# A MIXED METHODS STUDY OF GENDER, STEM DEPARTMENT CLIMATE, AND WORKPLACE OUTCOMES

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*The present study used a workplace climate survey (N = 252) and semi-structured interviews (N = 12) to investigate faculty perceptions of, and experiences in, their STEM departments across four diverse institutions in order to understand barriers to women's success. We found that although men and women are equally productive, women report that their department perceives them as less productive than men. Similarly, women believe they have less influence on, and experience less collegiality in, their departments than men. Women also perceive more sexism and discrimination than men. These quantitative findings are supplemented with qualitative data to more fully understand faculty perspectives. In addition, we found that workplace outcomes such as job satisfaction and turnover intentions are affected by the department climate for both men and women faculty members, which suggests that improving the climate serves all faculty members. Specific recommendations to improve STEM academic climates are discussed.*

**KEY WORDS:** *workplace climate, STEM women faculty, job satisfaction, faculty retention, quantitative*

## 1. INTRODUCTION

The underrepresentation of women in academic science, technology, engineering, and mathematics (STEM) fields is a nationwide concern. Although an increasing number of women earn advanced degrees, they are still underrepresented at prestigious institutions, in higher ranks and administrative positions, and in traditionally male careers [National Research Council (NRC), 2007). For women who are STEM faculty members, these problems persist because of features of the organizational climate (e.g., structure, policies, and practices) and the underrepresentation of women in academia (Settles et al., 2006).

There is a tendency to dismiss the lack of representation of women who apply for and occupy positions, receive awards, and get promoted, as natural or expected because of commonly held

stereotypes. Stereotypes are beliefs about appropriate characteristics or activities for members of a social group. For example, both women and men more easily associate men with science than women with science (NRC, 2007; Nosek et al., 2002). Simply knowing this cultural stereotype can influence attitudes and behavior, regardless of whether people agree with this stereotype. In addition to steering women away from pursuing a career in STEM, knowledge of stereotypes can inadvertently influence the functioning of organizations by affecting the workplace climate and ultimately job satisfaction for faculty members. Faculty job satisfaction is a strong predictor of turnover (Dougherty et al., 1985), which costs institutions significant time and money (Abbasi and Hollman, 2000).

The present research investigated gender differences in perceptions of the STEM workplace climate using a workplace climate survey that included perceptions of productivity, openness to women, sexism, women's influence, collegiality, work/life balance, and mentoring. In addition, we conducted in-depth interviews that provide vivid examples of the workplace climate. We also investigated the role of gender and climate on important workplace outcomes such as job satisfaction and turnover intentions. The aim was to uncover gender differences in perceptions of the workplace climate and identify areas that could be enhanced in order to increase the representation, retention, and advancement of women in STEM.

## 1.1 Perceptions of Productivity

Faculty members fulfill the roles of teacher, researcher, and service professionals in departments and institutions (Bailyn, 2003). These multiple demands can reduce perceptions of productivity (Bailyn, 2003) as well as job satisfaction and institutional commitment (Ostroff, 1992). Although age, education, and work activities are better predictors of productivity than gender, men spend more time focusing on key determinants for promotion and tenure (e.g., research and writing), which creates more positive views of their productivity (Davis and Astin, 1990). Men also benefit from feeling more welcomed in their departments, which is associated with greater research productivity (Monk-Turner and Fogerty, 2010). Regardless of this evidence that predictors other than gender are related to productivity, women may perceive themselves as less productive due to gender schemas (Valian, 2005). Likely because of these cultural associations, women in male-dominated STEM fields are underrated, receive fewer promotions, receive less recognition, and have heavier teaching and service loads compared to men, which may reduce time for research productivity (NRC, 2007).

## 1.2 Departmental Climate: Openness to Women

Compared to men scientists, women scientists do not feel as valued, respected, worthy, or visible (Corley, 2005). STEM women faculty members can experience isolation, neglect, and unequal treatment, which in turn can lead to lower job satisfaction and higher intentions to leave (Greene et al., 2010). The department's openness toward women might also affect productivity; for example, faculty members who felt more welcome in their department authored 10 more articles compared to those who felt less welcome (after controlling for age, gender, race, and experience in the academy) (Monk-Turner and Fogerty, 2010). Furthermore, formal and informal aspects of the workplace climate (e.g., the "old boys club") present women with more career complications and fewer opportunities, which can lead to lower satisfaction, retention, and success (Settles et al., 2006).

### 1.3 Departmental Climate: Discrimination and Sexism

Preconceived notions that some careers are gender specific can account for some of the discrimination of STEM women (Goltz, 2005). Discrimination often manifests in subtle, covert ways (NRC, 2007). This type of discrimination remains a problem today, as two-thirds of senior women faculty members report concerns about stereotyping and subtle bias (Gibson, 2006). Subtle discrimination is difficult to notice, and thus can have substantial adverse effects because it goes unaddressed. For example, women are assigned heavier teaching and service responsibilities (Bailyn, 2003), are interrupted more, and are marginalized in meetings (Schmaling, 2007). Many women do not report discrimination because they do not expect their reports to be taken seriously, they expect to experience backlash or retaliation, and they perceive procedures for dealing with discrimination are lacking or ineffective (Goltz, 2005). Furthermore, women working in a department with a history of gender bias report less job satisfaction and more discrimination compared to national averages (Greene et al., 2010).

### 1.4 Departmental Climate: Influence of Women in the Department

Gender discrimination and a sexist climate hinder women's level of perceived influence in their departments (Settles et al., 2006). Women believe their opinions are less valued and their opportunities are more limited compared to men. Although achieving tenure can increase perceptions of influence (Settles et al., 2006), women are underrepresented at higher ranks. At the top 50 U.S. universities, women make up only 3–15% of full professors in STEM departments (Bilimoria et al., 2008). Thus, women's influence may be limited by these structural factors, although it is not clear how women's influence may relate to workplace outcomes.

### 1.5 Departmental Climate: Perceptions of Collegiality

Collegiality is related to greater productivity (Brown, 1996) and less attrition (Burnett et al., 2012). Communicating about research with colleagues creates a sense of ease when testing ideas, expands research interests, and provides reinforcement for research (Fox, 2010). Men are more likely to talk about their research daily, whereas women talk about their research less than twice a week. Although women's lower frequency of discussing research suggests fewer collaborative endeavors for women, both groups are equally likely to collaborate (Corley, 2005). However, women rate their departments as less inclusive and more stressful than men (Fox, 2010). As a result, women may experience greater isolation, which can accumulate over time, leaving tenured women especially vulnerable to feelings of isolation rather than collegiality.

### 1.6 Departmental Climate: Work/Life Balance

STEM faculty members face high workload demands and requirements for tenure (Fox, 2010). Regardless of gender, achieving balance between work and family responsibilities is a significant source of faculty stress (Sorcinelli and Near, 1989). All faculty members experience family interference with work (and vice versa); however, women experience both types of interference more than men (Fox, 2010). In fact, most senior women faculty members report role conflict (Gerdes, 2003). Over 90% of women faculty members reported that work/life balance issues slowed their academic progress (Greene et al., 2010). Although women and men faculty members spend equal

amounts of time on academic work, family and household responsibilities still claim more time from women than men (31 versus 19 h) (Shollen et al., 2009). This time differential may inhibit the ability of women faculty members to advance in their careers (Glazer-Raymo, 1999). Perhaps not surprisingly, women scientists are less satisfied with their work/life balance than men scientists (Corley, 2005).

## 1.7 The Present Research

The primary purpose of the present research was to investigate gender differences in perceptions of the STEM workplace climate and discern which climate factors are related to workplace outcomes (e.g., job satisfaction and turnover intentions) across four institutions. The secondary purpose of the research was to hear the voices of our participants and deepen our understanding of potential quantitative findings. As such, we conducted a workplace climate survey and semi-structured interviews in our embedded correlational design [i.e., QUAN(qual)] (Creswell and Plano Clark, 2007). This mixed-methods approach, in which the quantitative results are the focus—but are supplemented by qualitative findings—allowed us to further validate and perhaps explain the quantitative findings. The more comprehensive understanding of the research problem generated by both the general trends (i.e., quantitative data) and the particular experiences of STEM faculty members (i.e., qualitative data) may then inform institutional strategies to improve workplace outcomes for STEM faculty members as well as women in STEM.

## 2. METHOD

### 2.1 Climate Survey: Participants

STEM (e.g., Biology, Chemistry, Physics, Engineering, Psychology) and social, behavioral, and economic (SBE) sciences (e.g., economics and political science) tenure-track faculty members ($N = 574$) from four diverse U.S. midwestern institutions were invited to participate in an online survey. The institutions comprise a National Science Foundation (NSF)-funded ADVANCE Consortium, linked by region, and include a public doctoral university, private Catholic university, public minority serving university, and federal institution. The response rate across the Consortium was 44% ($N = 252$), of which 152 were men (60%), 62 were women (25%), and 38 participants did not indicate gender (15%). The proportion of STEM women across the consortium was 18% (Schneider and Riffle, 2010), which compares favorably to our 25% response rate for STEM and SBE women. Data were not available by institution; rather, the focus of this research was on the regional STEM climate.

### 2.2 Climate Survey: Procedure

The dean for each college at each institution sent an email invitation to tenure-track STEM as well as SBE faculty members with a request to participate in the survey via a link in the email. Participants were entered in a raffle for a $100 gift card (excluding one institution due to incentive-driven research restrictions). Up to six reminders were sent to those who had not yet participated. Participants completed the measures given below.

Actual (versus perceived) productivity was measured by asking, "What are the most reliable and informative indicators of productivity in your research area"? A checklist of indicators was provided, and participants also provided information about their productivity (i.e., total dollar amount of external and internal grants, refereed articles published, dissertations or theses chaired, presentations at national/international conferences, and patents). Participants reported the number of committees on which they served and the number of committees on which they chaired (in a typical year), where the responses could range from zero (which received a value of 1 when coding the data) to greater than 5 (which received a value of 7), yielding a 7-point scale. Participants completed one item on perceptions of productivity, "Using the criteria you checked above (i.e., productivity metrics), how do you think your department views your productivity, compared to the departmental average"? on a scale of 1 (less productive) to 7 (more productive).

Participants completed two items on their department's openness to women (i.e., "Faculty would be comfortable with a woman or a man as department head" and "The climate for women in my department is good"). Participants rated these and all subsequent items, unless otherwise noted, on 5-point agreement scales ranging from 1 (strongly disagree) to 5 (strongly agree). Responses on these items were correlated ($r = .41$), and the mean of the two items was calculated. In this case and elsewhere, unless otherwise noted, subsequent scores were the means of items that were calculated so that higher scores denote a better workplace climate for women.

Participants completed four items about discrimination in their department (e.g., "My colleagues expect me to be a spokesperson for others of my gender" and "Sex discrimination or harassment is a problem in my department"). Items were rated on a 5-point agreement scale and were reverse scored and averaged. This resulted in a reliable scale ($\alpha = .74$). Participants completed one item about sexism in their department (i.e., "Please rate the climate of your unit/ department on the continuum") on a 5-point scale ranging from 1 (non-sexist) to 5 (sexist), which was reverse scored. Participants completed two items on perceptions of women's influence in the department (i.e., "Women faculty are less likely than men to have influence in departmental politics and administration" and "Men faculty are more likely than women faculty to be involved in informal social networks within the department"). The items were rated on 5-point scales, reverse scored, and correlated well ($r = .47$).

Participants reported their department's collegiality using six semantic differential items on 5-point scales: friendly (reverse scored; 1 = friendly, 5 = hostile), cooperative (reverse scored; 1 = cooperative, 5 = competitive), respectful (1 = disrespectful, 5 = respectful), collegial (reverse scored; 1 = collegial, 5 = contentious), collaborative (reverse scored; 1 = collaborative, 5 = individualistic), and supportive (1 = unsupportive, 5 = supportive). Items were averaged to create a collegiality score, which resulted in a reliable scale ($\alpha = .91$). Participants rated their satisfaction with work/life balance (i.e., "Balance between my professional and personal life") using a 5-point scale ranging from 1 (very dissatisfied) to 5 (very satisfied). Participants reported their job satisfaction using one item (i.e., "All things considered, I am satisfied with my current position"), with a 5-point agreement scale. Past research has suggested a one-item measure of turnover intent is valid (Dolbier et al., 2005).

Participants responded to one item regarding their intentions to quit or stay in their position (i.e., "I have seriously considered leaving this institution"), using a 5-point agreement scale. This item was reverse scored so that higher values denote intentions to stay—or lower intentions to quit. Past research has suggested a one-item measure of turnover intent is valid (Beehr and Gupta, 1978). Participants responded to one item about mentoring. Participants were asked, "Do you have a career-related mentor"? and responded yes or no.

## 2.3 Semi-Structured Interviews: Participants

In a purposive sample, STEM tenure-track faculty members ($N = 12$; 50% women) were interviewed. For our interviews, we oversampled tenured women compared to their representation in the STEM academy to provide vivid insights about the experiences of tenured women and men STEM faculty. Only tenured STEM faculty members were interviewed to ensure adequate time to experience department climate. Three faculty members were interviewed from each of four institutions, and we included participants from a variety of STEM fields for maximum variation. An effort was made to recruit equal numbers of women and men to ensure diverse representation. Consequently, two institutions had representation from two women and two men. Faculty members who provided interviews were also eligible to participate in the climate survey (described above).

## 2.4 Semi-Structured Interviews: Procedure

Two of the present authors (T.S. and P.D.) who are tenured women faculty members from two of the consortium institutions, introduced the interview study via email, requested participation in a 1-h interview about workplace experiences, and conducted the interviews. The interviews included general questions about the workplace, such as the following: "How would you describe your experiences now within your department or institution"? "What are the gender issues in your department"? "Have you received any mentoring, either formally or informally"? The interviews were digitally recorded and transcribed verbatim.

## 2.5 Mixed Methods: Procedure

Consistent with our goal to understand faculty experiences, we examined gender differences in our quantitative data and then examined how these department climate factors relate to workplace outcomes. Our quantitative analysis examined gender differences by using analysis of variance, which will indicate whether there is a statistically reliable difference (as indicated by probability, $p < .05$) between men and women in our sample. We conducted qualitative content analysis of the interviews, in which comments were coded into underlying themes. These themes were then examined for overlap between the major quantitative measures to merge the quantitative data and qualitative themes in order to provide further explanation and detail of the quantitative results (e.g., Burnett et al., 2012). Thus, representative quotes from the interviews illustrate significant trends found from the climate survey. We provide as much detail as possible (i.e., gender and field) about the interviewed participants while protecting their identities.

## 3. RESULTS

## 3.1 Productivity and Perceptions

After controlling for the year the faculty member was hired, women reported serving on more committees (estimate of the mean, $M_{Estimate} = 4.45$; standard error, SE = 0.30) than men ($M_{Estimate} = 3.69$, SE = 0.17) [F-test ($F$) (1,135) = 4.67, $p = .03$]. There were no gender differences in the number of committees chaired or research productivity (i.e., the number of publications or grants, external fellowships funded, monographs published, edited books published, book chap-

ters published, dissertation or theses chaired, or presentations at conferences; all $F < 1.97$, $p > .05$). Despite this lack of differences in reported productivity, women (actual mean, $M = 4.06$; standard deviation, SD = 1.88) perceived their departments as having lower views of their productivity than men ($M = 4.76$, SD = 1.63) [$F(1,139) = 5.70$, $p = .02$].

According to our interviews, women's perceptions that the department does not value their work may have stemmed from conflicting priorities. Women reported engaging in academic work they felt was not valued by their department. For example, one woman in mathematics reported that she would not get a promotion to full professor if she had gone up that year because other aspects of academic work were important to her. She thought that the department over-valued research for tenure, but that this value had been taken to an extreme that was not fair or right. Her priority was not always research, and although she thought others would get a promotion because of the volume of their research, she was critical of this type of faculty member:

> Yes, they show up for class, but other than that they have their T.A. do all the work, and they just spent all their time doing research. And, yes, they are churning out two papers a year, but that's all they do. We would be a terrible department if we went on like that.

A woman in science had been pressured multiple times to "just write papers," but she considered other priorities, which were not supported in her department, such as service to the community related to her specialty:

> I'm sitting here going: $700,000 [for the community] versus one paper in a journal? That's a no-brainer! So, a lot of times I feel like I'm just making the decisions because I think it's the right thing to do as opposed to because I'm supported doing it.

These conflicting departmental and personal priorities were reported by women but not men faculty members. Perhaps a lack the flexibility within departmental priorities may have contributed to women feeling as though the department does not value their productivity. Although men generally perceived their departments as having higher perceptions of their productivity, men faculty members discussed a lack of clarity on what was required of them upon evaluation. One male faculty member said, "I would be happy if the administration would say, 'This is what you have to do to stay here.' Because since they don't do that, it has eroded the quality of the faculty." Men discussed a need for guidelines on how they would be evaluated, which might also address women's concerns about perceptions of productivity.

### 3.2 Openness to Women

Our climate survey revealed that women faculty members ($M = 3.56$, SD = 1.03) saw their department as less open to women than did men faculty members ($M = 4.01$, SD = .94) [$F(1,137) = 4.29$, $p = .04$]. Stories shared in the interviews further highlighted the problem of inclusion for women. When discussing trouble she had experienced in the tenure process, one woman in engineering said:

> I don't know if I'm running into this because I'm a woman, or because everybody would run into this—because the general notion is that "while we're a closed club, we're going to keep the riff raff like you out as long as we can."

On the other hand, a woman in engineering felt that her department was open to women: "I feel very comfortable going to anybody to ask for help. Everybody seems to have an open-door policy."

Two male faculty members stated how difficult it was to find potential faculty members that are women, but they stated different reasons for the problem. One maintained that it was difficult to find women applicants: "There's not too many of them." The other acknowledged that:

> *For the people that we're trying to hire for chemistry or biology, the ones they tend to want to hire are not female, they're not African-American. The issue to hire someone female or male may be a problem based on the fact that you can't talk about these issues.*

Thus, while some departments may be more open to women than others, some STEM fields may be struggling to find female candidates. One male faculty member felt that emphasizing "how folks working in the STEM fields have a direct impact on the quality of life of people around them" might facilitate recruitment of women. Such comments illustrate ways in which subtle changes—including emphasizing how STEM can directly impact quality of life—may create environments that are more open to women in the future.

## 3.3 Lack of Discrimination and Non-Sexism

Women ($M$ = 3.78, SD = 0.95) were less likely than men ($M$ = 4.33, SD = 0.70) to report that their department lacked discrimination [$F(1,138)$ = 13.96, $p$ < .01]. Women ($M$ = 3.69, SD = 1.12) also were less likely than men ($M$ = 4.29, SD = 1.00) to report that their department was non-sexist [$F(1,139)$ = 7.11, $p$ = .01]. Similarly, women but not men reported incidents of discrimination and sexism in interviews. For example, one woman recalled being treated as a subordinate rather than a colleague by a male full professor. Another woman scientist reported concerns about a change occurring in her department's promotion policies when she was the only person in line for promotion. Although she was not sure that it was gender discrimination, she felt that the recent change was an attempt to block her promotion. She felt that although her institution's process was clear, the department felt that women "get away with" meeting the minimums:

> *Well, they [the department] think, "they [women]"—I mean, it's always like we and they; like we're down there somewhere—"They [women] think that once they've met the minimums, they can move forward." What does it mean, then, the minimums? If you're required, you know, "X" papers to be published for promotion, then why should there be more? And if more, then, well, 10% more? 20% more? 12% more? You know, it's essentially setting up a new rule, right? ... We have these rules, so let's play by them! Not just the applicants, but also the people who make decisions: the department, the department head, or the department committee.*

Clearly, this woman felt that her department had treated her case differently. However, one woman reported that her department had curbed similar tendencies by hiring more women.

When it came to discrimination, a male faculty member said, "I encourage dealing with it institutionally when that's called for." His response to more subtle "male aggressive behavior" was "a confident female who, laughs at it, basically… encourage the victim to adopt a posture of superior intellect and a superior personality." This male faculty member understood that discrimination is a problem and that discrimination can be more subtle and "hard to prove." Another male faculty member did not see institutional approaches to discrimination as effective, saying: "I am absolutely in favor of equal opportunity. I am absolutely opposed to affirmative action. I think affirmative action is institutionalized racism and genderism." Although women reported

more experiences of discrimination and were less likely to see their department as non-sexist compared to men, the interviews with men suggests that some men are aware that discrimination—in blatant and subtle forms—is still a problem in STEM departments. However, these men were somewhat critical of institutional approaches to solving this problem.

### 3.4 Influence of Women in the Department

Women faculty members ($M = 3.06$, SD = 1.20) perceived that women had less influence in the department than did men faculty members ($M = 3.91$, SD = .92) [$F(1,136) = 14.23$, $p < .01$]. In interviews, women reported more mixed experiences in terms of the influence women have in their departments. A woman faculty member reported having influence through service on tenure committees; however, she also reported being asked to serve on a lot of committees: "If you're a woman, you're much more sought after to be on certain committees, because nowadays lots of committees [say], 'Oh you have to have a woman on it!'" If this perception that a "token" woman is needed on committees is widespread, it may explain the earlier finding that women serve on more committees than men. However, it also highlights potential problems with women's influence on these committees. If women do serve as tokens, they are present on the committee but may have little influence because they are easily discounted.

However, women may have influence through coalition building. For example, one woman reported that having a prominent woman in her department being promoted up the ranks had made it easier for her. Another woman reported building a group of capable and merited younger women that sought to identify the traits and qualities the division looked for in individuals who are promoted in the management ranks. Their goal was to develop rules; she said, "If we have this set of rules, we can play by the rules. But there were no rules." However, the group was received with apprehension by male leadership, which perhaps echoes the findings about openness, and the group did not meet its goals. While the interviews indicate that women faculty members understand the significance of having influence, women do not believe that they have attained influence within their departments, according to the climate survey. Furthermore, in some departments there are no women to provide any influence. Two of our male interviewees noted that they did not have any women faculty members in their departments. Upon further query, one admitted that he had only a few female students in his classes.

### 3.5 Collegiality

Women perceived less collegiality in their departments ($M = 3.21$, SD = .74) than men ($M = 3.83$, SD = .85) [$F(1,140) = 6.90$, $p = .01$]. However, both men and women described their departments as collegial in interviews. For example, one man reported that the recognition and respect that he felt in his position came from his colleagues in the department. A woman similarly reported that department collegiality had contributed to her happiness in her position:

> *I think that I am at a good place within the department. I have a pretty good relationship with all my colleagues, pretty much… I mean, I feel like my being here, my contribution is being valued, which contributes to my being very happy with what I am doing.*

A man highlighted the collegiality within the department, saying that department members "feel like they can speak to each other about whatever issues are going on."

However, some women reported problems with department collegiality in interviews. One woman reported retreating from her department and "hibernating" in her laboratory, where she felt most comfortable. Another woman reported that two full professors in the department had not spoken to each other in years. Furthermore, these faculty members conducted research in her area and had taken advantage of her success through her students and funding. There were several problems in this department that influenced her perception of collegiality. Not only did she feel that she was being taken advantage of, she also felt that she could not bring up the problem to her department.

## 3.6 Work/Life Balance

Women reported being less satisfied with their work/life balance ($M = 2.87$, SD = 1.24) than men ($M = 3.47$, SD = 1.06) [$F(1,138) = 6.91$, $p = .01$]. Interview data revealed concerns for work/life balance regardless of gender. One woman scientist reported teaching more evening classes to spend more time with her children, which made her feel disconnected with her colleagues who mostly worked during the day. Another woman said that many young women discover that they cannot balance work and life, which then affects their productivity: "It's this fallacy that 'you can do it all,' and they find they can't, and so then the work drops." A woman also felt pressured to make certain choices as a mother: "I did have people at higher levels saying, 'Just put them in daycare, that's the right choice, and you'll be fine.' But that really depends on the mother. Everybody makes a different choice."

Men also complained about inflexibility in their institutions in interviews. One man reported that his family suffered because of his devotion to an institution, which unfortunately was not worth his devotion. He felt that the tenure process was insensitive to home life and that only "a single person who has no social life with a cot in your office" would be successful in the tenure process. Although many agreed that there was a lack of work/life balance, there also was perceived a hesitancy to admit this problem individually as well as within their departments or institutions. One woman explained, "A lot of us want to not talk about the struggles of balancing work and family, but I think if we can talk about it, we can help each other and help the administration see what our needs are."

## 3.7 Mentoring

According to our climate survey, only 18% ($N = 45$) of our sample currently had a career mentor. Of those with a mentor, 26 were men (58%), 17 were women (38%), and two did not indicate gender (4%). However, whether participants had a career mentor did not significantly differ by gender [chi-square non-parametric test ($\chi^2$) (1, $N = 214$) = 2.92, $p = .09$]. The sample was distributed evenly across rank; i.e., 16 assistant professors (36%), 14 associate professors (31%), and 13 full professors (29%), with two participants not indicating rank (4%).

Although few faculty members in our survey have mentors, the impact of mentoring was reflected in several interviews. For example, one woman reported that she had not received mentoring and was trying to provide mentoring to the next generation. She spoke of the importance of mentoring this younger generation: "I can think of one very specific incident right now, not relative to me but relative to somebody else, but it [mentoring] would have made a huge difference in their life. And that's sort of sad." Similarly, a man in engineering saw mentoring as valuable to his career; he reported that his department chair had pushed him to achieve more and

thus had advanced his career. Furthermore, mentoring also benefits the mentor, according to one male faculty member: "It's incredibly rewarding to see someone help someone else climb the mountain and not only come up to your level—whatever that means—but then also go beyond you." Although these qualitative reports highlight the importance of mentoring, unfortunately few faculty members reported having mentors.

### 3.8 Examining Climate Indicators as Predictors of Workplace Outcomes

We conducted two hierarchical regression analyses to examine climate predictors of job satisfaction and intentions to stay in one's current position, respectively. We also examined the interaction of gender and climate indicators (i.e., departmental views of productivity, openness to women, lack of discrimination, non-sexism, women's influence, collegiality, and work/life balance) on job satisfaction and intentions. For all models the first step included gender and rank (given their importance in perceptions of climate) (see Schneider and Riffle, 2010; Schneider and Jackson, 2010), the second step included the seven climate indicators, and the third step included interactions between gender and any significant climate indicators. (Interactions with rank were also examined but were not significant, so they are not discussed further.) Across these regressions, we examined whether the regression model was significantly improved ($p < .05$) by the additional predictors compared to a model with fewer predictors. Table 1 presents the correlations and descriptive statistics, which reflects a lack of correlation between rank and the climate indicators.

As shown in Table 2, we first examined job satisfaction by regressing job satisfaction on rank and gender, which was not significant [$F(2, 190) < 1$]. The second step added the seven climate variables, and the change in the $F$ statistic was evaluated to discern model improvement. These added variables did improve the model [$F_{change} (7, 183) = 21.11, p < .01$], and accounted for 45% of the variance in job satisfaction. Being male, perceiving your department as viewing you as productive, in a collegial department, and more satisfied with work/life balance significantly

**TABLE 1:** Correlations and descriptive statistics for climate indicators ($N = 189$)

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1. Rank | — | | | | | | | |
| 2. Productivity | .04 | — | | | | | | |
| 3. Open to women | .06 | .16[1] | — | | | | | |
| 4. Discrimination | −.01 | .24[2] | .42[2] | — | | | | |
| 5. Sexism | −.06 | −.11 | −.38[2] | -.57[2] | — | | | |
| 6. Women have influence | −.01 | .24[2] | .48[2] | .56[2] | −.48[2] | — | | |
| 7. Collegiality | −.08 | .17[1] | .32[2] | .42[2] | −.50[2] | .31[2] | — | |
| 8. Balance | .02 | .21[2] | .16[1] | .13 | −.14[1] | .21[2] | .32[2] | — |
| Mean | 1.71 | 4.70 | 4.01 | 4.21 | 1.94 | 3.74 | 3.72 | 3.35 |
| Standard deviation | .46 | 1.64 | 0.96 | 0.79 | 1.11 | 1.06 | 0.88 | 1.17 |

[1]$p < .05.$
[2]$p < .01.$

**TABLE 2:** Summary of hierarchical regression analyses for workplace outcomes ($N = 189$)

| Variable | Job satisfaction ($\beta$) | Intentions to stay ($\beta$) |
|---|---|---|
| Step 1 | | |
| Gender (women, 1; men, 2) | −.02 | .02 |
| Rank | −.05 | .16[1] |
| Step 2 | | |
| Gender | .22[2] | −.16[1] |
| Rank | .06 | .09 |
| Productivity | .19[2] | −.06 |
| Open to women | .07 | .14[3] |
| Discrimination | .09 | −.18[3] |
| Sexism | .02 | −.05 |
| Women have influence | .12 | −.14 |
| Collegiality | .39[2] | −.14[3] |
| Work/life balance | .18[2] | −.15[1] |
| Step 3 | | |
| Gender | .51[3] | — |
| Rank | .04 | — |
| Productivity | −.14 | — |
| Open to women | .09 | — |
| Discrimination | .11 | — |
| Sexism | .02 | — |
| Women have influence | .10 | — |
| Collegiality | .66[2] | — |
| Work/life balance | .44[1] | — |
| Gender × productivity | .41[3] | — |
| Gender × collegiality | −.43 | — |
| Gender × balance | −.32 | — |

[1]$p < .05$.
[2]$p < .01$.
[3]$p < .10$.

predicted job satisfaction. The third step included the interaction of gender with the three significant climate variables, which improved the model [$F_{\text{change}} (3, 180) = 2.84$, $p < .05$] and accounted for an additional 3% of variance in job satisfaction. Although there was a marginal interaction between gender and perceptions of productivity, none of the gender interactions were significant, which suggests that collegiality and work/life balance are important predictors of job satisfaction for both men and women faculty members.

Next, we examined turnover intention by regressing turnover intention on rank and gender; this first step was not significant [$F = 2.23$, $p = .11$ $R^2 = .02$]. The second step added the seven climate variables, which improved the model [$F_{change}$ (7, 180) = 5.34, $p < .01$] and accounted for 19% of the variance in turnover intention. As shown in Table 2, being male and more satisfied with work/life balance is related to higher intentions to stay (versus quitting). The third step included the interaction of gender with the significant climate indicators, which did not improve the model [$F_{change}$ (3, 177) = 1.48, $p = .22$]. Thus, including interactions with gender did not explain significant variance, which suggest that there was no moderating effect of gender on climate indicators for turnover intentions. The best model for turnover intentions is Step 2, which includes the significant direct effects of gender, openness to women, and work/life balance.

## 4. DISCUSSION

Across STEM fields and in four diverse institutions, our climate findings show that women generally perceived a more negative workplace climate than men in terms of perceptions of productivity, discrimination, sexism, work/life balance, collegiality, and their influence in the department. These findings are consistent with past research showing gender differences in perceptions of department climate (e.g., Corley, 2005; Greene et al., 2010; Settles et al., 2006). For example, women faculty members perceived their department as evaluating their productivity lower compared to men. However, there were no actual differences in productivity—in fact, women were equally productive and served on more committees. The findings converge with other research findings indicating that there are no actual gender differences in productivity, but women consistently perceive they are less productive (Monk-Turner and Fogerty, 2010). Perhaps these perceptions reflect the "felt" climate, which was different for men and women in the present study. Qualitative reports further highlighted differences in perceptions of productivity between women and their departments. For example, women reported that they felt unsupported by their department when choosing priorities (e.g., teaching and service); even if they felt it was "the right thing."

Furthermore, our survey showed that these climate variables were related to workplace outcomes. Predictors of both job satisfaction and intentions to stay in one's current position were being in a department that views you as productive, a department that is collegial, and a department in which you are satisfied with your work/life balance. Consistent with initial analyses on climate variables, there was an effect of gender. Men were more satisfied with their jobs and had greater intentions to stay than women. However, gender did not interact with climate predictors on these workplace outcomes. This finding suggests that addressing these departmental issues (i.e., views of productivity, collegiality, and work/life balance) will improve job satisfaction and decrease job turnover intentions for both men and women in the STEM academy.

### 4.1 Implications

The results of this study highlight a need to address the academic department to enhance perceptions of climate for women, increase job satisfaction, and decrease turnover intention for all. The substantial impact of bias, including gender stereotypes, experienced in STEM academic settings has molded the ADVANCE program at the NSF. Numerous ADVANCE-funded institutions are developing best practices with the goal of transforming STEM departments and overall institu-

tion workplace climate change. The present data highlighted needs within our specific institutions. While the implications are broad reaching, these findings highlighted several needs specific to the four institutions included in this study. Consequently, these findings helped to shape initiatives developed as part of the ADVANCE program's goal of institutional transformation.

The perceptions of discrimination and sexism pointed to the need for individuals within each consortium institution who could promote equity and act as both a resource and a contact person. The NSF ADVANCE programs (e.g., University of California Irvine, University of Illinois at Chicago, and LEADER) have addressed this problem by creating a system of equity advisors (e.g., senior faculty members) who raise awareness about equity in hiring, retaining, and promoting faculty members in the institution. Their role is also to promote a supportive environment by serving as a resource, confidant, and consultant on matters relating to equitable assessment, resources, teaching, research, and work/life balance. Another way to address departmental sexism is to confront implicit bias, which is indirect or unintentional bias. Several ADVANCE institutions have developed workshops on implicit bias in order to address workplace climate issues (e.g., University of Michigan, University of Wisconsin, and LEADER). Such workshops would be especially important for department chairs, promotion and tenure committees, and search committees, as well as for STEM departments in general.

Only a small percentage of faculty members reported that they had mentors at the time of the climate survey; however, the interviews revealed the importance that the role of mentor can play in academia. Furthermore, research suggests that mentoring serves as a valuable conduit for junior faculty career development (Boice, 1993), which may facilitate productivity and job satisfaction. In particular, mentors provide mentees with psychosocial and career-based support, advice on issues faced by junior faculty members (e.g., department politics and policies, requesting resources), and guide them toward a state of independence. Mentoring programs could also help address perceptions regarding productivity, work/life balance, and collegiality. The lack of mentoring observed in these four institutions led directly to the development of a formal mentoring program. Mentoring research suggests that ideal pairings between mentors and mentees are needed (Polander et al., 2013). Ideal pairings are based on the mentors' expertise and experience and the mentees' interests and needs within a number of broad areas, including networking, advancement, productivity, and work/life balance. Coaching is another practice designed to provide opportunities for faculty members to increase productivity, improve work/family balance, and refine goals for career advancement. Coaching differs from mentoring in that it provides an objective, third-party perspective in developing and working toward the attainment of career goals. Thus, institutions facing similar lack of mentoring might consider both mentoring and coaching programs. Over time, initiatives like these may improve workplace climate, resulting in a greater sense of collegiality and belonging, and thus increasing job satisfaction, retention, and advancement of women in STEM.

## 4.2 Limitations and Future Research

One limitation of this study is that we are examining climate factors at specific institutions that may not generalize to other institutions. Different institutions or disciplines often possess their own individual cultures, which can foster and facilitate varying leadership styles, levels of collegiality and collaboration, or support for women through a range of formal (e.g., policies) and informal (e.g., social norms) mechanisms. However, in order to ensure that climate interventions are being appropriately targeted, individual institution or discipline climate issues should be ex-

amined, given that such issues vary (Ambrose et al., 2005; Xu, 2008). Still, our findings may be broadly generalizable, given that our four institutions have somewhat different priorities regarding research, teaching, and service.

Our results also highlight the need for additional research on antecedents and the consequences of gender differences in perceptions of productivity. Although equally productive, women reported lower departmental perceptions of their productivity than men. Research suggests that productivity perceptions may be influenced by the way faculty members choose to allocate their time and efforts at work. Specifically, faculty members engaging in more work contributing to promotion and tenure tend to hold more positive perceptions of their productivity (Davis and Astin, 1990). Future research should examine faculty allocations of time to research, teaching, and service, along with perceptions of departmental value of these factors as predictors of perceived productivity.

## 5. CONCLUSION

The number of women in STEM careers is increasing; however, women remain underrepresented and experience different STEM department climate than their male counterparts. Perhaps by addressing workplace climate issues through programs, the new norm could be experiences of collegiality, equal treatment, and ultimately greater job satisfaction and productivity for all STEM faculty members.

## ACKNOWLEDGMENTS

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