

AC 2007-202: ELEMENTS OF THE WORK ENVIRONMENT THAT CONTRIBUTE TO THE ABILITY OF ENGINEERING FACULTY TO MANAGE WORK-LIFE TENSIONS

Elizabeth Creamer, Virginia Tech

Elizabeth Creamer is a Professor of Educational Research and Evaluation and Director of Research and Assessment for the ADVANCE VT project at Virginia Tech. She is the co-PI or PI of over \$1.5 million in grants from the National Science Foundation that address issues of women's under-representation in science and engineering. She teaches graduate courses in mixed methods and qualitative research methods.

Margaret Layne, Virginia Tech

Margaret (Peggy) Layne is the Director of the ADVANCE VT Project at Virginia Tech and a doctoral student in the Science and Technology Studies Program. Prior to coming to Virginia Tech, she spent two years as a fellow at the National Academy of Engineering, where she directed the program on diversity in the engineering workforce. Ms. Layne also spent a year as an AAAS Congressional Fellow in the office of Senator Bob Graham (D-FL), where she was responsible for water, wastewater, and solid and hazardous waste policy issues. She has 17 years of environmental engineering experience, and was formerly a principal at Harding Lawson Associates in Tallahassee, FL, where she managed the office and directed hazardous waste site investigation and cleanup projects. Ms. Layne has degrees in environmental engineering from Vanderbilt University and the University of North Carolina School of Public Health. She served as president of the Society of Women Engineers in 1996-97, and currently serves on the American Society of Civil Engineers' Energy Policy Committee. She is a registered professional engineer in three states.

Elements of the Work Environment that Contribute to the Ability of Engineering Faculty to Manage Work-Life Tensions

Introduction

Work-family policies are generally the centerpiece of institutional efforts to promote the success of women faculty in science and engineering. Institutions funded by the National Science Foundation ADVANCE Program, have been in the vanguard of the movement to transform institutional and departmental culture in order to recruit and retain more women and minorities as faculty in science and engineering. Among a broad portfolio of initiatives aimed at recognizing that faculty life extends beyond work performance, the 19 round one and two ADVANCE institutions have promoted such work-family policies as dual-career hiring, stopping or delaying the tenure clock for childbirth or adoption, on-campus childcare and lactation rooms, and the opportunity for temporary periods of part-time employment to deal with family crises, such as the terminal illness of a parent. The formalization of many work-life initiatives in colleges and universities in the U.S. is recent enough, however, that there has been little opportunity to provide empirical support for the link between “family-friendly” policies and overall faculty job satisfaction.

One way that ADVANCE institutions have promoted institutional change is through dissemination of findings from faculty work-life or climate questionnaires. The leadership team of the ADVANCE program at Virginia Tech distributed a campus-wide questionnaire in January 2005 to all instructional and research faculty. The questionnaire contained major sections with both attitudinal and behavioral questions about the university and departmental climate. Also included were sections about work-life issues, family characteristics, and the employment status of the spouse. A split-half reliability test on responses to the questionnaire revealed that the questionnaire has very strong reliability (.954).

Previous research not related to the ADVANCE projects has documented a significant positive relationship between overall job satisfaction and positive views about the “spillover” between work and non-work for both female and male faculty members¹. Spillover refers to the attitudes, capabilities, energies, and obligations that are affected by competing family responsibilities². Overall job satisfaction is linked to behavior, including productivity and both intent to leave^{3,4} and actual turnover⁵. Female faculty members are generally found to be less satisfied with all dimensions of their faculty roles⁶ and are significantly more likely than male faculty to depart from an institution after earning tenure⁵. While some turnover contributes to organizational vitality, satisfaction with the work environment can offset the loss of the most productive faculty, a group particularly prone to turnover⁵.

This paper presents findings from a statistical analysis of the impact of elements of the university and departmental climate and work-non-work satisfaction on the overall job satisfaction of faculty in engineering at a single round-two, ADVANCE institution. The paper builds on

previous research⁷ using results from the *AdvanceVT* Work-Life Questionnaire⁸ to identify elements of departmental and university policies and practices that contribute to the ability of engineering faculty members to manage work-life tensions. As compared to the expression “worklife,” we use “work-life” to refer to managing the demands of both a work and personal or family life.

The paper addresses three research questions:

RQ 1: How does the overall job satisfaction of faculty members in engineering compare by gender and to non-engineering faculty?

RQ 2: Is there a relationship between perceptions of work-life tensions and overall job satisfaction and how does this vary by gender and among engineering and non-engineering faculty?

RQ 3: What elements of university and departmental policies and practices are related to engineering faculty members’ perceptions about work-life spillover and do these vary by gender?

Results and Discussion

Findings document a significant link for both male and female faculty between job satisfaction and positive attitudes about the feasibility of being successful in a faculty role while managing work-life responsibilities. Findings also demonstrate that policies and practices, particularly in regard to dual-career hiring and the reward structure, are significantly related to perceptions about the ability to be successful as a faculty member and manage non-work responsibilities.

Following a brief description of the demographic characteristics of the sample, findings from statistical analyses are presented for each of the three research questions.

Characteristics of the Sample

Twelve hundred and nine faculty responded, a 59.5% response rate (N=1209), including 816 tenure-track and tenured faculty. Responses were received from 154 of the 283 faculty in engineering at the time, a response rate of 54.4%. Of the tenure-track and tenured faculty, 80% of the women and 91% of the men are currently married or partnered. A higher percentage of the married female (58%) than male (34%) faculty respondents from engineering have a spouse/partner who is also employed or seeking employment as an academic. This compares to 39% of the married/partnered faculty members overall⁹. Perhaps because of the rural location of Virginia Tech, both the percentage of married faculty and of dual-career academic couples is higher than what is found nationally where 72% of the faculty are married (men, 82.1%; women 62.0%). Across the country, about 29% of engineering faculty members have an academic spouse (men, 21.1%; women, 37.7%)¹⁰.

Table 1 compares descriptive information about the male and female tenure track and tenured engineering faculty responding to the questionnaire. An asterisk indicates comparisons where the differences are statistically significant by gender.

Many of the significant differences between the male and female faculty in engineering in the sample are related to age and the relative newness of women to faculty positions in engineering

at Virginia Tech. Women engineers are equally as likely to be married, but significantly more likely to have children and to be untenured than are their male colleagues. They are significantly less likely to hold the rank of full professor. There are not statistically significant differences among engineering faculty by gender in mean number of children (men=.85; women=1.40) or average weekly work hours (men=56.73; female 58.75).

Table 1: Demographic Characteristics of Engineering Faculty Respondents by Gender (N=154)

	Male Engineering Respondents (N=134) #	Female Engineering Respondents (N=20) #	Chi-Square Probability*
Marital Status			N.S.
Married	118	19	
Unmarried	13	1	
Children			5.82*
Yes	61	13	
No	41	1	
Position			4.27*
Untenured tenure-track	31	9	
Tenured tenure-track	103	11	
Rank (Tenured & Tenure Track Only)			10.995*
Assistant Professor	29	7	
Associate Professor	39	11	
Full Professor	66	2	

*N.S. = not significant; $p < .05$

Overall Job Satisfaction of Faculty in Engineering

The first research question addresses overall job satisfaction of faculty in engineering and how it compares to non-engineering faculty and by gender. In these analyses, job satisfaction is measured as the mean of agreement with three items from the questionnaire: (a) “Virginia Tech is a good place to work”, (b) “I feel I ‘fit in’ at Virginia Tech”, and (c) “Overall, I am satisfied with my job at Virginia Tech”. Respondents gauged their agreement to these and other questionnaire items using a four-point scale (1=strongly disagree; 2=somewhat disagree; 3=somewhat agree; 4=strongly agree). It is common in social science research to cluster similar questionnaire items in what are called factors or scales and to confirm their reliability through a statistical procedure called factor analysis. A complete list of all the questionnaire items in each of the scales appears in an appendix at the end of the paper. A reliability index (Chronbach Alpha) is included with each scale.

Most faculty report relatively high levels of job satisfaction. Nationwide, most full-time faculty members rank their overall job satisfaction as either satisfactory or very satisfactory¹¹.

Similarly, most faculty respondents at Virginia Tech agreed somewhat that they are satisfied with their job overall.

Table 2 presents a comparison of the levels of overall job satisfaction among engineers, with a comparison by gender and to non-engineering faculty.

Table 2: A Comparison Between the Means of Overall Job Satisfaction of Engineering and Non-Engineering Faculty Members and Between Female and Male Engineering Faculty Members

Overall Comparison *		Comparison Among Engineers*	
Engineers (n=149)	Non-Engineering (n=635)	Female (n=19)	Male (n=130)
3.05	3.11	2.63	3.11

* Correlation coefficient significant at the probability level .05 level or less.

The asterisks indicate that there are significant differences in the level of satisfaction between engineering and non-engineering faculty, as well as between male and female engineering faculty. At the time they responded to the questionnaire, engineering faculty were significantly less satisfied with their jobs than faculty members in other units.

Most importantly for purposes of this paper, female engineers were significantly less satisfied than male engineers in their jobs overall. While this is consistent with findings reported at a national level, the practical significance of this finding is amplified given its implications for retention, as well as in light of the resources and proactive strategies that are required to recruit to faculty positions from the relatively small pool of women graduating with doctorates in engineering who want to pursue an academic career.

Work-Life Spillover and Its Link to Job Satisfaction

The second research question examines the link between overall job satisfaction and seven questionnaire items group together in the Work-Life Scale. Most of the items in this scale are related to perceptions about the ability to be successful in a faculty role while managing non-work responsibilities (e.g. “It is not difficult to have a personal life and be promoted or earn tenure at Virginia Tech.”). Other items are related to perceptions that administrators and faculty colleagues respect a commitment to responsibilities outside of work (e.g. “Virginia Tech cares about the family/home life of its faculty.”). A complete list of questionnaire items in Work-Life Scale appears in the appendix.

Perceptions about work-life tensions are fairly uniform across the four faculty groupings. A comparison of the means reveals that there are not statistically significant differences between male and female engineers and between engineering and faculty members in other disciplines in perceptions about the items in the work-life scale. By and large, most faculty members agree somewhat with items in the Work-Life Scale (women=2.58; men=2.95; engineers=2.90; non-engineers=2.95).

Table 3 displays the Pearson Correlation Coefficient results from four separate analyses. A correlation coefficient is a statistical measure that reflects the degree to which high or low scores on one variable tend to match high or low scores on another variable. Values for correlation coefficients range from -1 to +1. Values between .30 and .49 are interpreted as moderately strong; .50 or greater demonstrate a strong relationship. High and low scores are assessed by variation from the mean¹².

The asterisks in Table 3 indicate that there is a significant correlation for each of the four groups between overall job satisfaction and perceptions about support for responsibilities and interests outside of work. Possibly because of hours spent in the lab and with graduate students, the correlation is significantly higher for engineers than non-engineers.

Table 3: A Comparison of the Correlation Coefficient Between the Work-Life Scale and Job Satisfaction of Engineering and Non-Engineering Faculty Respondents and Between Female and Male Engineering Faculty Respondents

Overall Comparison *		Comparison Among Engineers*	
Engineers (n=98)	Non-Engineering (n=423)	Female (n=12)	Male (n=186)
.417	.431	.663	.399

* Correlation coefficient significant at the probability level .05 level or less.

The correlations coefficients indicate that work-life issues are moderately strongly linked to overall job satisfaction for male engineering faculty and strongly linked to overall job satisfaction for female engineering faculty. The link is 40% stronger for female than male faculty in engineering. For both male and female faculty in engineering, more positive views about work-life spillover are significantly associated with greater levels of overall job satisfaction.

Policies and Practices Related to Work-Life Balance For Faculty

After demonstrating a positive and significant link for both male and female faculty between overall job satisfaction and positive views about work-life issues, the third research question sought to identify elements of the university and departmental work environment that correlated with a positive disposition about work-life spillover. Elements of the environment include formal and informal policies such as those regarding dual-career hires and the reward system. Informal practices include such things as efforts to provide mentoring, feedback about performance, opportunities for collaboration, and other dimensions of collegiality.

Table 4 displays correlation coefficients between institutional policies and practices and perceptions about work-life issues for engineering and non-engineering faculty. The asterisks indicate the probability level of the correlation coefficients. The smaller frequency counts reflect the number of respondents remaining after using a pairwise deletion.

Table 4: Correlation Between Institutional Policies and Practices and Work-Life Spillover Between Engineering and Non-Engineering Faculty

	Engineering Respondents (n=81) Correlation/Probability	Non-Engineering Respondents (n=341) Correlation/Probability
Balance	.492**	.461**
Dept. Administration	.380**	.332**
Rewards/Recognition	.388**	.468**
Resources	.356**	.377**
Spouse Satisfaction	.381**	.443*
Mentoring/Feedback	.335**	.371**

*p<.05; **p<.01

When male and females respondents are combined, there is a moderately strong, positive relationship between all of the variables listed in Table 4 and Work-Life Spillover. Even though there is a stronger relationship between perceptions about work-life and overall job satisfaction for engineering than for non-engineering faculty, there are not dramatic differences between engineers and non-engineers in policies and practices that influence their perceptions about environmental support for work-life issues.

The scale, Balance, which contains a single item from the questionnaire (“I am able to balance the teaching, research, and outreach activities expected of me”), is the variable most strongly related to perceptions about work-life for both engineering and non-engineering faculty. As with other elements of the reward structure, clarity about expectations is likely to help faculty members feel more confident that they are doing well at what is expected of them.

The Resources and the Recognition/Rewards scales were moderately strongly correlated to perceptions about work-life for male and female faculty in engineering. The Reward/Recognition Scale contains items related to the transparency of policies (e. g. “The requirements for promotion are clearly articulated in my department.”; “ Faculty in my department receive accurate and timely information about their progress toward tenure or promotion.”); to perceptions about recognition (e. g. “My departmental administration values my contributions to the department.”); and to perceptions that merit is fairly evaluated in the university reward structure (e. g. “This university rewards the efforts of faculty members who do outstanding work.”). In other words, faculty members who felt that performance expectations were clear, that merit was rewarded, and that their work was valued were likely to have positive attitudes about work-life issues. Transparent policies about performance expectations can mitigate some of the stress faculty members, particularly female faculty members, feel about having significant personal commitments beyond the work place.

The scale “spouse job satisfaction” had a significant positive relationship to perceptions about work-life spillover for both male and female engineering faculty. The relationship was much stronger for women than for men. Opportunities for spousal employment is an issue for all

faculty, but it is particularly salient for female faculty in engineering because they are more likely than other faculty to have a spouse or partner who is also in a technical field⁴.

Conclusions

There is substantial evidence in the research literature that perceptions about the potential to accommodate a family is an influential factor not only in women's choice of a faculty career, but their willingness to remain employed in one⁴. Findings presented in this paper document that there is a much stronger statistical link between overall job satisfaction and perceptions about work-life issues for female than male faculty in engineering. It also demonstrates that a number of elements of the work environment, such as clarity of the reward structure and satisfaction with a spouse's employment opportunities, are related to an assessment that it possible to be successful as a faculty member and to sustain interests and responsibilities outside of work.

"Family-friendly" policies and practices, such as the option to stop or delay the tenure clock for childbirth or adoption, on-campus childcare, and funds to support dual-career hiring, serve both practical and symbolic purposes. On the practical side, they offer resources, like childcare, that ease the time demands of a family. On the other hand, the symbolic role of work-life polices may be equally, if not more salient to overall faculty job satisfaction. When reflected in informal practices, such policies can be an effective way to communicate a work environment that does not penalize faculty who dedicate time to fitness, personal interests, or responsibilities in the family and community. Transparency about performance expectations appears to be an additional practice that could be considered "family friendly" because it counters perceptions that scientific roles are incompatible with having interests outside of work.

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⁸http://www.advance.vt.edu/Measuring_Progress/Faculty_Survey_2005/AdvanceVT_faculty_survey_instrument.pdf

⁹ *AdvanceVT Faculty work-Life Survey Data Report on Work-Life Issues, 2005*.

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¹¹ The Faculty. (2005, September 16). *Chronicle of Higher Education*, 52 (4), p. A25.

¹² Kerlinger, F. N., & Lee, H. B. (1999). *Foundations of behavioral research* (fourth ed.). N.Y.: Harcourt College Publishers.

Appendix A: Questionnaire Items in Each Scale with Reliability Measure

(Note: Reliability measures (α) above .70 are considered to be strong. An asterisk designates negatively worded items that were reverse coded during the analyses.)

Work-Life ($\alpha=.800$)

- This university cares about family/home life of its faculty.
- *It is difficult to have a personal life and be promoted or earn tenure at this university.
- *My personal or family responsibilities have slowed my advancement at this university.
- *I have seriously considered leaving my current job in order to achieve a better balance between my personal and professional life.
- *Professional/job demands force me to make unreasonable compromises about personal or family responsibilities and interests.
- *In my department, faculty who have children are considered less committed to their careers.
- *Meetings in my department are often scheduled at times that conflict with

Balance ($\alpha=.83$)

I am able to balance the teaching, research and outreach activities expected of me.

Collaboration/Collegiality ($\alpha= 0.7016$)

I have the opportunity to collaborate with colleagues at this university who share my interests.

My field or area of study is valued by colleagues in my department.

Collaboration is rewarded in my department.

I have good relationships with my co-workers.

Department Administration ($\alpha= 0.9131$)

I am treated fairly by the administration in my department.

The leadership of my department can be trusted.

The administration in my department is approachable when faculty members have job-related issues/concerns.

Overall, my department is well managed.

I feel free to express my opinions in my job without worrying about negative results.

Mentoring/Feedback ($\alpha= 0.8413$)

Performance expectations for faculty are communicated clearly in my department.

My job performance is reviewed in person with me at least once a year.

My performance reviews are based on how well I perform my job.

I receive useful recommendations on how I can improve my job performance from my department.

Recognition/Rewards ($\alpha= 0.8803$)

This university rewards the efforts of faculty members who do outstanding work.
Faculty members at this university are usually promoted or given opportunities based on good performance.
I am satisfied with the amount of input I have about major policy decisions in my department.
The requirements for tenure or promotion are clearly articulated in my department.
I am recognized for the contributions I make to the department.
My department's administration values my contributions to the department.
Faculty in my department receive accurate and timely information about their progress toward tenure or promotion.

Resources ($\alpha= 0.7672$)

I have the equipment and supplies I need to do my job at this university.
I have the lab or office space I need to do my job at this university.
This university provides the support that faculty members need to garner funded research projects.

Job Satisfaction ($\alpha= 0.8089$)

This university is a good place to work.
I feel I "fit in" at this university.
How satisfied are you with your job at this university overall?
How satisfied are you with your salary at this university?

Spouse/Partner ($\alpha = 0.646$)

My spouse/partner is satisfied w/ quality of life in geographic area.
I am satisfied with assistance offered by this university in finding employment for spouses/partners
*I have seriously considered leaving this university in order to improved the employment of my spouse/partner.