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Gender and Race Differences in Job Satisfaction and Commitment among STEM Faculty: The Influence of Network Integration and Work-Family Balance

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GENDER AND RACE DIFFERENCES IN JOB SATISFACTION AND COMMITMENT AMONG STEM FACULTY: THE INFLUENCE OF NETWORK INTEGRATION AND WORK-FAMILY BALANCE

by

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Using data on 137 Science, Technology, Engineering, and Mathematics (STEM) faculty working at a research intensive Midwestern University, this study explores whether gender and race variation in network (connections to other faculty within one's primary department) and work-life (family-friendly work climate and satisfaction with work-life balance) integration can explain gender and race variation in job satisfaction and organizational commitment. Results indicate that job satisfaction did not significantly vary by gender or race. Women, however, were less likely to say they intend to remain at their current institution. Compared to men, women had lower levels of integration in the departmental friendship network, worked at the University for a shorter period of time, and were more likely to be unmarried. Size of friendship networks and years at the institution were positively correlated with organizational commitment while being unmarried was negatively correlated with organizational commitment. Thus, these three factors explained the gender differences in organizational commitment. Network integration in research networks and work-life integration did not predict organizational commitment and did not vary by gender. The significant differences in organizational

commitment between white and nonwhite faculty remain unexplained as network and work-life integration did not vary by race.

Introduction

Historically, women faculty and faculty of racial minority groups have been underrepresented in the fields of Science and Engineering (National Science Foundation [NSF], 2006, 2008). According to the reports by National Science Foundation (NSF) (2006, 2008), however, women and minorities' share of doctoral degrees and faculty positions has been increasing over time. In 2006, women earned 40.2% of Science and Engineering doctoral degrees, and they constituted 42% of full-time tenured or tenure-track faculty with relatively recent doctorates (those who received Ph.D. within 7 years)[1] (NSF, 2008). In terms of race, Asians, Blacks, Hispanics, and American Indians earned 35% of all Science and Engineering doctoral degrees as a group in 2003. Among the recently employed faculty (those who received Ph.D. in 2000 or later), 28% were minorities as of 2003 (NSF, 2006).

The rising inflow of women and minorities into Science and Engineering might give the impression that time could solve their underrepresentation. Unfortunately, however, the recent increase in their proportions at the assistant professor level does not necessarily improve their representation at the full professor level. This is because successful recruiting of under-represented faculty will not diversify faculty if the institution fails to retain these new hires. Recruiting will not matter if under-represented

[1] It is important to note that NSF defines "Science and Engineering" as Physical, Mathematical, Computer, Environmental, Life, Engineering, Psychological and Social Sciences (Fox, 2001). Compared to the other fields, women's representation is higher in Psychology (71.3% of doctorate degree recipients and 46.2% of all tenured or tenure-track faculty in 2006) and in Social Sciences (45.7% of doctorate degree recipients and 33.9% of all tenured or tenure-track faculty in 2006) (NSF, 2008). Therefore, the proportion of women doctoral degree holders and faculty would have been smaller if the two fields had been excluded from the calculation.

faculty leak out of the pipeline at the stages of the tenure and promotion stage of their career. Thus, in addition to recruitment, we need to consider retention a crucial aspect in increasing faculty diversity. Furthermore, this study places value on faculty retention because it costs time and money to replace faculty (especially faculty from an under-represented group) when somebody leaves the position (Moody, 2004). Considering the cost of losing underrepresented faculty after recruitment efforts, furthering the understanding of faculty retention would be of great interest and value for administrators within academic institutions.

This study pays particular attention to the influence of academic climate perceptions to explore the mechanisms of faculty retention in Science and Engineering. It is important to know in general how academic climate can promote faculty retention in addition to understanding gender and race variations in retention. Given that under-represented faculty are likely to report feelings of isolation (MIT Report, 1999; Smith & Calasanti, 2005) and that work-family conflict is a prevalent problem in academia (Jacobs & Winslow, 2004; Mason & Goulden, 2002, 2004; Monosson, 2008), I focus on two key academic climate perceptions (network integration and work-family balance) and examine their influence on job satisfaction and organizational commitment. Job satisfaction and organizational commitment are treated as proxy indicators for faculty retention in this paper. A detailed discussion on these indicators is in the later section.

In an attempt to understand retention of under-represented faculty, this study takes a two-step approach. First, I explore gender and race variation in academic climate perceptions (network integration and work-family balance) as well as variation in job satisfaction and organizational commitment. Secondly, I explore whether gender and race

variation in academic climate perceptions can explain gender and race variation in job satisfaction and organizational commitment, if any. In other words, I investigate if gender and race variation in job satisfaction and organizational commitment is mediated by academic climate perceptions.

For several reasons, this study advances past research. First, it explores the mechanism of retention focusing on academia, which has unique organizational structures and may have different turnover patterns compared to business organizations. The second advantage of this study is that it measures isolation from a network perspective (the number of connections in the research exchange network and the friendship network within the department). A handful of previous research reported that there is perceived isolation among women and minority faculty (Cornell University Provost's Advisory Committee on Faculty Work Life [CUPACFWL], 2006; MIT, 1999; Monroe, Ozyurt, Wrigley, & Alexander, 2008; Ross & Gatta, 2009: Smith & Calasanti, 2005; Yen, Quinn, Carrigan, Litzler, & Riskin, 2007). Therefore, the unique use of the network perspective will contribute to a better understanding of isolation in academia. Finally, this study explores how the level of network integration is related to job satisfaction and organizational commitment. This relationship has been studied in non-academic organizations (Ibarra & Andrews, 1993; Roberts & O'Reilly, 1979) but not in academic settings.

To start with, I will define the terms job satisfaction and organizational commitment and explore gender and race variation in these concepts. Then I will discuss work climate perceptions (network integration and work-family balance) in academic and non-academic environments focusing on gender and race variation. At the end of each

section on network integration and work-family balance, I will explore how they are related to job satisfaction and organizational commitment.

1. Job Satisfaction and Organizational Commitment

Faculty retention is difficult to directly study because faculty turnover takes place over a long period of time. Therefore, this research explores two proxy indicators for faculty retention: job satisfaction and organizational commitment. Job satisfaction is defined as an affective reaction to the roles that workers play at workplace (Kalleberg, 1977). On the other hand, organizational commitment is defined as workers' response to more general conditions, such as organizational context (Ibarra & Andrews, 1993). More specifically, this study conceptualizes organizational commitment as an intention to remain at the organization under the assumption that changing one's job could be a negative response to overall organizational conditions.

It is important to consider job satisfaction and organizational commitment as distinct concepts for two reasons. First, job satisfaction and organization commitment are different reactions to work environments. As their definitions in the previous paragraph showed, job satisfaction is a reaction to one's work itself while organizational commitment is a reaction to the organizational contexts (Ibarra & Andrews, 1993; Kalleberg, 1977). Simply put, job satisfaction and organizational commitment are specific (former) and general perceptions (latter) of the workplace.

Second, job satisfaction and organization commitment are related to retention at different levels. It is possible that workers keep working for the same organization because they like their roles at the workplace (i.e., they have high job satisfaction).

However, it is also possible that workers keep the job even though they are not satisfied with the work itself (i.e., they have low job satisfaction). There are many potential reasons why dissatisfied workers are not always likely to leave the organization. For example, close relationships with colleagues, good compensations (e.g., salary, benefits), and lack of alternative jobs might stop them from leaving. Unlike job satisfaction, however, organizational commitment (i.e., intention to remain at the organization) is strongly related to retention (Mobley, Horner, & Hollingsworth, 1978). Because intentions often cause subsequent behavior, information on workers' intentions to remain or leave the organization helps predict the actual act of leaving (Callister, 2006). Thus, based on the previous studies' argument that job satisfaction and organizational commitment are distinct reactions to the workplace (Ibarra & Andrews, 1993; Kalleberg, 1977) and that they predict retention at the different levels (Callister, 2006; Mobley et al., 1978), this study explores the two concepts simultaneously.

Gender and Race

Several studies examined gender and race variation in job satisfaction and organizational commitment among faculty. However, they offer mixed findings. In terms of job satisfaction, some researchers argue that women tend to have lower job satisfaction than men (Bilimoria, Perry, Liang, Stoller, Higgins, & Taylor, 2006; Callister, 2006; CUPACFWL, 2006; Rosser, 2004) while others argue that men and women are equally satisfied (Sabharwal & Corley, 2009).

Two previous studies explored differences in job satisfaction among faculty across race. Sabharwal and Corley (2009) found that Asians were more dissatisfied than Whites, but African Americans were equally or more satisfied than Whites. A study at

Cornell University (CUPACFWL, 2006) found that faculty job satisfaction did not significantly vary by race. In sum, the previous studies provide inconsistent findings whether job satisfaction varies by gender and race, and it is worthwhile to investigate gender and race variation further.

Less research has focused on organizational commitment. For example, I only found one study which explored race variation in organizational commitment. Rosser (2004) found that minority faculty as a group had lower organizational commitment than White faculty. The few studies on gender differences in organizational commitment have also produced inconsistent findings. One study found no significant gender variation (Xu, 2008). There are also two studies in contrast that found women's tendency to have lower organizational commitment than men (Callister, 2006) and men's tendency to lower organizational commitment than women (Smart, 1990). Smart's study (1990) showed that among tenured faculty, women tended to have higher organizational commitment than men, but among non-tenured faculty, there was no significant gender difference.

As identified above, there are mixed findings on gender and race variation in job satisfaction and organizational commitment. However, the majority of the previous research found that compared to men and Whites, women and minority faculty have either equal or lower job satisfaction and organizational commitment. Thus, I hypothesize that among Science and Engineering faculty, women and minorities have lower job satisfaction and organizational commitment than men and Whites.

This study focuses on academic climate perceptions (network integration and work-family balance) as potential factors that mediate gender and race differences in faculty job satisfaction and organizational commitment. The following sections assess

gender and race variation in network integration and work-family balance, and then discuss the association of network integration and work-family balance with job satisfaction and organizational commitment.

2. Network Integration

Network integration is especially important for faculty in Science and Engineering. Compared to other disciplines, isolation has a particularly disadvantageous effect in Science and Engineering because cooperation among researchers (i.e., teamwork) is almost a requirement for career success in these fields (Fox, 2001). Besides opportunities for cooperation, isolation could cause negative consequences. There are many opportunities to make subjective judgments about faculty in academia (e.g., evaluations of colleagues, vitae, and job candidates), and those who are subjects of negative stereotypes (often women and minorities) tend to be vulnerable to unequal evaluation and treatment caused by biased interactions (Ross & Gatta, 2009). Considering the importance of network integration in the fields of Science and Engineering, this study attempts to further understand its relationship with faculty job satisfaction and organizational commitment. This section starts with theoretical explanations for gender and race variation in network integration in the workplace. Then, I will provide a review of empirical research which (a) has focused on perceptions of isolation in academic environments or (b) has conducted social network analyses primarily focusing on non-academic work environments.

Theoretical Explanation

There are two major theoretical explanations for gender and race variation in network integration in the workplace: the human capital perspective and the systematic barriers perspective. The human capital perspective explains that women and minorities' human capital (e.g., rank and experience) is generally lower compared to White men, and this difference makes women and minorities less desirable contacts and consequently make them isolates (Blau & Ferber, 1987, Miller, 1986, as cited in Ibarra, 1992, p.426). On the other hand, the systematic barriers perspective explains that organizational structures (e.g., being a numerical minority, stratification) bias interaction patterns among workers. Then, these biased interactions amplify differences between minority and majority groups and maintain unequal network integration levels (Kanter, 1977; Morrison & Von Glinow, 1990, Fairhurst & Snavely, 1983, as cited in Ibarra, 1992, p.426).

Kanter's (1977) idea of tokenism is an example of the systematic barriers perspective. She points out the importance of relative numbers in the workplace. Numerically rare individuals, such as women in male-dominated workplaces and minorities in White-dominated workplaces, are considered tokens. Tokens often gather attention from others in the workplace. Because of their visibility, the differences between tokens and the dominant group are exaggerated. While tokens become self-conscious of their numerical minority status, members of the dominant group become aware of the commonalities within the group by contrasting themselves to the tokens. Thus, the tokens have a tendency to become outsiders or end up being in isolated positions.

In sum, the human capital perspective emphasizes individual characteristics while the systematic barriers perspective emphasizes characteristics at the organizational level.

Comparing the effectiveness of these two perspectives is not the purpose of this study. However, these perspectives imply the complex process that prevents integration of women and minorities in organizations which have been traditionally dominated by White men. Next, I will review empirical research.

Perceived Isolation in Academia

In recent years, researchers have paid much attention to isolation of under-represented faculty in academic work environments; it has been often reported that women and minorities are likely to experience feelings of isolation (CUPACFWL, 2006; MIT, 1999; Monroe et al., 2008; Ross & Gatta, 2009: Smith & Calasanti, 2005; Yen et al., 2007). The study by Smith and Calasanti (2005) explored two indicators of isolation: institutional isolation and social isolation. The first concept, institutional isolation, is perceived exclusion "from inner-circles and decision-making" (Smith & Calasanti, 2005, p.309), and the second concept, social isolation, is perceived exclusion "from supportive networks" (Smith & Calasanti, 2005, p.310) (e.g., close friendship). Women were more likely than men to feel socially isolated, but there was no gender difference in institutional isolation. Compared to Whites, Asians were more likely to feel institutionally isolated, and African American were more likely to feel socially isolated.

Although it is a prevalent view that under-represented faculty tend to feel isolated, previous studies on academic settings measured network integration with "perceived" isolation (CUPACFWL, 2006; MIT, 1999; Monroe et al., 2008; Ross & Gatta, 2009: Smith & Calasanti, 2005; Yen et al., 2007). For example, it is possible that some faculty reported feeling integrated at the workplace when they had a strong relationship with only one other faculty member. At the same time, it is possible that faculty reported

feeling isolated even though they engaged in interactions with multiple other faculty members. Due to their methodologies (e.g., interviews, surveys of work climate perceptions), how well faculty were actually connected with each other was not shown very clearly in the previous research. Thus, this study takes a different approach. Instead of feelings of isolation, I analyze faculty's interaction patterns within Science and Engineering departments using the network data which were obtained at a research intensive Midwestern University. I count the self-reported number of connections within their departments to compare levels of network integration by gender and race. The use of actual network ties in measuring integration levels is the uniqueness and strength of this study.

Social Networks

To my knowledge, no research has examined network ties at an academic institution. Yet there is plenty of social network literature on non-academic organizations (e.g., a newspaper publishing company, an advertising firm, state government) (Brass, 1981, 1985; Ibarra, 1992, 1993; Moore, 1988, 1992; Pelgi & Moore, 2004). The network perspective conceptualizes that an organization consists of interdependent individuals who interact with each other and form personal networks (Brass, Galaskiewicz, Greve, & Tsai, 2004). Network researchers analyze interaction patterns and precedence or consequences of these patterns.

Informal organizational networks are often the focus of research because informal interactions are related to work outcomes, such as getting a promotion (Brass, 1985; Moore, 1992). Informal networks are "discretionary patterns of interaction, where the content of relationships may be work related, social, or a combination of both" (Ibarra,

1993, p.58). Such networks can be divided into two categories (instrumental networks and expressive networks) based on the characteristics of interactions. In instrumental networks, individuals exchange job-related resources, such as information, advice, and materials, while friendship and social supports are shared in expressive networks (Ibarra, 1993). In Smith and Calasanti's study (2005) on the perceptions of isolation among faculty, for example, interactions in instrumental networks might have influenced the perceptions of institutional isolation while interactions in friendship networks might have influenced the perceptions of social isolation.

Overall, the results of social network research provide mixed findings on whether integration patterns vary by gender in non-academic organizations. It seems that for the workplaces with a high proportion of women, research found no significant gender difference or women's greater informal network integration than men (Brass, 1985; Ibarra, 1992). In the cases where women's proportion was low, however, women were found to be less integrated than men (Moore, 1988, 1992).

For example, Ibarra's (1992) study on an advertisement firm had a sample in which women were highly represented (57%), and she found that men and women had equal network integration levels controlling for individual characteristics (e.g., education, tenure status, past work), rank, and departments. In addition, Brass' (1985) sample of workers at a newspaper publishing company also included a high percentage of women (46%). His findings showed that women were more integrated in the informal interaction network than men. Based on this previous research, women might be better at building informal networks than men. However, it is highly possible that men and women's interaction patterns might be influenced by gender composition in the workplace. Even if

women are better able to develop informal networks than men, these relationship skills might be compromised when there are few women in the workplace.

There are two studies that found gender differences in informal network integration at the male-dominated workplaces. Moore (1988) conducted an international comparative research among the United States, West Germany, and Australia on elites in powerful national organizations (e.g., politics, business, news media). Her sample had only 54 women (4%) out of 1415 respondents, and the results showed that in all countries, women were less integrated in informal elite networks than men. Another study by Moore (1992) analyzed informal interaction patterns on state government. This study had a higher, but still relatively small proportion of women (36% or 36 women out of 101 respondents). Her results revealed that men were more integrated than women in the instrumental network and that there was no significant gender difference in the expressive network. Thus, consistent with systematic barriers perspective women might be more likely than men to become isolates particularly when they work in male-dominated workplaces.

Compared to gender variation, race variation in network integration has been less studied and understood (Miller, Lincoln, & Olson, 1981). Women and minorities tend to have common characteristics (e.g., numerical minority status, negative stereotypes regarding competence, lower social status than White men) (Fernandez, 1981, Morrison & Von Glinow, 1991, O'Leary & Ickovics, 1992, Ridgeway, 1991, as cited in Ibarra, 1993, p.66); therefore, they may have similar levels of isolation within organizations.

Academic Science and Engineering departments are clear examples of instances where women and minorities are numerically rare. Therefore, I hypothesize that women

and minority faculty have lower levels of network integration compared to men and White faculty, respectively.

Network Integration on Job satisfaction and Organizational Commitment

For several reasons, network integration should have considerable influence on Science and Engineering faculty's job satisfaction and organizational commitment. First, there are previous faculty retention studies that found a major effect of interpersonal issues, such as relationship with colleagues and chairperson, on decision to leave an institution (Johnsrud & Heck, 1994; Maiter, 1990; Weiler, 1985). Therefore, it is likely that networking in the workplace influences faculty's reactions to the workplace.

Secondly, empirical research on non-academic settings (an advertising firm and high technology military organizations) has shown the association between network integration (measured with informal interaction patterns or communication patterns) and reactions to the work environments (measure with evaluation of the workplace or job satisfaction and organizational commitment) (Ibarra & Andrews, 1993; Roberts & O'Reilly, 1979). For academic settings, research has identified that perceived network integration is positively related to job satisfaction (Bilimoria, et al, 2006; CUPACFWL, 2006; Settles, Cortina, Stewart, & Malley, 2007) and organizational commitment (Smith & Calasanti, 2005).

Putting the previous studies on academic and non-academic settings together, it is likely that network integration is positively related to job satisfaction and organizational commitment. In fact, network researchers generally emphasize the benefits from social networks in workplace (Burt, 1998; Lin, 1999; Palgi & Moore, 2004). Therefore, I

predict that more integrated faculty will have higher job satisfaction and organizational commitment than less integrated faculty.

Although I expect a positive influence of network integration, some researchers argue that individuals can face negative consequences of networks (Brass et al., 2004; Labianca & Brass, 2006). According to Labianca and Brass (2006), for example, negative relationships could cause social liabilities. Taking into account the potential negative consequences of network integration, this study also explores the influence of over-integration. That is, instead of simply assuming positive linear relationships of network integration with job satisfaction and organizational commitment, I test curvilinear relationships of network integration with job satisfaction and organizational commitment.

3. Work-Family Balance

In this section, I discuss the other potential mediator in gender and race variation in job satisfaction and organizational commitment: work-family balance. Work-family conflict has been recognized as a prevalent problem in academia (Mason & Goulden, 2002, 2004; O'Laughlin & Bischoff, 2005). Balancing work and family life is a common concern among faculty of all disciplines (UC Faculty Family Friendly Edge [UCFFFE], 2005), but faculty in Science and Engineering are especially likely to struggle with tension between work and family because of the particular characteristics of the fields, such as competitiveness, long working hours, and necessity of traveling (Mason & Ekman, 2007; Monroe et al., 2008). Therefore, there is a strong possibility that work-family balance has an influence on faculty's job satisfaction and organizational commitment. When I use the term work-family balance, it represents the general

experience of balancing work and family life and the experience of conflict between the two spheres. In the following paragraphs, I will review the literature on work-family balance in both academic and non-academic environments, and then explain why I expect that gender and race variation in work-family balance among Science and Engineering faculty exists.

Work-Family Balance

Work-family conflict is commonly experienced in academia (Mason & Goulden, 2002, 2004; O'Laughlin & Bischoff, 2005). According to the research by Jacobs and Gerson (2004), among workers in various occupations, highly educated men and women who have technical, managerial, or professional positions have a tendency to work for the longest hours and experience the biggest gap between their ideal work hours and the actual work hours. Considering that university professors tend to work for longer hours per week compared to other professionals (Jacobs & Winslow, 2004), it is particularly worthwhile to study work-family balance in academic environments.

In addition, there are reasons why faculty's work-family balance should be taken seriously. For example, Mason and Goulden's studies (2002, 2004) showed a strong interconnected relationship between family and academic careers. They point out that family factors influence job outcomes (e.g., success in earning tenure) while academic careers influence family outcomes (e.g., delay/forgo marriage and child bearing).

Work-family balance is a serious concern outside of academia as well, and there are many previous studies on work-family conflict in non-academic settings (e.g., Hochschild, 1989; Jacobs & Gerson, 2004). Some scholars have argued that the contradiction between the norms of an ideal worker and a good mother/parent makes it

hard to combine work and family (Blair-Loy, 2003: Garey, 1999; Glass, 2000; Hays, 1996; Jacobs & Gerson, 2004; Williams, 2000). Based on the norm of an ideal worker, both men and women workers are expected to be highly committed to career in terms of time and emotion, and yet, the norm of motherhood/parenthood requires the same level of exceedingly high commitment to children (Blair-Loy, 2003; Hays, 1996). Thus, literature generally suggests that the expectation for heavy involvement in both career and parenting leads to work-family conflict.

The concept of role spillover is often used in work-family balance literature (Glass & Estes, 1997; Jacobs & Gerson, 2004; Keene & Quadagno, 2004). There are two types of role spillover: work to family spillover and family to work spillover. Work to family spillover "affects the family by impairing both individual and family functioning" (Glass & Estes, 1997, p.294), while family to work spillover "often takes the form of lower productivity, higher absenteeism, and greater turn over" (Glass & Estes, 1997, p.294). Either way, experience of role spillover could be detrimental to work-family balance.

The idea of role spillover resembles Mason and Goulden's (2002, 2004) argument over the interconnectedness between family and academic careers. In fact, previous studies have shown that faculty members struggle managing role spillover (Drago, Colbeck, Stauffer, Pirretti, Burkum, Fazioli, Lazarro, & Habasevich, 2006; O'Laughlin & Bischoff, 2005). As is the case in non-academic settings, it appears that the incompatibility between the norms of an ideal worker (i.e., an ideal faculty member) and a mother/caregiver is present in academic settings.

Gender, Race, and Work-Family Balance

I hypothesize that women and minority faculty might have more work-family conflict. In other words, work-family balance is lower for women and minorities than for men and White faculty. I developed this hypothesis considering the influence of women and minority faculty's status as tokens. As described before, numerically rare individuals are highly visible in the workplace, and they tend to be self-conscious of their difference from the majority group (Kanter, 1977). In the case of under-represented faculty, therefore, they might try extra hard to be accepted by their colleagues. In other words, they might keenly feel the necessity of following the norm of an ideal worker to be recognized as a good faculty member. Such pressure might trigger heavy involvement in work life, which can lead to work to family spillover.

Work-Family Balance, Job Satisfaction and Organizational Commitment

There are reasons why we should expect the influence of work-family balance on job satisfaction and organizational commitment. In the case of academia, research has identified the associations of work-family balance and job satisfaction and organizational commitment among faculty (CUPACFWL, 2006; UCFFFE, 2005). The influence of satisfaction with personal life on job satisfaction is observed among faculty at Cornell University (CUPACFWL, 2006). Also, a study with faculty in the University of California system showed that following low salary, family/geographic considerations were the second most common reason why both men and women faculty changed jobs (UCFFFE, 2005).

In addition, scholars who advocate the change toward family-friendly work environments often mention the negative influence of work-family conflict on job satisfaction and organizational commitment (Glass & Estes, 1997; Richman, Civian,

Shannon, Hill & Brennan, 2008). For example, Glass and Estes (1997) emphasize the necessity of family-friendly workplace because work-family conflict could lead to turnover. More specifically, they argue that employees who suffer role spillover might change jobs for better conditions to accommodate family demands.

In sum, this review of the literature suggests that work-family balance should affect job satisfaction and organizational commitment. Therefore, I expect that Science and Engineering faculty who perceive higher levels of work-family balance have higher job satisfaction and organizational commitment than faculty who perceive lower levels of work-family balance.

The Current Study

Figure 1 presents my conceptual model. Based on the literature, I hypothesize that women and nonwhite faculty have lower job satisfaction and organizational commitment than men and White faculty, respectively (H1). Women and nonwhite faculty will also have lower network integration and worse work-family balance (H2a and H3a). Network integration and work-family balance will have a positive association with job satisfaction and organizational commitment (H2b and H3b). Thus, I expect that gender and race differences in job satisfaction and organizational commitment should disappear upon controlling for network integration and work-family balance.

(Figure 1 about here)

Additional Factors

When studying network integration and work-family balance among faculty, it is necessary to take into account the influence of individual characteristics other than

gender and race. First of all, the recent increase in the proportions of women and minorities in Science and Engineering (NSF, 2006, 2008) means that under-represented faculty are likely to be new at the institution. That is, they might be less integrated because they have had fewer interaction opportunities compared to those who have been around longer. It is also possible that the longer faculty have worked at the institution, the better they have become at combining work and family life. This is because accumulation of experience might help them improve time management skills.

Secondly, interaction opportunities might be limited by family factors. For example, faculty have a strong tendency to marry partners who are also faculty (13% of men faculty's partners and 18% of women faculty's partners) or who have professional or managerial jobs (71% of men faculty's partners and 70% of women faculty's partners) (Jacobs & Winslow, 2004). Considering that partners' work demands could possibly increase faculty's share of family responsibility, faculty whose partner works full-time might have less time to interact with colleagues or have higher tendency to experience work-family conflict compared to those without a partner or those whose partner is not employed full-time.

Beside employment status of partners, whether or not faculty have children could influence their socialization patterns and work-family balance. For example, those who have children might not have enough time to have non-work related interactions with colleagues (e.g., eating out together, sharing recreational activities). On the other hand, it is also possible that presence of children might increase interaction opportunities among faculty who have children (e.g., exchange advice and support with childcare, attending

birthday parties). Thus, this study controls for years working at the institution, presence of a partner and partner's employment status, and presence of children.

Methods

Data Collection

The COACHE Job Satisfaction Survey and the Faculty Network Survey were conducted at a research intensive Midwestern University in the spring of 2008. Both surveys were administered to faculty in Science, Technology, Engineering, and Mathematics (STEM) departments via the web. The COACHE Survey asked faculty to assess their experiences regarding the academic climate within their primary departments. The Network Survey asked faculty to identify connections among faculty within and outside of their primary department. Some demographic information (years working at the institution, presence of a partner / partner's employment status, number of children) was obtained through the COACHE Survey while the other key demographic information (gender, race) was obtained from the Office of Institutional Research and Planning (IRP), which manages information on the university's students, faculty and staff.

Sample

All full-time faculty in 26 STEM department (452 faculty members) were invited to participate in the COACHE Job Satisfaction Survey and the Faculty Network Survey. The response rates to the COACHE Survey and the Network Survey were 48% (216) and 68% (307), respectively. Faculty who responded to only one of the two surveys were excluded from the sample. Many of the concepts of interest in this study contained some missing data. Cases were lost due to missing data on job satisfaction (n=10),

organizational commitment (n=33), departmental research exchange network (n=16), departmental friendship network (n=42), work-family balance variables (n=24 for family-friendly work climate scale, and n=13 for satisfaction with work-life balance). Three faculty members who were planning to retire within five years were excluded from the analysis because their response to the organization commitment variable was irrelevant to the interest of this study. After removing faculty with missing data and the retiring respondents, the final sample included 137 faculty members (30% of the original population). The sample contained 117 men (102 white and 15 nonwhite) and 20 women (14 white and six nonwhite). They were 27 assistant professors, 40 associate professors, and 70 full professors.

Nonresponse to the Network and COACHE Surveys did not meaningfully vary by gender, race, or rank (See Appendix A). Women faculty were 14% of the original population, and 15% of the sample. The percentage of nonwhite faculty was 19% in the original population, and 15% in the sample (the shift was not statistically significant). Also, proportions of assistant, associate, and full professors were 19%, 30%, and 51% in the original population, and 20%, 29%, and 51% in the sample, respectively.

Measures and Variables

Job satisfaction. *Job satisfaction* was measured using a scale which consists of two items from the COACHE Survey. The survey asked (1) “All things considered, how satisfied or dissatisfied are you with your department as a place to work?” and (2) “All things considered, how satisfied or dissatisfied are you with your institution as a place to work?” Faculty identified their level of satisfaction with a five-point scale (1=very dissatisfied; 2=dissatisfied; 3=neither satisfied not dissatisfied; 4=satisfied; 5=very

satisfied). The mean score on the two items was used for the scale (Cronbach's alpha: 0.79). If a respondent had a missing value on one of the two scale items, then job satisfaction was measured using the single valid item.

Organizational commitment. The measure of *organizational commitment* was obtained from a question in the COACHE Survey, "Assuming you have or will achieve tenure, how long do you plan to remain at your institution?" The respondents chose one category from four answer choices: "I haven't thought that far ahead"; "For no more than five years"; "For the foreseeable future"; and "For the rest of my career." Based on their answers, the respondents were categorized into two groups: 0= "Not sure or leaving," and 1= "Staying." The first category, "not sure or leaving," is a combination of "I haven't thought that far ahead" (n=13) and "For no more than five years" (n=15) and the second category, "staying," is a combination of "For the foreseeable future" (n=63) and "For the rest of my career" (n=46). I collapsed these categories because the number in each category was too small to conduct valid statistical analysis on the four categories separately. These numbers became even smaller for gender and race subgroup analyses. Also, grouping them into two categories (staying versus everyone else) was a logical procedure considering that the purpose of this study is to explore organizational commitment in terms of intention to remain at the institution.

Network integration. The Network Survey asked about interactions with two types of faculty (within one's primary department and outside of the department). For each type, network integration was measured with the numbers of self-reported connections in two kinds of informal networks: the departmental research exchange

network (the instrumental network) and departmental friendship network (the expressive network).

For *the departmental research exchange network*, the integration levels were measured based on the response to two questions, "Have you **received** helpful research related information, advice, or equipment from each of the following faculty members in the <department name inserted here> during the 2007-2008 academic year?" and "Have you **provided** research related information, advice, or equipment to each of the following faculty members in the <department name inserted here> during the 2007-2008 academic year?" Faculty were provided a list of all faculty in the tenure home department and were asked to identify the frequency they interacted with each faculty member (1=Never; 2=Once a semester or less; 3=A few times a semester; 4=A few times a month; 5=Once a week or more). I used "3=A few times a semester" as the cut-off for identifying the presence of a network tie. In other words, faculty who selected either "1=Never," or "2=Once a semester or less" were assigned a value indicating that a tie did not exist. The cut-off was chosen for following reasons. Providing a list of all network members makes respondents more inclined to identify a connection (Brewer, 2000). I wanted to ensure that the ties measured are not weak connections. One way to assess tie strength is the frequency of contact between the two actors. Strong ties are characterized as having a higher frequency of interaction (Granovetter, 1973). Casual contact would not be consistent a strong tie. In the context of this research, interacting less than once a semester or only once semester is considered casual contact. In contrast, interacting a few times a semester or more is considered a strong tie.

The numbers of ties identified in the two questions above were combined for the departmental research exchange network. If faculty indicated either receiving from or providing research-related help/aid to another faculty member in their department, the tie was given the value of one. The within department research exchange variable was created by summing the binary tie variables. The variable ranges from zero, indicating the respondent engaged in no research exchange with other faculty in their primary department, to 35. Since the largest department size is 38, this respondent clearly felt he or she had a strong research exchange tie with almost everyone in their home department. This was not the norm. In fact, this variable was highly skewed with a mean of 6.57 and the standard deviation of 5.09. The majority of faculty (90%), reported 11 or fewer faculty with whom they engaged in research exchange.

For *the departmental friendship network*, faculty were asked, "Thinking about non-work related interactions, have you spent free time together (such as eating dinner, working out, or other leisure activities) or discussed personal matters (e.g., family celebrations or difficulties) with each of the following faculty members in the <department name inserted here > during the 2007-2008 academic year?" Faculty identified the frequency of interactions using the same list of faculty in the department and the same five choices of frequency as they did for the research exchange network. The same cut-off point ("3=A few times a semester") was used to indicate the presence of a relational tie for friendship. The within department friendship network variable was created by summing relational ties each faculty member had. The variable ranges from zero to 24. Like research exchange, this variable was highly skewed with a mean of 5.94

and the standard deviation of 5.16. The majority of faculty (90%), reported 11 or fewer faculty with whom they engaged in non-work related interactions.

The extreme outlier cases within the research exchange and friendship network size produced non-normal variables, which could pose a problem within data analyses. To address the issue of non-normality I first tried to transform the variables. None of the 8 transformations produced adequate univariate statistics (Skewness and Kurtosis). Truncation of the extreme outliers, however, solved the skewness problem. Research exchange and friendship network size were truncated whereby values of 12 or greater were recoded as 11. For the research exchange network size variable, a total of 13 cases were truncated. For friendship network size, a total of 14 cases were truncated.

In addition to the questions about connections within the department, the Network Survey asked questions about the number of connections to other faculty outside of one's primary department (the frequency of interaction with faculty outside of the department was not asked). It is important to control for connections outside of one's primary department, but within the University because connections outside might lessen the impact of isolation within one's department. Two dummy variables indicate the presence of cross-departmental research exchange network and cross-departmental friendship.

The variable, *the cross-departmental research exchange network* (0=not present; 1=present), was developed using responses to two questions "From how many <university name inserted here> faculty members outside of the <department name inserted here> have you **received** helpful research related information, advice or equipment during the 2007-2008 academic year?" and "From how many <university name> faculty members outside of the <department name> have you **provided** helpful

research related information, advice or equipment during the 2007-2008 academic year?" To answer these questions, faculty wrote (typed in) the numbers of connections. If there was none, they answered "0." The cross-departmental research exchange network was considered not to be present only when faculty identified no tie in both of the above questions. The question, "With how many <university name> faculty members outside of the <department name> have you spent free time with or discussed personal matters during the 2007-2008 academic year?," was used for *the cross-departmental friendship network* (0=not present; 1=present). The friendship network was considered present when faculty identified one connection or more.

Work-family balance. Two measures were used for work-family balance: the family-friendly work climate scale and self-reported satisfaction with work-life balance. The first measure, *the family-friendly work climate scale*, consists of three items. The COACHE survey asked the respondents to identify their levels of agreement or disagreement with three statements regarding work climate (1=strongly disagree; 2=disagree; 3=neither agree nor disagree; 4=agree; 5=strongly agree). There was slight variation in item wording depending on faculty rank. Assistant professors were specifically asked to respond to the following two statements: (1) "My institution does what it can to make having children and the tenure-track compatible."; (2) "My departmental colleagues do what they can to make having children and the tenure-track compatible." The first two items for associate and full professors were worded slightly differently: (1) "My institution does what it can to make family obligations (e.g., child or elder care) and a post-tenure faculty career compatible."; (2) "My departmental colleagues do what they can to make family obligations (e.g., child or elder care) and a

post-tenure faculty career compatible." Although the question wording varied across rank, the first two statements tap into similar concepts: (1) supportive climate with balancing work and family at the institutional level, and (2) supportive climate with balancing work and family in the department. The third item regarding family-friendly work climate, (3) "My colleagues are respectful of my efforts to balance work and home responsibilities", was worded in the same way regardless of faculty rank. Thus, the family-friendly work climate scale was created using the two items with the merged response, and the third item with a single statement. The mean score of at least one valid item was used to create the scale (Cronbach's alpha: 0.80).

Satisfaction with work-life balance was measured with a single item from the COACHE Survey. The respondents were asked "How satisfied or dissatisfied are you with the balance between your professional time and your personal or family time?" They identified their level of satisfaction with a five-point scale (1=very dissatisfied; 2=dissatisfied; 3=neither satisfied not dissatisfied; 4=satisfied; 5=very satisfied).

Other variables. *Female* is a dichotomous variable (0=male; 1=female). *Nonwhite* is also a dichotomous variable which indicates whether or not the respondent is nonwhite (0=white; 1=nonwhite). *Years working at the institution* was included as a continuous variable. It ranges from zero to 42 years. For *presence of a partner / partner's employment status*, the respondents were categorized into three mutually exclusive groups, and then a set of three dichotomous variables were created: (1) no partner is present (0=others; 1=partner not present), (2) partner is not employed full-time (0=others; 1=partner not employed full-time), and (3) partner is employed full-time (0=others; 1=partner employed full-time). This study used the second group, "partner is not

employed full-time," as the reference group because the largest number of faculty in the sample fit in the category (n=66). Lastly, *Presence of children* under the age of 18 living at home is a dichotomous variable (0=not present; 1=present).

The size of the 26 STEM departments varied from 8 to 38 faculty members, and it was suspected that workplace climate or faculty's working experience might be influenced by their department size. More importantly, one's department size influences the number of network ties they can develop. Therefore, the *department size* (i.e., the number of faculty in respondent's department) was added as a control variable as well. Table 1 presents the means and standard deviations for the continuous variables, and the percentages for the categorical variables.

(Table 1 about here)

Analytic Strategy

The analysis for this paper has two parts. First, bivariate analyses were conducted to assess gender and race variation in each of the four major concepts of the study: job satisfaction, organizational commitment, network integration, and work-family balance. In addition to the bivariate analyses, I conducted regression analyses to assess gender and race variation in network integration and work-family balance controlling for the other individual characteristics (years working at the institution on network integration, presence of a partner and partner's employment status, and presence of children) and the department size. Second, using linear regression, I assessed the influence of network integration and work-family balance on job satisfaction. Sets of variables were added sequentially to assess if network integration and work-family balance could explain gender and race differences in job satisfaction. I also ran sequential logistic regressions to

assess the influence of network integration and work-family balance on organizational commitment.

The participants of the study were clustered into 26 STEM departments, and the complex sample design violated the assumption of independent observations. For example, it was possible that respondent #1 and respondent #2 were in the same department, and respondent #1's satisfaction with work-life balance had something to do with respondent #2's satisfaction level. Therefore, I made adjustments for clustering using the statistical software Stata for all of the bivariate and multivariate regression analyses. Finally, the number of women and minority faculty in the sample was low. Therefore, the power of the statistical tests was compromised. For this reason, I report statistical significance at the $p<.10$ level and I discuss the size of substantively meaningful differences.

Results

Gender and Race Variation in Job Satisfaction and Organizational Commitment

Table 2a and Table 2b provide the results of bivariate analyses for gender and race variation in job satisfaction (t-tests for mean score differences) and organizational commitment (chi square tests for percentage differences). There were no significant gender or race differences in job satisfaction. There was a slight trend for non-white faculty to have lower job satisfaction (mean= 3.55) compared to white faculty (mean= 3.88); this difference is over a ¼ of a standard deviation difference for job satisfaction across race ((3.88-3.55)/.87=.379). In contrast, the means for job satisfaction across gender are virtually identical (3.80 for women and 3.83 for men).

(Table 2a about here)

Table 2b shows the distribution between two categories of the organizational commitment variable (0=Not sure or leaving; 1=Staying) by gender and race. Unlike job satisfaction, significant gender ($p<.10$) and race ($p<.05$) variation occurred for organizational commitment. In terms of gender variation, 83% of men intend to remain in the institution, whereas only 60% of women do so. In terms of race variation, 84% of white faculty intend to remain, whereas only 57% of nonwhite faculty intend to remain. Thus, Hypothesis 1 was partially supported. While gender (being female) and race (being nonwhite) did not have a significant association with job satisfaction, there was significant race and gender variation in organizational commitment.

(Table 2b about here)

Gender and Race Variation in Network Integration and Work-family Balance

The results of bivariate analyses (t-tests) investigating race and gender differences in network integration and work-family balance are shown in Table 3. There were no gender or race differences in departmental research exchange network size. All respondents reported close to six other faculty members within their departmental research exchange networks. For the departmental friendship network, however, meaningful differences occur across gender. Women reported significantly fewer friendship connections within their departments than men. The mean number of friendship ties was 3.95 for women, whereas the mean was 5.50 for men ($p<.05$). Thus, Hypothesis 2a was partially supported because I found the significant gender differences in integration within friendship networks but not research exchange networks. Contrary to my expectation, gender and race variation was not significant in the two measures of

work-family balance (on the right side of Table 3). Therefore, the results did not support Hypothesis 3a.

(Table 3 about here)

To assess the robustness of gender and race differences in network integration and work-family balance, I ran multivariate regressions with all control variables included in the models. I accounted for the clustering in 26 departments. The first model regressed the dependent variables on gender and race, and the control variables were added in the second model. Because the network integration variables were count outcomes, I conducted Poisson regressions. I conducted Ordinary Least Squares (OLS) regressions for the family-friendly work climate scale considering that the scale used the mean score of the three items included. For the satisfaction with work-life balance, which was measured with a single item with a five-range scale (i.e., ordered categories), I chose the Ordinal regression models. Table 4 presents the results of these regression analyses.

(Table 4 about here)

For the departmental research exchange network, there was no significant association with gender and race. For the departmental friendship network, however, the association of gender was significantly negative in both column III ($p<.10$) and column IV ($p<.05$). The incidence rate ratio in the column IV shows that controlling for the other variables, women had 30% smaller number of friendship ties (i.e., integration levels) compared to men. Similar to the results of the bivariate analyses (Table 3), the results of the regression analyses partially supported Hypothesis 2a by showing only the significant association of gender with network integration in the departmental friendship network.

As shown on the right side of Table 4, no significant association of gender and race was observed for either of the work-family balance measures. Column VIII shows that presence of a partner and partner's employment status had a significant association with satisfaction with work-life balance. Compared to the case where partner did not work full-time, having no partner or having a partner with a full-time job decreased the odds of having higher satisfaction with work-life balance by 71% or 62%, respectively. In other words, faculty were most likely to be satisfied with work-life balance if they had a partner who did not have high work demands. Thus, consistent with the results of the bivariate analyses (Table 3), gender and race did not have a significant association with work-family balance when the other individual characteristics and the department size were controlled in the regression models. Therefore, the results of the multivariate analyses also rejected Hypothesis 3a.

Job Satisfaction

As described above, gender and race variation in job satisfaction, organizational commitment, network integration, and work-family balance was tested for the first part of the analysis. As the next step, the relationship of network integration and work-family balance with job satisfaction and organizational commitment were investigated through multiple regression analyses. Table 5a provides the results of the OLS models that regressed job satisfaction on network integration variables and work-family balance variables controlling for the other variables. I chose the OLS model because the job satisfaction scale used the mean score of the two items included. Model 1 shows gender and race variation in job satisfaction, and the other individual characteristics and the department size were added in Model 2. Model 2 was the baseline model to which the

network integration variables and the work-family balance variables were added separately (Model 3 and Model 4) and then were added all together in the final model (Model 5).

(Table 5a about here)

Consistent with bivariate analysis, Model 1 in Table 5a shows that neither gender nor race had a significant association with job satisfaction. Their associations were not significant even when the other individual characteristics and the department size were controlled (Model 2). Model 3 added the network integration variables to the baseline model. While integration in the departmental research exchange network was not a significant predictor of job satisfaction, integration in the departmental friendship network was a significant predictor (beta= .174, $p<.10$). Having more friends within one's department is associated with higher job satisfaction. Thus, Hypothesis 2b was partially supported for job satisfaction.

To test the influence of over-integration on job satisfaction, I ran a regression similar to Model 3 with the addition of the squared variables for the departmental research exchange network and the departmental friendship network separately (results not shown). There was no significant curvilinear effect for either network. That is, I did not find negative consequences of over-integration in the departmental networks. However, it is important to remember that I brought down the maximum number of network by collapsing the cases with 12 ties or above into the value of 11.

Model 4 in Table 5a reports the results of adding the work-family balance variables to the baseline model. Consistent with hypothesis 3b, work-family balance had a significantly positive influence with job satisfaction. There was a strong positive

association between family-friendly work climate and job satisfaction (beta= .496, p<.01). Satisfaction with work-life balance also had a significant association with job satisfaction (beta= .180, p<.05).

All variables were included in the final model (Model 5 in Table 5a). Integration in the departmental friendship network lost significance, but both measures of the work-family balance were still significant predictors of job satisfaction. Judging from the beta coefficients, which represent relative strength of the predictors in the model, family-friendly work climate had the strongest influence (positive) on job satisfaction among the variables included in Model 5.

One of the purposes of this study was to investigate gender and race variation in job satisfaction and the influence of network integration and work-family balance as mediators. Therefore, I examined the changes in the coefficients for gender and race throughout the models in Table 5a. In the case of gender, the coefficients and the beta coefficients were very small in all models, and they were all nonsignificant. It appears that job satisfaction did not vary by gender. Although not statistically significant, there is some race variation in job satisfaction. The race coefficients across the models in Table 5a ranged from -.332 to -.227. The lowest race difference in job satisfaction occurs in Model 3 and Model 5 suggesting that adding network integration slightly reduced the race differences in job satisfaction. This occurs due to the race difference in friendship network integration. Although not significant, there was a small indication that nonwhite faculty reported fewer friendships in their department compared to white faculty.

Organizational Commitment

Because the organizational commitment variable was a binary variable (0= Not sure or leaving; 1= Staying), I used a logistic regression model to analyze the predictors of organizational commitment. Table 5b presents the results of the regressions. Consistent with bivariate analyses reported earlier, organizational commitment significantly varies by gender and race (Model 1). Compared to men, the odds of intending to remain at the institution were lower for women by a factor of 0.37. Compared to white faculty, the odds were lower for nonwhite faculty by a factor of 0.30.

(Table 5b about here)

Gender variation in organizational commitment was no longer statistically significant when including control variables (Model 2) or network integration variables (Model 3) in the regression equation. In Model 2, two control variables were significant predictors of organizational commitment. Years working at the institution was positively associated with organizational commitment (odds ratio= 1.08, $p<.01$). Also, faculty members without a partner reported lower organizational commitment compared to faculty members with a partner who was not employed full-time (odds ratio= .15, $p<.05$). It appears that gender variation in the control variables accounted for the disappearance of the significant association of gender and organizational commitment in Model 2. Women tended to be newer at the institution than men, and women were more likely than men to have no partner (See Appendix B). These gender differences suggest that there might be more complex mechanisms of gender variation in organizational commitment than what has been discussed in this paper.

Model 3 shows that integration in the departmental friendship network was a significant predictor of organizational commitment (odds ratio= 1.13, $p<.10$). Having

more friends within one's department is associated with higher organizational commitment. Considering the former finding that integration in the departmental friendship network was significantly lower for women than men (Table 3), the likely explanation for the reduction of the gender coefficient in Model 3 is that the gender difference in friendship network integration reduced the gender differences in organizational commitment. Thus, both differences in demographic characteristics and in the friendship network integration explain gender differences in organizational commitment.

Model 4 adds network variables with the control variables. The effect of years working at the institution, relationship status, and friendship network integration did not change substantially. When including the control variables, integration in the departmental friendship network had a significant positive association with organizational commitment (odds ratio= 1.18, $p<.10$). Thus, Hypothesis 2b was partially supported for organizational commitment. [2]

It is important to note that the direction of the association for gender with organizational commitment becomes positive in Model 4. Although not statistically significant, the odds of intending to remain at their institution were higher for women than men if the network integration levels as well as the other control variables were held constant. Women's organizational commitment could be higher than men if there was no gender variation in friendship network integration, years working at the institution and likelihood of having no partner. Therefore, the changes in the coefficients suggest a

[2] I tested the influence of over-integration on organizational commitment in the same way as job satisfaction, but there was no significant curvilinear effect (the results not shown).

mediation effect of integration in the departmental friendship network, years working at the institution, and likelihood of having no partner on gender differences in organizational commitment.

Model 5 added the work-family balance variables. Neither the family-friendly work climate scale nor satisfaction with work-life balance had a significant influence on organizational commitment. Thus, the results rejected Hypothesis 3b for organizational commitment. Given that there was not significant gender variation in the work-family balance measures (Table 3) and that the coefficients for gender did not change much between Model 2 and Model 4, work-family balance does not appear to mediate gender differences in organizational commitment.

I also assessed mediation of race differences in organizational commitment. Unlike gender, the coefficients and the odds ratios for the race variable were almost the same values from Model 1 to Model 6, and yet their significant level dropped when the control variables were added ($P<.05$ in Model 1 and Model 3 and $p<.10$ in the other models). Similar to gender variation, my preliminary analysis showed a significant race difference in years working at the institution (See Appendix B). Therefore, it appears that the nonwhite faculty's tendency to be new at the institution accounted for the decrease in the significant association of race and organizational commitment. The mean years working at the institution were 13.6 years for white faculty, whereas they were 6.7 years for nonwhite faculty.

Considering that race variation (i.e., the coefficient of the race variable) remained statistically significant after controlling for race differences in departmental friendship network and years working at the institution, it is likely that there are additional

unexplained reasons why nonwhite faculty have lower organizational commitment than white faculty.

The multiple regression analyses (Table 5a and Table 5b) revealed that variation in job satisfaction and organizational commitment were explained by different factors. Comparing the variance explained in the regression models in Table 5a, it is clear that the work-family balance variables made the most significant contribution to predict job satisfaction (R^2increased from 0.047 to 0.374 between Model 2 and Model 4). For organizational commitment, however, work-family balance did not explain the variation as much as it did for job satisfaction (R^2 improved only from 0.187 to 0.209 between Model 2 and Model 4 in Table 5b). Instead, the individual characteristics which were added in the analyses as control variables, such as years working at the institution and presence of a partner, were actually the most significant contributors of the variance in the model (R^2 increased from 0.071 to 0.187 between Model 1 and Model 2 in Table 5b).

Discussion and Conclusion

The purpose of this study was to explore the potential mediation effect of network integration and work-family balance on gender and race variation in job satisfaction and organizational commitment. I first analyzed gender and race variation in job satisfaction, organizational commitment, network integration, and work-life balance. Then, I explored whether network integration and work-family balance explained gender and race variation in job satisfaction and organizational commitment.

One of the most important findings of this research is that women and minority faculty had lower organizational commitment compared to men and whites, respectively.

This finding was consistent with the findings from the previous studies (Callister, 2006; Rosser, 2004), and it suggests that university administrators should make retention efforts in addition to recruitment efforts to increase faculty diversity. The current study revealed that lower organizational commitment among women and minority faculty could make the rising inflow of women and minorities in Science and Engineering less effective in increasing their representation.

The findings from this study provide clues on how to arrange work environments that have the capacity to retain faculty. The analyses of the self-reported personal networks revealed the positive association between the departmental friendship network and organizational commitment (Although integration in the friendship network had a significant association with organizational commitment, integration in the research exchange network did not). More specifically, the results showed that women tended to be less integrated in the departmental friendship network than men, and it lowered their organizational commitment. This study revealed that network integration was the part of the mechanisms that caused gender variation in organizational commitment. Therefore, promoting women's integration in non-work related interactions in the department (e.g., eating out together, sharing leisure activities, having conversations about personal matters) may be a useful strategy in making them more likely to want to stay at the institution. Results also showed that women faculty's tendency to be new at the institution and their high likelihood of being without a partner explained their lower organizational commitment than men.

Unfortunately, I cannot make suggestions on how to improve retention for minority faculty based on the findings of this study. There was no significant race

variation in network integration and work-family balance, and minority faculty had significantly lower organizational commitment than whites even after accounting for network integration, work-family balance, the individual characteristics, and the department size. Some factors other than network integration and work-family balance might explain race variation in organizational commitment, and exploring these factors (e.g., discrimination, tenure and promotion process) is a subject of a future study.

The positive influence of work-family balance on job satisfaction is another important finding. Although the strategy is not specifically targeting under-represented faculty, improvement of work-family balance might lead to an increase in job satisfaction and eventually contribute to faculty retention. Future research should look into the condition of work-family balance among faculty in more detail. This study used perceptions of a family-friendly work climate and satisfaction with work-life balance as the measures of work-family balance, but it would be interesting to further examine the association of work-family balance with faculty retention using more sophisticated measures. It has been suggested that researchers should use multidimensional measures (i.e., measures that consist of items on work characteristics, family characteristics, and role spillover) to study work-family balance (Keene & Quadagno, 2004). Therefore, future research should examine faculty's demands from family life (e.g., amount of housework and child care) as well as demands from work life (e.g., hours spent on teaching, research, service work) and the spillover effects between them.

For several reasons, the results of this research should be interpreted with caution. First, this study had low statistical power due to the small sample size. The analytic sample consisted of 137 faculty members, and there were only 20 women and 21

nonwhites. Although I could not find significant gender and race variation in job satisfaction and work-family balance measures, the results could have shown significant variation if the sample size were larger. Also, this study could not explore the intersections of gender and race due to the small numbers of women and minorities in the sample (14 white women, six nonwhite women, and 15 nonwhite men). Yet this limitation of analysis is important evidence that women and minority faculty are still underrepresented in Science and Engineering. There were only six nonwhite women in the sample, and I could not examine how their dual minority status (women and racial minority) made their experience different from that of white women and nonwhite men. In fact, nonwhite women had the lowest integration level in both the departmental research network and friendship network when I examined the mean difference between white men, nonwhite men, white women, and nonwhite women for the preliminary analyses (See Appendix C). Therefore, future research with a bigger sample and more nonwhite women should explore the intersection of gender and race.

In addition, there is a question of causality. The use of the cross sectional data makes it difficult to distinguish preceding variables from outcome variables. For example I argued that integration in the departmental friendship network had a positive influence on organizational commitment. It is possible, however, that some faculty were planning to leave the institution in the near future, and it made them reluctant to get involved with other faculty. Future research should use longitudinal data to clarify the causal ordering.

Lastly, the generalizability of the findings is questionable. The data were collected at only one setting, a research intensive Midwestern University. Its geographic location, size of the university, facilities, administrative services, and many other factors

might have influenced the results. For example, faculty might have different network integration patterns at universities where teaching is the primary focus. Also, women faculty were more likely than men faculty to be single possibly due the location of the university. The university is the only research intensive university in a Midwestern state. Therefore, it might be more difficult to find a marriage partner or find employment for both spouses in the community compared to the urban areas on the West or East Coast where there are multiple universities and academic employment opportunities.

Regardless of these limitations, this research advanced the field by showing the importance of effort to retain under-represented faculty, the positive association between the departmental friendship network and organizational commitment, the possibility of retaining more women by promoting their non-work related interactions with other faculty, and the strong association of work-family balance with job satisfaction for faculty in general. The findings did not fully support the proposed conceptual model. However, this study furthered the understanding of faculty retention and provided empirical evidence that faculty retention could be improved through network integration and work-family balance.

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Table 1: Means/Percentages and Standard Deviations of All Variables

Variables	Mean/%	S.D.	Min.	Max.
Focal demographics				
Gender				
Male	85%			
Female	15%			
Race				
White	85%			
Nonwhite	15%			
Dependent variables				
Job satisfaction	3.82	0.87	1	5
Organizational commitment				
Not sure or leaving 0	20%			
Staying 1	80%			
Mediators				
Network integration				
Departmental research exchange network	5.93	3.25	0	11
Departmental friendship network	5.28	3.62	0	11
Work-family balance				
Family-friendly work climate	3.60	0.94	1	5
Satisfaction with work-life balance	3.05	1.08	1	5
Control variables				
Years working at the institution	12.52	10.61	0	42
Presence of a partner and partner's employment status				
No partner is present	11%			
Partner is not employed full-time	48%			
Partner is employed full-time	41%			
Presence of children (1=present)	45%			
Network outside of the department				
Cross-departmental research exchange network (1=present)	78%			
Cross-departmental friendship network (1=present)	70%			
Size of the department	22.06		8	38

Note: N=137

Table 2a: Levels of Job Satisfaction by Gender and Race (T-tests)

	Job Satisfaction	
	Mean	S.E.
Men (N=117)	3.83	0.11
Women (N=20)	3.80	0.19
White (N=116)	3.88	0.11
Nonwhite (N=21)	3.55	0.19

Note: N=137

* p<.10, ** p<.05, *** p<.01

Table 2b: Levels of Organizational Commitment by Gender and Race (Chi square tests)

	Organizational Commitment				
	Not sure or leaving (N=28)	Staying (N=109)			
	%	%	Row total	Chi-sq	
Men	17%	83%	100%	5.51	*
	(20)	(97)	(117)		
Women	40%	60%	100%		
	(8)	(12)	(20)		
White	16%	84%	100%	7.67	**
	(19)	(97)	(116)		
Nonwhite	43%	57%	100%		
	(9)	(12)	(21)		

Note: N=137

* p<.10, ** p<.05, *** p<.01

Cell size in parentheses

Table 3: Network Integration and Work-Family Balance by Gender and Race (T-tests)

	Network Integration					Work-Family Balance			
	Departmental research exchange network		Departmental friendship network			Family-Friendly Work Climate		Satisfaction with Work-Life Balance	
	Mean	S.E.	Mean	S.E.		Mean	S.E.	Mean	S.E.
Men (N=117)	5.95	0.47	5.50	0.35	**	3.62	0.10	3.05	0.12
Women (N=20)	5.85	0.61	3.95	0.61		3.44	0.20	3.05	0.21
White (N=116)	5.94	0.46	5.36	0.35		3.61	0.12	3.04	0.12
Nonwhite (N=21)	5.90	0.71	4.81	0.74		3.51	0.15	3.10	0.14

Note: N=137

* p<.10, ** p<.05, *** p<.01

Table 4: Network Integration and Work-Family Balance on Individual Characteristics

	Network Integration				Work-Family Balance					
	Departmental research exchange network[a]		Departmental friendship network[a]		Family-friendly work climate[b]				Satisfaction with work-life balance[c]	
	I	II	III	IV	V		VI		VII	VIII
	Incidence Rate Ratio	Incidence Rate Ratio	Incidence Rate Ratio	Incidence Rate Ratio	b/se	beta	b/se	beta	Odds Ratio	Odds Ratio
Female	0.98	1.05	0.73 *	0.70 **	-0.17 [0.19]	-0.06	-0.15 [0.30]	-0.06	1.00	1.68
Nonwhite	1.00	1.04	0.94	1.13	-0.08 [0.23]	-0.03	-0.05 [0.22]	-0.02	1.08	1.38
Years working at the institution		1.00		1.00			0.00 [0.01]	0.00		1.02
Presence of a partner and partner's employment status										
No partner is present†		0.85		1.24			-0.09 [0.42]	-0.03		0.29 **
Partner is employed full-time†		0.90		0.90			0.05 [0.19]	0.02		0.38 ***
Presence of children (1=present)		0.98		0.89			-0.12 [0.17]	-0.06		0.75
Size of the department		1.01		1.02 ***			0.00 [0.01]	0.01		1.00
R-squared	0.00	0.01	0.01	0.04	0.01		0.01		0.00	0.03

Note: †Reference group: Partner is not employed full-time.
Standard errors in brackets; N=137
[a] Poisson regression
[b] Ordinary Least Square regression
[c] Ordinal regression
* p<.10, ** p<.05, *** p<.01

Table 5a: Ordinary Least Square Model (OLS) for Job Satisfaction

	Model 1		Model 2		Model 3		Model 4		Model 5	
	b/se	beta	b/se	beta	b/se	beta	b/se	beta	b/se	beta
Female	0.03	0.01	0.08	0.03	0.11	0.05	0.11	0.04	0.13	0.05
	[0.17]		[0.22]		[0.24]		[0.15]		[0.16]	
Nonwhite	-0.33	-0.14	-0.24	-0.10	-0.23	-0.10	-0.25	-0.10	-0.23	-0.09
	[0.21]		[0.20]		[0.19]		[0.16]		[0.17]	
Control Variables										
Years working at the institution			0.01	0.08	0.01	0.08	0.01	0.07	0.01	0.09
			[0.01]		[0.01]		[0.01]		[0.01]	
No partner is present†			-0.05	-0.01	-0.05	0.00	0.10	0.03	0.13	0.06
			[0.26]		[0.25]		[0.19]		[0.18]	
Partner is employed full-time†			0.04	-0.02	0.07	-0.02	0.10	0.03	0.09	0.05
			[0.20]		[0.19]		[0.15]		[0.15]	
Presence of children (1=present)			-0.02	0.02	0.01	0.04	0.06	0.06	0.10	0.05
			[0.17]		[0.17]		[0.14]		[0.12]	
Size of the department			0.01	0.14	0.01	0.11	0.01	0.14	0.01	0.13
			[0.01]		[0.01]		[0.01]		[0.01]	
Network integration										
Departmental research exchange network					0.00	0.00			0.02	0.06
					[0.03]				[0.02]	
Departmental friendship network					0.04	0.17 *			0.02	0.07
					[0.02]				[0.02]	
Cross-departmental research exchange network (1=present)					0.29	0.14			0.26	0.13
					[0.23]				[0.20]	
Cross-departmental friendship network (1=present)					-0.01	0.00			-0.15	-0.08
					[0.19]				[0.16]	
Work-family balance										
Family-friendly work climate							0.46	0.50 ***	0.46	0.49 ***
							[0.08]		[0.09]	
Satisfaction with work-life balance							0.15	0.18 **	0.15	0.18 **
							[0.06]		[0.06]	
Constant	3.87	***	3.49	***	3.09	***	1.32	***	1.02	**
	[0.11]		[0.28]		[0.39]		[0.35]		[0.38]	
R2	0.02		0.05		0.09		0.37		0.40	

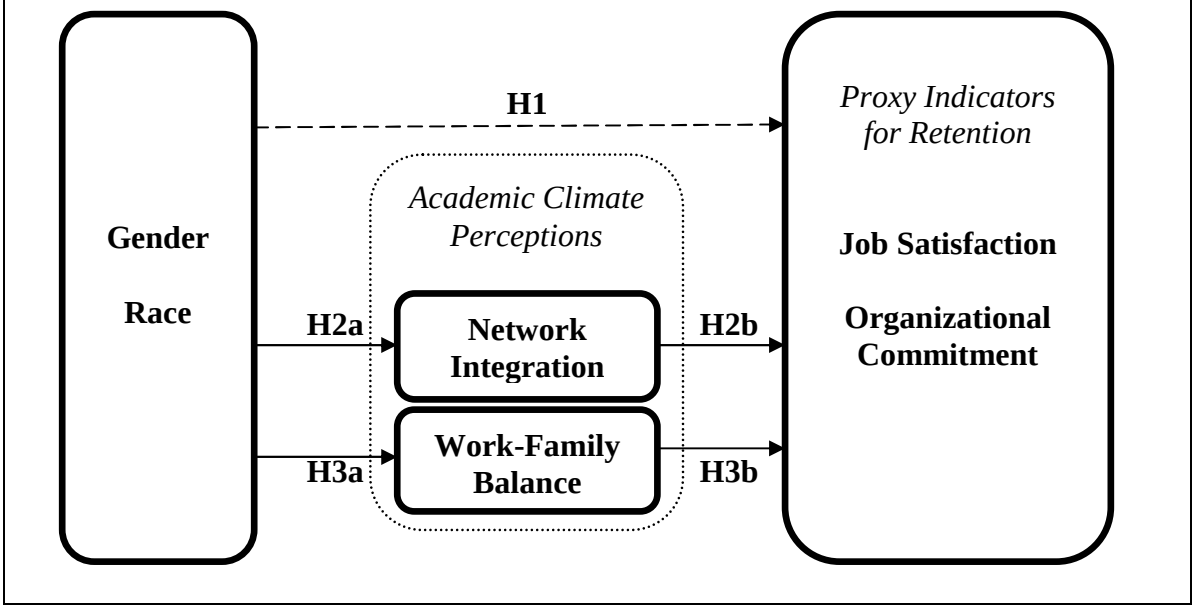
Note: †Reference group: Partner is not employed full-time.
Standard errors in brackets; N=137
* p<.10, ** p<.05, *** p<.01

Table 5b: Logistic Regression Model for Organizational Commitment

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	b/se	Odds Ratio	b/se	Odds Ratio	b/se	Odds Ratio	b/se	Odds Ratio	b/se	Odds Ratio	b/se	Odds Ratio
Female	-1.00	0.37 *	-0.15	0.86	-0.88	0.41	0.13	1.14	-0.09	0.92	0.26	1.30
	[0.60]		[0.84]		[0.63]		[0.81]		[0.82]		[0.76]	
Nonwhite	-1.21	0.30 **	-1.10	0.33 *	-1.15	0.32 **	-1.13	0.32 *	-1.07	0.34 *	-1.12	0.33 *
	[0.51]		[0.63]		[0.52]		[0.66]		[0.61]		[0.63]	
Control Variables												
Years working at the institution			0.08	1.08 ***			0.09	1.10 ***	0.09	1.10 ***	0.12	1.12 ***
			[0.02]				[0.03]		[0.02]		[0.03]	
No partner is present†			-1.89	0.15 **			-1.99	0.14 **	-1.91	0.15 **	-1.94	0.14 **
			[0.82]				[0.80]		[0.89]		[0.83]	
Partner is employed full-time†			-0.57	0.57			-0.61	0.55	-0.63	0.53	-0.72	0.49
			[0.60]				[0.62]		[0.62]		[0.62]	
Presence of children (1=present)			0.38	1.46			0.71	2.04	0.44	1.56	0.93	2.53
			[0.47]				[0.62]		[0.44]		[0.66]	
Size of the department			0.02	1.03			0.03	1.03	0.03	1.03	0.03	1.03
			[0.04]				[0.04]		[0.04]		[0.04]	
Network integration												
Departmental research exchange network					0.00	1.00	-0.05	0.95			-0.03	0.98
					[0.10]		[0.07]				[0.08]	
Departmental friendship network					0.12	1.13 *	0.17	1.18 *			0.16	1.17
					[0.07]		[0.10]				[0.11]	
Cross-departmental research exchange network (1=present)					0.64	1.90	0.79	2.21			0.76	2.14
					[0.55]		[0.62]				[0.67]	
Cross-departmental friendship network (1=present)					-0.14	0.87	-0.65	0.53			-0.91	0.40
					[0.47]		[0.59]				[0.62]	
Work-family balance												
Family-friendly work climate									0.49	1.63	0.56	1.74
									[0.35]		[0.35]	
Satisfaction with work-life balance									-0.05	0.95	-0.04	0.96
									[0.29]		[0.24]	
Intercept	1.79	5.98 ***	0.66	1.94	0.81	2.26	-0.29	0.75	-1.06	0.35	-2.39	0.09
	[0.30]		[1.04]		[0.97]		[1.58]		[1.55]		[2.27]	
R2	0.07		0.19		0.10		0.23		0.21		0.26	
Wald Chi2	8.55		31.32		16.56		51.08		34.54		68.69	
df	2		7		6		11		9		13	

Note: †Reference group: Partner is not employed full-time.
Standard errors in brackets; N=137
* p<.10, ** p<.05, *** p<.01

Figure 1: Conceptual Model



Appendix A: Analysis of Non-Response (Chi square tests)

	Population		Analytic Sample		Not In Analytic Sample		
	%	*N*	*%*	*N*	*%*	*N*	*Chi-Sq*
Gender							
Male	86%	387	85%	117	86%	270	0.01
Female	14%	65	15%	20	14%	45	
Race							
White	81%	365	85%	116	79%	249	1.94
Nonwhite	19%	87	15%	21	21%	66	
Rank							
Assistant	19%	85	20%	27	18%	58	0.12
Associate	30%	135	29%	40	30%	95	
Full	51%	232	51%	70	51%	162	
N (total)	452		137		315		

Note: * p<.10, ** p<.05, *** p<.01

Appendix B: Means/Percentages and Standard Deviations of Control Variables by Gender and Race (Chi square tests or t-test)

Variables	Men		Women			Whites		Nonwhites		
	Mean/%	S.E.	Mean/%	S.E.		Mean/%	S.E.	Mean/%	S.E.	
Years working at the institution	13.14	1.45	8.90	1.77	*	13.57	1.40	6.71	1.01	***
Presence of a partner and partner's employment status										
No partner is present	6%		40%			11%		9.52%‡		
Partner is not employed full-time	55%		10%‡		***	51%		33%		
Partner is employed full-time	39%		50%			38%		57%		
Presence of children (1=present)	44%		45%			39%		76%		***
Network outside of the department										
Cross-departmental research exchange network (1=present)	77%		85%			79%		71%		
Cross-departmental friendship network (1=present)	68%		85%			70%		71%		
Size of the department	22.38	2.67	20.20	2.80		22.74	2.89	18.29	1.96	

Note: ‡ Due to the small number of women and minorities in the sample, the cell frequencies were smaller than 5. Therefore, the statistical significance should be interpreted with caution .

N=137

* p<.10, ** p<.05, *** p<.01

Appendix C: Network Integration by the Intersections of Gender and Race

	Network Integration			
	Departmental research exchange		Departmental friendship network	
	Mean	S.E.	Mean	S.E.
White men (N=102)	5.83	0.48	5.47	0.38
Nonwhite men (N=15)	6.73	0.81	5.73	0.99
White women (N=14)	6.71	0.66	4.57	0.69
Nonwhite women (N=6)	3.83	1.13	2.50	0.34