

AC 2008-438: CHANGES IN THE NATURE OF FACULTY WORK IN ENGINEERING DURING THE FIRST THREE YEARS

Elizabeth Creamer, Virginia Polytechnic Institute and State University

Elizabeth Creamer is Professor, Educational Research and Evaluation at Virginia Tech. She is the PI or CO-PI of two grants related to undergraduate women in engineering and other STEM fields and Director of Research and Assessment for the AdvanceVT project.

Tonya Saddler, Virginia Polytechnic Institute and State University

Tonya Saddler is a doctoral candidate in the Higher Education Program at Virginia Tech and a member of the VTADVANCE team.

Margaret Layne, Virginia Polytechnic Institute and State University

Peggy Layne is Director of the VTADVANCE Program and a doctoral student in the Science Technology Studies program at Virginia Tech.

Changes in the Nature of Faculty Work in Engineering during the First Three Years

Abstract

The literature frames the socialization process of new faculty members as if they face an identical set of challenges in each of their pre-tenure years, regardless of discipline. This research uses a longitudinal research design and interview data to determine if there are differences by year in the experiences of a cohort pre-tenure faculty in engineering at a research-intensive university. Two major shifts in priorities occurred within the three years: a shift from an emphasis on securing external funding to managing a research team and multiple sources of funding; and secondly, a shift from concern about the ambiguity of tenure expectations to growing confidence about expectations attributed largely to clear feedback about performance. Research findings presented here suggest that new faculty will benefit from professional development opportunities that address such issues as conflict, interpersonal communication, and essentials of supervision in a team and laboratory setting.

Introduction and Review of Related Literature

Social and organizational features of faculty work, often referred to in more generic way as climate, are recognized as one of the strongest influences on academic scientists' and engineers' productivity¹ and satisfaction². Perceptions of climate reflect policies, practices, and interactions at both a local level, as within a lab or department, and at more global level of the college or university. The Collaborative on Academic Careers in Higher Education (COACHE), an emerging voice from Harvard University about faculty careers, measures climate to include (a) personal and professional interactions with colleagues, (b) opportunities for collaboration, (c) sense of fit, (d) intellectual vitality of the senior faculty, (e) fairness of evaluation, (f) equitable treatment, and (g) support for professional development. Perceptions of climate at the more local level of the department are more strongly related to productivity and satisfaction than perceptions about similar issues at the level of the college or university³.

The centrality of teamwork in a lab setting is one element of faculty work that distinguishes academics in engineering and the natural and physical sciences from most of their colleagues in the social sciences, professional fields such as business and education, and the humanities. Teamwork is widely recognized to be the central feature of modern scientific research⁴. Teamwork is distinguished from collaboration because it involves cooperation between scientists, students, technicians, and others of equal and unequal status⁵. It is heavily dependent on external funding⁶. As compared to "big science" such as occurs at Lawrence Livermore or Sandia Labs, "small science" is a single investigator working in a designated laboratory space and developing an independent research agenda⁷. The lab setting serves as a prime venue for education, recruitment, and retention of both graduate and undergraduate students to STEM fields⁸. It provides the principal context for the socialization of graduate students⁹, but also presents challenges to new faculty members who have little prior experience in managing teams or supervising students within the context of multiple deadlines for deliverables from funding agencies.

Unlike their counterparts in industry, the nature of faculty work dictates that faculty members in engineering juggle the intensive time demands in the laboratory with other responsibilities that are important to promotion, including at research-intensive universities maintaining a satisfactory record in teaching, service, and outreach. Lack of clarity about expectations for tenure and inadequate feedback about performance concern faculty in many settings¹⁰. After climate and nature of work, clarity and reasonableness of tenure policies and practices is the third strongest factor in predicting the overall job satisfaction, as indicated by 6773 respondents at over 80 colleges and universities to the COACHE survey. Sorcinelli¹¹ identified a more comprehensive listing of stressors that weighed heavily on new faculty members across disciplines: (a) lack of time, (b) inadequate feedback and recognition, (c) unrealistic expectations, (d) lack of collegiality, and (e) inability to achieve a satisfactory balance between work and life outside of work. Time and balance issues are key stressors identified in other studies as well¹².

Context

Much research has documented that perceptions of collegiality and climate are particularly salient to female faculty members and important to the recruitment and retention of women in the sciences and engineering¹³. Virginia Tech is one 31 colleges and universities to date to receive five-year institutional transformation grants from the National Science Foundation's (NSF) Advance program. This program is targeted to improving the recruitment and success of female faculty members in science and engineering through program initiatives designed to improve departmental and university climate. As part of the research and assessment component of this project at Virginia Tech, a research project was launched to conduct yearly interviews with the cohort of faculty entering faculty positions in engineering in the fall of 2003. A time of severe budget restraints, the cohort was unusually small, with only 12 new faculty members (5 women; 7 men) hired in engineering. Each member of the cohort was contacted once a year to participate in an interview and to discuss the priorities, challenges, and support that were unique to that year.

Purpose

It is rare to find research about pre-tenure faculty that is disciplinary specific or considers how that experience may vary in significant ways between the first and last year prior to the mandatory tenure year. This paper presents early findings from a longitudinal research project about faculty member's perceptions about changes in jobs demands during the first three years of a faculty appointment in engineering. Data were derived from a yearly interview in each of three years with a single cohort of engineering faculty members (N=12) entering tenure track positions at a single research-intensive institution in fall 2003 (25 interviews for a 70% response rate). The cohort approach has the advantage of providing a way to control for the institutional, fiscal, and disciplinary contexts that influence experiences during a given time period. Yearly interviews overcome many of the limitations of retrospective interviewing and allow insight into how faculty members acclimate over time to changing job demands. The research has theoretical implications to the literature about faculty socialization and practical implications for interventions designed to recruit and prepare individuals for faculty careers. It also offers early

career engineering faculty members an idea of the types of challenges they might expect to encounter during their first three years of employment.

Methods

The data for this research derives from 25 interviews conducted with 12 pre-tenure faculty members in engineering at a single research-intensive university in each of the first three years of employment. An investigation of the first three years is important because it is a critical period of adjustment to a new institutional climate and expectations, as well as to a faculty role. It also is the time period when faculty members are establishing the foundation for their future research program.

The following sections describe the sample, data collection procedures, and methods used to conduct the analysis.

Sample

The sample consists of 12 pre-tenure faculty members (5 females; 7 males) all hired as untenured faculty in the fall of 2003. Due to fiscal restraints, this is the entire pool of new faculty members hired in engineering at a single research-intensive university at that time. All but two of the participants have a spouse or partner. The relative gender balance is unprecedented and reflects institutional initiatives and top-level leadership at the time. The population includes non-native Americans, but is otherwise is not ethnically diverse.

Table 1 provides information about the gender, rank, discipline, and prior experiences as a faculty member for each of participants.

Table 1. Key characteristics of the participants at entry

Participant ID	Rank	Discipline	Prior experience as a faculty member
NF-F1	Assistant Professor	Industrial and Systems	
NF-F3	Associate Professor	Computer Science	
NF-F4	Assistant Professor	Civil and Environmental	
NF-F5	Assistant Professor	Mechanical	3 years
NF-F6	Associate Professor	Aerospace and Ocean	5 years
NF-M1	Assistant Professor	Mechanical	
NF-M2	Assistant Professor	Electrical	
NF-M3	Assistant Professor	Computer Science	
NF-M4	Assistant Professor	Electrical	
NF-M5	Assistant Professor	Aerospace and Ocean	2 years
NF-M6	Associate Professor	Electrical	

*F in first column=female; M=male.

Data collection procedures

The first author initiated the project and conducted an individual interview with the members of the 2003 new faculty cohort in each of the three academic years following the initial hire. All three co-authors conducted a group interview in the fifth and final year of project as a form of member checking and to gain more information about key conclusions from the analysis of the first three years of data.

The content and format of the interviews varied from year to year. In every case, participants were asked to reflect on the priorities and challenges unique to that year and the clarity of the expectations for tenure. A small incentive, such as memory stick, was offered to participants each year. Interviews in the first and second year were semi-structured and lasted between forty-five minutes to an hour. The participant signed an IRB form, agreeing to participate in the longitudinal project. The interviews were recorded and transcribed verbatim. Most of the questions in the first year interview protocol dealt with impressions of the recruiting and hiring practice. Participants were also asked to reflect on experiences that lead to their interest in being a faculty members and to identify what things a department head or administrator could do at the moment to directly impact research productivity in a positive way.

A semi-structured interview protocol was also used as a guide during the interviews conducted in the second year. Participants were asked to reflect on 7 issues: (a) satisfaction with first year performance, (b) positive aspects of the first year, (c) challenging issues of the first year, (d) work-life issues impacting satisfaction and ability to work at a preferred level, (e) clarity about the expectations for tenure and promotion, (f) networking and mentoring opportunities, and (g) challenges anticipated in the coming year.

A more open-ended format was used during the third year to allow follow-up on issues and challenges mentioned in the interviews during the previous two years. This interview was conducted by telephone and lasted between thirty to forty minutes. The lead author completed detailed field notes during and immediately following each interview.

Analytical Procedures

The three-person team began working on the analysis of the transcripts and field notes during the fourth year of the project, with each person assuming primary responsibility for a single year. The team first met to define a preliminary, targeted (vs emergent) coding scheme and to establish procedures to enter the coding in the qualitative software NVIVO. The coding scheme involved three major categories: tenure and promotion, challenges, and supports. As a second step, each team member coded all the transcripts from their assigned year, the team then met to discuss identify findings. The second author, Saddler, then entered all the data into NVIVO and produced a matrix that showed the number of responses by category and year.

As a final step to confirm and triangulate findings for the first three years, a semi-structured interview guide was developed to serve as a member check of key findings. Participants met as a group during two lunch meetings. They signed an IRB form and completed a brief instrument to collect demographic information relevant to the study, such as number of graduate students funded by year. The group interview was recorded and transcribed verbatim.

Findings and Discussion

This paper summarizes several key findings from a longitudinal research project about faculty member's perceptions about **changes** in job demands during the first three years of a faculty appointment in engineering launched by the *AdvanceVT* project. It speaks directly to two areas of change emphasized by most members of a 12-person cohort of faculty members entering faculty positions at a single research-intensive institution: a shift from an emphasis on securing external funding to managing a research team and multiple sources of funding; and secondly, a shift from concern about the ambiguity of tenure expectations to growing confidence about expectations attributed largely to clear feedback about performance.

While this paper addresses two areas where shifts occurred in engineering faculty participants' views, there were a number of additional challenges where there was little shift in emphasis from year-to-year. For example, time pressures and multi-tasking were at the top of the list of challenges reported by faculty in each of the three years. Appropriate employment opportunities for a partner remained an on-going concern for all of the married or partnered participants. Top sources of support also did not vary in any significant way between the first and third years. These were: resources, collegiality, and departmental climate. Findings about these topics, as well as gender differences are reported elsewhere¹⁴.

The remainder of this section of the paper describes the two topics where perceptions of engineering faculty members shifted between the first and third years.

Clarity of T and P Policies

As has been found to be the case nationally and across disciplines (e.g. by COACHE), policies and practices related to tenure and promotion was the challenge mentioned most frequently by members of the 2003 cohort of new faculty in engineering. Comments coded in this category include references to (a) one's own performance relative to standards, (b) opinions voiced about the clarity of the policies, and (c) feedback received about performance. The number of

references increased over the course of three years. Comments about mixed messages and unclear policies diminished over the course of the first three years. At the same time, references to the value of concrete feedback emerged. Variation among the practices of departments within engineering is apparent, however. This reflects whether a formal mentoring system is in place, if it involves on-going interaction initiated by a mentor, and includes comprehensive annual reviews.

In the face of generic information summarizing the performance of others in the department in previous years, during his second year, a male faculty in electrical engineering commented on what seemed at the time to be unrealistic expectations when he said:

I guess what I'm having trouble with is that at one year I'm looking at these expectations for what I will need to have completed at the end of five years and the naïve thing is to divide by 5. But if I divide by 5 I get something that at this point seems unachievable. (Electrical engineering, male, year 1)

The views of a female participant in a department without a formal mentoring system shifted somewhat between the second and third year interview. During the second year interview, she described a few exchanges initiated by her department head about the tenure requirements, but her sense was that it was her responsibility to find the information in printed form. In her second year, she said, "I feel like it's not a big secret. The information is out there if I feel like researching it." A year later, her perspective shifted somewhat, as shown in the following quote:

T & P is a pretty open process. When I first got here, I got a lot of information. I haven't done much about getting any more information. I am not too worried about it. I didn't come here to get tenure. I enjoy what I do and figure I will get tenure. If I don't get tenure, I'd have to reconsider my career options. But I have every indication that I will get it. (Civil engineer, female, year 3)

The increase in confidence expressed by this participant reflects her sense of meeting key standards, as well as the system of review in place to provide formal feedback about performance. Clarity about tenure policies does not derive solely from detailed, written policies. Evidence of other faculty member's progress on key benchmarks and concrete and routine feedback about performance in light of expectations are important ways of erasing the perception that tenure policies are ambiguous.

Managing a Research Team

The number of comments related to the challenge of managing a research team is a second area where change was noted between the first and third year. This reflects a shift in focus after the second year from securing external funding to managing what generally turned out to be multiple grants on different topics, along with a growing number of students. The key concern raised in this area in the second and third year of a faculty appointment was effective strategies for managing and supervising students. A second area was related to the time demands of recruiting quality students to the teams.

During the third year interview, a male faculty in aerospace engineering captured the kinds of activities that are involved in shifting priorities from securing external funding to managing external funding:

My first two years, I spent a lot of time writing proposals. Now it has shifted to an enormous amount of time trying to manage these projects. I am spending a lot of time in meetings and planning. I spend a lot of time recruiting student to fill the GRA slots that have been created. My research group has grown a lot, so we spend a lot of time interacting. Last year I had two students; this year I had 5. I expect to add two more... It's all so new. You have these budgets that you work with the Office of Sponsored programs. It's a lot of managerial stuff. We don't get much support for that. (Aerospace engineer, male, year 3).

His words reflect escalating time demands of managing several grants and how the types of skills required to perform job responsibilities expand from scholarly to practical matters.

After the second year, participants often characterized themselves as experimenting with different strategies to interact effectively with students working with them on projects. Many looked to senior colleagues as models. A third year electrical engineering male faculty member spoke about his challenge meeting with students on a regular basis. He stated,

I started meeting once a week. I was so overwhelmed with that, that I switched to meeting as a team once a week. Then I meet on an ad hoc basis to work through thorny issues. I am still meeting with most of them every other week or so, but not quite every week. (Electrical engineering, male, year 3)

As they gained experience, other participants described strategies they used to streamline the amount of time they spent with graduate students. One of these was to engage advanced students to work with those with less experience on the teams. Time demands on faculty members lessened somewhat as advanced students gained content area expertise and experience with preparing papers and presentations.

Summary and Conclusions

Three years is a relatively short time span, particularly given that many faculty members do not receive formal feedback regarding their performance until after the second year review. While issues of collegiality, climate, and time management were sources of both challenges and support for new engineering faculty members across the years, key shifts occurred in attitudes about performance expectations and about what is entailed in supervising the activities of a growing research team. Between the first and third years, faculty members expressed growing clarity about performance expectations. They continued to struggle with effective strategies to supervise team members, while maintaining personal standards of accuracy and quality.

This research contributes to the literature about the socialization process for new faculty by underscoring the importance of recognizing unique characteristics of the social organizational settings of faculty work that occurs in a laboratory setting. It provides support for the argument that challenges faced by pre-tenure faculty members change in some important ways from year to year.

Much research emerging from COACHE and other sources underscores the importance faculty place on feedback about performance and how few new faculty members are satisfied with the type of feedback they receive¹⁵. This is an example of an element of perceptions about climate that can be addressed directly with relative ease because it is something within the control of a department head to implement or refine. Participants found benchmarks of the expectations helpful at first, but concrete, individualized feedback was particularly prized. This kind of feedback adds to a sense of “fit” and appears to reduce anxiety that there is some hidden penalty for committing time to family responsibilities¹⁶.

Experience suggests that universities invest considerably more resources in programs and activities targeted to help faculty secure external funding than interventions designed with the purpose of helping faculty members to gain the skills needed to be effective managers after an award is made. The laboratory setting simultaneously is recognized as an incubator for the next generation of academic scientists and a place that because of its insularity that can be toxic, particularly for women¹⁷. Research findings presented here suggest that new faculty will benefit from professional development opportunities that address such issues as conflict, interpersonal communication, and essentials of supervision. A number of Advance institutions have had success in developing programs that address unconscious bias by using tutorials developed by Valian¹⁸. Strategies for managing a research team also would be a valuable topic for a departmental mentoring program in the sciences and engineering.

References

-
- ¹ Fox, M. F., & Mohapatra, S. (2007). Social-organization characteristics of work and publication productivity among academic scientists in doctoral-granting departments. *The Journal of Higher Education*, 78 (5), 542-571.
 - ² *Tenure-track job satisfaction survey: COACHE report highlights*. (2007, August). Cambridge, MA: Harvard Graduate School of Education.
 - ³ Olsen, D., Creamer, E., & Layne, M. A. (2005). AdvanceVT faculty job satisfaction model. Poster presented at the 2005 Advance PI Meeting, Washington, DC. (http://www.advance.vt.edu/Measuring_Progress/Posters/Faculty_satisfaction_poster.pdf)
 - ⁴ Fox & Mohapatra, 2007.

-
- ⁵ Bradley, R. T. (1982). Ethical problems in team researcher: A structural analysis and an agenda for resolution. *The American Sociologist*, 17, 87-94.
- ⁶ Dewey, T. G. (2007, December, 14). *Big opportunities in small science*. [Point of View]. *The Chronicle of Higher Education*, B16.
- ⁷ Dewey, T. G., 2007.
- ⁸ Dewey, T. G., 2007.
- ⁹ Fox, M. F. (1998). Women in science and engineering: Theory, practice, and policy in programs. *SIGNS*, 24 (1). 201-223.
- ¹⁰ COACHE, 2007.
- ¹¹ Sorcinelli, M. D. (1992). New and junior faculty stress: Research and response. In M. D. Sorcinelli & A. E. Austin (Eds.), *Developing new and junior faculty* (pp. 27-37). San Francisco, CA: Jossey-Bass Publishers.
- ¹² Olsen, D. (1993). Work satisfaction and stress in the first and third year of academic appointment. *Journal of Higher Education*, 64 (4), 453-471.
- ¹³ Saddler, T., & Creamer, E. G. (2006). *Collegiality and the job satisfaction of science and engineering women and minority faculty*. Poster presentation. Association for the Study of Higher Education (ASHE) National Conference. Anaheim, CA, November 1-4, 2006.
- ¹⁴ Creamer, E. G., & Saddler, Y. S. (2008). *A Longitudinal Analysis of the Priorities and Challenges of Pre-tenure Faculty in Engineering and the Sciences by Gender*. Paper presented at the American Educational Research Association annual meeting. New York City. March 24-28, 2008.
- ¹⁵ COACHE, 2007.
- ¹⁶ Amelink, C. A., & Creamer, E. G. (in press). Work-Life Spillover and Job Satisfaction of Married/Partnered Faculty Members. *Journal of Women and Minorities in Science and Engineering*.
- ¹⁷ Fox, M. F., 1998.
- ¹⁸ <http://www.hunter.cuny.edu/gendertutorial/>.