Still: The Associate Professor Survey." Report on the Committee on the Status of Women in the Profession." URL, Retrieved on 2/8/17: http://www.mla.org/pdf/cswp_final042909.pdf
29. National Science Foundation. 2017. *Women, Minorities, and Persons with Disabilities in Science and Engineering*. URL, Retrieved on 2/8/17: <https://www.nsf.gov/statistics/2017/nsf17310/>.
30. Nelson, Donna J. 2007. "A National Analysis of Diversity in Science and Engineering Faculties at Research Universities." Norman, OK. URL, Retrieved 2/9/17: http://faculty-staff.ou.edu/N/Donna.J.Nelson-1/diversity/Faculty_Tables_FY07/07Report.pdf.
31. Okpara, John, Michael Squillace, Emmanuel A. Erondu. 2005. "Gender Differences and Job Satisfaction: A Study of University Teachers in the United States." *Women In Management Review*, 20(3): 177-190.
32. Olsen, SD. S. Maple, and F. Stage. 1995. "Women and Minority Job Satisfaction." *Journal of Higher Education*. 66(3): 267-293.
33. Paxton, Molly, Carrie Figdor, and Valerie Tiberius. 2012. "Quantifying the Gender Gap: An Empirical Study of the Underrepresentation of Women in Philosophy," *Hypatia* 27 (4): 949-957.
34. Rocque, William and Sandra Laursen. 2007. "Faculty Career Trajectories and the Institutional Factors that Shape Them: Comparative Analysis of Longitudinal Faculty Interview Data, A Report to the LEAP Project." URL, Retrieved on 2/8/17: <http://www.colorado.edu/eeer/downloads/LEAPtrajectoriesReport2007.pdf>
35. Rosser, Vicki J. 2004. "Faculty Member's Intentions to leave: A National Study on Their Worklife and Satisfaction." *Research in Higher Education* 45, 285-309.
36. Rubin, Herbert J. and Irene S. Rubin. 1995. *Qualitative Interviewing: The Art of Hearing Data*. Thousand Oaks, CA: Sage Press.
37. Shanafelt, Tait D., Colin West, Jeff Sloan, Paul Novotny, Greg Poland, Ron Menaker, Teresa Rummans, Lotte Dyrbye. 2009. "Career Fit and Burnout among Academic Faculty." *Archives of Internal Medicine* 169(10): 990-995.
38. Trower, Cathy and Jared Bleak. 2004. "The Study of New Scholars: Tenure-Track Faculty Job Satisfaction Survey." Harvard University.

39. Turner, Caroline, Juan González and J. Luke Wood. 2008. "Faculty of Color in Academe: What 20 Years of Literature Tells Us." *Journal of Diversity in Higher Education*, 1 (3): 139-168.
40. Turner, Caroline, Juan González and Kathleen Wong. 2011. "Faculty Women of Color: The Critical Nexus of Race and Gender." *Journal of Diversity in Higher Education*, 4 (4): 199-211.
41. UD-AAUP. 2013. Union Survey Results, 2013. URL, Retrieved on 2/8/17: <http://www.udel.edu/aaup/2013survey.pdf>.
42. Valian, Virginia 1999. *Why So Slow? The Advancement of Women*. Cambridge, Mass: MIT Press.
43. Vican, Shawna and Friedman, Asia. 2017. "Metrics, Money, and Managerialism: Faculty Experiences of Competing Logics in Higher Education." Working Paper, UD ADVANCE Institute, Newark, DE.
44. Waltman, Jean. 2008. "Assessing the Academic Work Environment for Science and Engineering Faculty at the University of Michigan in 2001 and 2006: Gender, Race, and Discipline in Department- and University-Related Climate Factors."
45. Wolverson, Mimi, Robert Ackerman, and Spencer Holt. 2005. "Preparing for Leadership: What Academic Department Chairs Need to Know," *Journal of Higher Education Policy and Management*, 27(2): 227-238.
46. Yoder, Brian. 2015. "Engineering by the Numbers," American Society for Engineering Education. URL, Retrieved on 2/8/17: <https://www.asee.org/papers-and-publications/publications/college-profiles/15EngineeringbytheNumbersPart1.pdf>.
47. Zellers, Darlene, Valerie Howard, and Maureen Barcic. 2008. "Faculty Mentoring Programs: Re-envisioning Rather than Reinventing the Wheel." *Review of Educational Research*, 78(3): 552-588.