

# Is the Gender Climate in Chemistry Still Chilly? Changes in the Last Decade and the Long-Term Impact of COACH-Sponsored Workshops

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## S Supporting Information

**ABSTRACT:** The representation of women among recipients of chemistry Ph.D. degrees has increased in recent years, but their representation among the faculty in academic departments is still below what would be expected given the proportion of degrees received. Articles published in the *Journal of Chemical Education* in 2010 documented a hostile gender-related climate in academic chemistry and the way in which COACH had helped women deal with this hostile environment. This paper replicates and extends the 2010 analyses. Findings from surveys of over 400 women indicate that the negative gender-related climate within chemistry changed very little from 2006 to 2016. Women who had participated in COACH continued to report that they often used skills learned in COACH workshops and that these skills helped them in their careers. Discussion of the findings emphasizes the extent to which commitment and actions by administrators and the profession as a whole are needed to promote the full inclusion of women within the field.

**KEYWORDS:** *Women in Chemistry, Collaborative/Cooperative Learning, Professional Development*

While the historic underrepresentation of women in the physical sciences has been well-documented, the situation appears to be gradually changing, especially in chemistry. In 2015, 41% of the Ph.D. degrees in chemistry were awarded to women, compared to 35% in 2007.<sup>1</sup> While these data suggest an increasing level of gender equity in the field as a whole, this pattern does not appear to have generalized to the academic workforce. In fact, women have received more than 25% of all chemistry Ph.D. degrees since the mid-1980s. Yet, by 2012–2013 they still represented less than 20% of the tenured and tenure-track positions in the top 50 schools in terms of chemical research and development funding and only 30% of the assistant professors.<sup>2</sup> In other words, the probability of a woman with a newly minted Ph.D. in chemistry obtaining an academic position appears to be substantially lower than that for a man. As a result, students within chemistry departments are likely to view the profession as substantially more male dominated than the actual composition of the field.

A relatively large literature has documented ways in which the academic scientific community has fostered an unwelcoming climate for women, and a 2010 article in the *Journal of Chemical Education*<sup>3</sup> substantiated this conclusion using data from a sample of women academic chemists. A companion article<sup>4</sup> examined efforts designed to help women academic chemists advance their careers: workshops conducted by COACH, the Committee on the Advancement of Women Chemists. COACH was established in 1999 by a small group of senior women chemists to design and implement projects to help women advance their careers by finding effective ways to negotiate often hostile work environments. As part of these efforts they have sponsored workshops teaching skills in, primarily, communication and negotiation. The 2010 article described the

workshops and participants' views of their impact. The results were overwhelmingly positive, with participants reporting that they frequently used skills taught in the workshops and that the skills had helped them in their workplace interactions and careers.<sup>4</sup>

This paper reports on a replication and extension of these earlier articles, comparing the data used in the 2010 analyses with data gathered over the subsequent decade, a period in which, as noted above, the representation of women among chemistry Ph.D. recipients continued to grow. We examine (i) changes from 2006 to 2016 in academic women chemists' perceptions of the gender-related climate within the field, and (ii) the utility of COACH-sponsored workshops. As more women have obtained Ph.D. degrees and joined faculty ranks, has the climate in academic chemistry become more accepting? Have the skills taught in COACH workshops been used less often or seen as less helpful? One could expect that increased representation of women in the field could be related to an improved gender climate. On the other hand, disciplinary and departmental norms are often long-standing, and it is possible that elements of gender bias are so entrenched within academic chemistry that there has been little change over time. If the latter were the case we would expect to find little change in the extent to which COACH participants used skills they had learned or saw them as useful.

Our analysis looked at a wide variety of areas related to gender equities within the field, from factors that affect the

Received: March 26, 2018

Revised: June 8, 2018

Published: July 20, 2018

recruitment and hiring of women, to elements that facilitate women's career progress, the ways in which departments allocate resources and rewards, and more general perceptions of support and career satisfaction. In analyzing the impact of COACH we examined participants' reports of how frequently they used the negotiation and communication skills and how helpful the skills had been. Our analysis involved numerous statistical analyses, which are summarized in an extensive [Supporting Information](#) document. In the remainder of this paper we briefly describe the data and methods used in our analysis, summarize our results, and discuss their implications for promoting an academic sector that utilizes all of the available talent within chemistry.

## ■ DATA AND METHODOLOGY

Data were gathered via Internet-based surveys using the methods described in the 2010 papers and approved by the University of Oregon's institutional review board for work with human subjects. Information came from two sets of surveys. The first was questionnaires completed by participants prior to attending 18 COACH-sponsored workshops from 2006 through 2015. Data from these surveys were available for 228 attendees. The other was follow-up surveys sent to participants in COACH workshops two or more years after their initial participation (total  $n = 226$ ). One follow-up survey, with 112 respondents, was completed in 2007–2008 and provided the data reported in the 2010 *Journal of Chemical Education* article.<sup>4</sup> The second survey, with a total of 114 respondents, was completed in 2015–2016. A subsample ( $n = 52$ ) responded to both follow-up surveys, and data from this subgroup were also examined in separate analyses. Thus, we used both a trend design, comparing changes over time in responses to the preworkshop and follow-up questionnaires with all respondents, and a panel design, examining changes over time in the responses to the follow-up questionnaire by those who responded at both time periods.

Each survey included a large number of individual questions, generally asked in a Likert-scale format. Using standard scaling techniques, we combined individual items into 8 general measures of respondents' perceptions of gender equity within their department and the field. (See discussion in the [Supporting Information](#) for details.) Two measures, both from the preworkshop surveys, asked about factors that affect the recruitment and hiring of women into academic chemistry departments. Three measures addressed factors related to the respondents' work environment: perceived gender inequities in access to departmental resources, gender differences in departmental and institutional recognition and rewards, and the extent to which their departments and institutions were supportive of women faculty (follow-up survey only). Two measures, taken from the preworkshop data, assessed participants' beliefs about factors that influence women's career progress and differentiated influences that were related to women's behaviors and decisions and those related to departmental and discipline-wide norms and policies. Finally, the preworkshop surveys included questions regarding participants' satisfaction with their work situation.

Three general measures from the follow-up surveys assessed the utility of COACH workshops. Two examined the extent to which participants used the skills that were taught and a third assessed the extent to which the skills had helped in various aspects of their work life and careers.

Data were available from both sets of surveys on participants' age, tenured status, rank, race–ethnicity, and specialty area within chemistry. In addition, the follow-up surveys included

information on the participants' administrative experience and the representation of women within the tenure-track faculty of their departments.

Our analysis focused on the extent to which perceptions of the gendered climate and the utility of COACH workshops changed over time. First, we examined the distribution of responses to each measure across all years. Then, we compared responses from earlier periods (2006–2010) to more recent periods (2011–2016) using *t*-tests and effect sizes (Cohen's *d*), a descriptive statistic often used by social scientists to describe the magnitude of a difference between two groups. Traditionally, effect sizes of 0.20 have been seen as small, 0.50 as medium and 0.80 as large.<sup>5</sup>

To further test our results, we conducted two-way analyses of variance examining the extent to which differences over time were related to the participants' demographic and career-related characteristics. We also regressed each of the 11 dependent measures (8 of climate and 3 of utility of the workshops) on time period and the demographic and career-related measures. For analyses of the preworkshop surveys, we checked whether any differences appeared when time was measured continuously or as a dichotomy. We also examined the relationship of perceptions of inequities to general satisfaction and the relationship of perceptions of inequities to views of the COACH workshops. Taken together, these analyses provided insights into the extent to which perceptions of climate and utility of the workshops had changed over time and the relationship of demographic and career-related variables to any perceived changes.

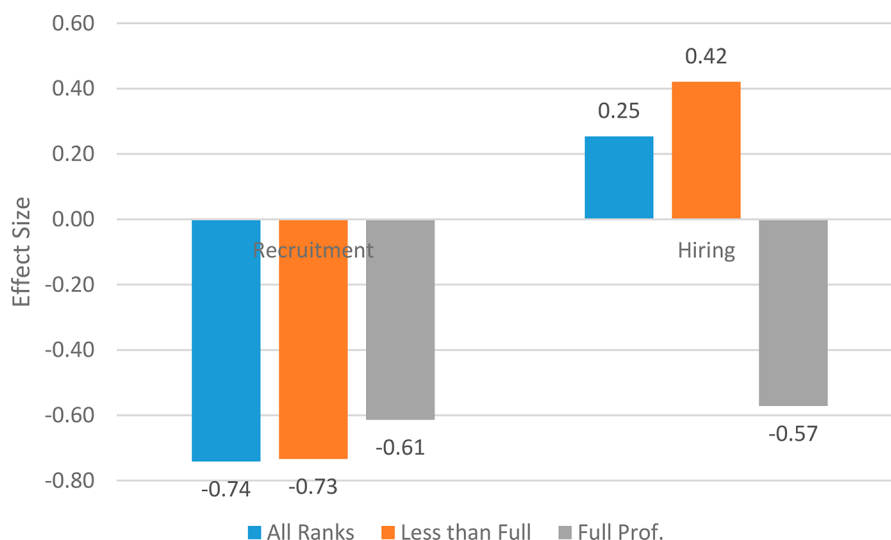
## ■ DEMOGRAPHIC AND CAREER CHARACTERISTICS OF SAMPLES

The survey respondents were a diverse group ([Supporting Information](#) Tables 2 and 3). On average, the respondents to the preworkshop surveys were relatively young and in the midst of establishing their careers. While they ranged in age from 23 to 66, two-thirds were 40 years old or younger. Slightly more than one-third were tenured, but only 12% held the rank of full professor. Of those responding, 30% reported a race–ethnicity other than non-Hispanic white, and slightly more than one-tenth of the respondents attended workshops at conferences oriented toward members of minority groups (SACNAS or NOBCCChE). Respondents specialized in all subfields of chemistry.

While respondents to the follow-up surveys were similar to respondents to the preworkshop surveys in distributions of race–ethnicity and specialty area, the follow-up sample, and especially those who responded in 2015–2016, was substantially older and more established. By 2015–2016, their average age was 51, over 90% were tenured, over three-fifths held the rank of full professor, and most of the rest were at the rank of associate. Almost one-fourth of the respondents to the follow-up surveys had held or were currently in a higher-level administrative position, such as department chair, associate dean, associate provost, or dean. Paralleling changes in the field as a whole, the percentage of women in tenure-track positions in the respondents' departments increased significantly over the decade, from an average of 21% in 2007 to 31% in 2015–2016 ( $p < 0.001$ ).

## ■ HAS THE GENDER-RELATED CLIMATE OF ACADEMIC CHEMISTRY BECOME LESS CHILLY?

In general, we found no indication that women academic chemists viewed the field as more welcoming and equitable in recent years compared to a decade earlier. While the nature of



**Figure 1.** Effect sizes associated with changes in views regarding factors affecting recruitment and hiring of women faculty by rank. Note: Bars in the figure indicate the magnitude of the associated effect sizes. Changes over time were statistically significant ( $p < 0.001$ ) for recruitment for the total group and those at ranks lower than full. For hiring they were statistically significant ( $p = 0.01$ ) for those at ranks less than full.

changes varied somewhat from one measure to another and from one subgroup to another, there was no consistent pattern of change that would point to improvement in the previously documented chilly climate.

#### Recruitment and Hiring of Women

Respondents in all years perceived substantial barriers to recruiting women for academic positions. On average around two-thirds reported that each of the following factors posed a moderate or major difficulty in recruitment:

- Lack of mentoring of potential women faculty
- Uncertainty about employment for partner or spouse
- Concerns about having both a family and a career
- Few successful women faculty in the department
- An unwelcoming departmental environment

Respondents in later years were significantly more likely to report that these issues presented difficulties, and this perception of increased difficulties remained when demographic characteristics were controlled in multivariate analyses. Reports of worse recruiting barriers over time were statistically significant for the scale score and 4 of the 5 individual items; the associated effect size was substantial. (See Figure 1 and Tables 4 and 5 in the Supporting Information).

The participants rated issues related to hiring as somewhat less problematic than those related to recruitment. On average, more than half reported that issues related to few women applicants and spousal employment posed a moderate or serious difficulty. About one-third rated a “lack of commitment of department faculty members to increase the number of women faculty” in these difficulty categories, but less than one-fifth cited explicit opposition to the hiring of women as either a major or moderate difficulty. Overall, respondents were less likely to perceive problems in hiring women in the more recent years, but this pattern varied by seniority of the respondents. Women who were more established in their careers, and perhaps more aware of the intricacies involved in hiring, tended to see these issues as more problematic in recent years while those who were more junior rated them as less problematic. It should be stressed however that the magnitude of these differences was relatively small, less than one-half of a point on the

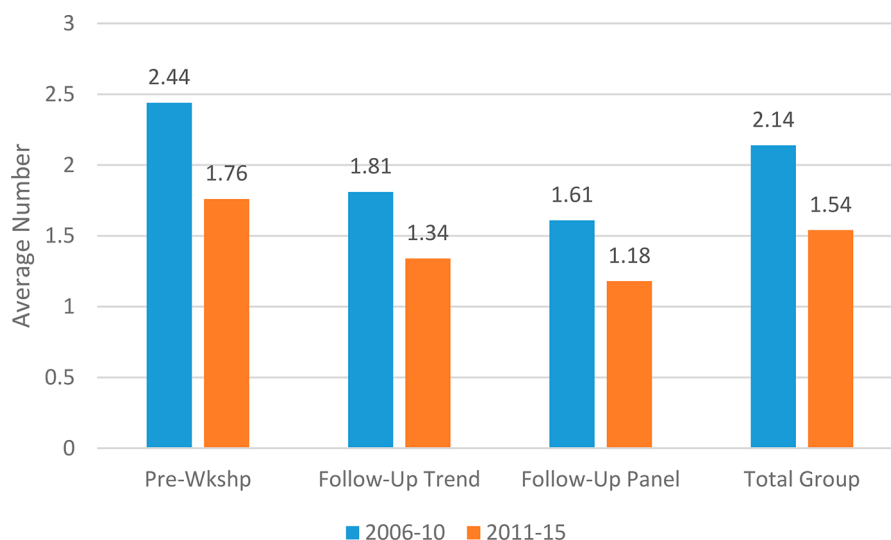
measurement scale. (See Supporting Information Tables 6–8, and Figure 1.)

#### Resources, Rewards, Recognition, and General Support

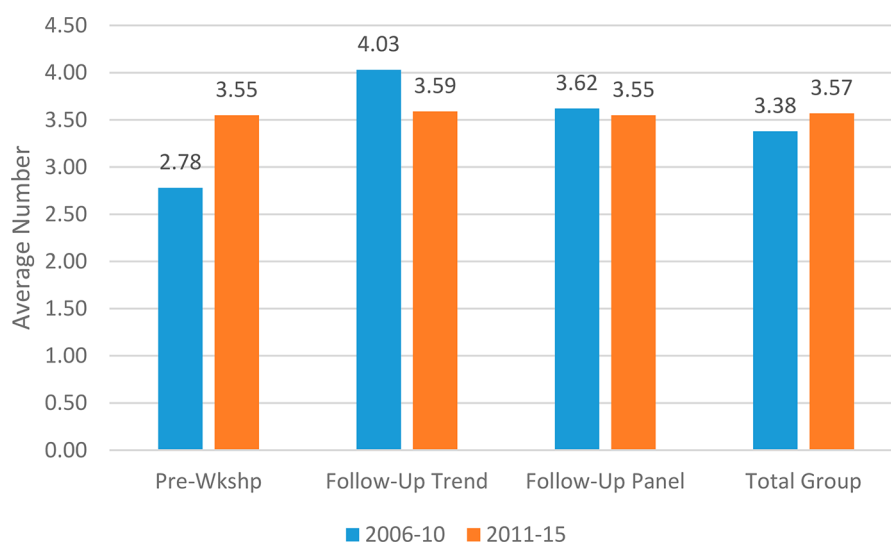
A series of questions asked respondents whether men, women, or neither group of faculty received preferential allocation of a variety of resources, including space, funding for equipment and travel, and assistance for research, teaching, and clerical needs. Analyses indicated a declining perception of male privilege over time in this area. On average, in the earlier years, respondents reported that male faculty received greater access to approximately 2.1 of the 6 items listed; however, in later years, the average fell to 1.5, a change that was statistically significant. (See Supporting Information Tables 9–11 for detailed results and Figure 2 for average scores for the total group and each sample.)

Other questions asked respondents about the extent to which men, women, or neither group were more likely to have various rewards and recognition including higher salaries and promotion rates, lower teaching and committee loads, and recognition within the department and the university. Changes over time differed somewhat between the preworkshop and follow-up samples. The more junior faculty who responded to the preworkshop survey were significantly more likely in later years to perceive that men faculty were privileged, while the more senior women who responded to the follow-up surveys perceived a slight decline in male privilege over time. In addition, women who were in departments with a higher proportion of women colleagues were more likely to see a decline in the extent to which men were privileged in rewards and recognition. Even though the patterns of change varied, perceptions of inequitable treatment were relatively high and quite similar between the two groups. On average, in the later time period, respondents in each of the sample groups reported that men faculty were privileged on half of the listed items. The most common areas in which disparities were reported were salary, recognition within the university, and being taken seriously by graduate students. (See Supporting Information Tables 12–15 and Figure 3.)

The follow-up surveys asked about the extent to which top level administration, departmental administration, department faculty and staff, and graduate students were “supportive of women.”



**Figure 2.** Average number of resource-related items (out of 6) perceived to favor male faculty, by time and sample. Note: Items in the scale included males receiving more or better space, greater equipment allocations, more funding for travel, more hours of teaching assistance, more hours of research assistance, and ease of receiving secretarial assistance. Change over time was statistically significant for the total group ( $p < 0.01$ ) and the preworkshop survey sample ( $p < 0.05$ ).



**Figure 3.** Average number of rewards and recognition-related items (out of 7) perceived to favor male faculty, by time and sample. Note: Items in the scale included males receiving higher salaries, heavier teaching loads (reversed), heavier committee loads (reversed), better promotion rates, more recognition within the university, and being taken more seriously by graduate students and by undergraduate students. Changes over time were statistically significant ( $p < 0.01$ ) for the preworkshop sample.

On average, close to two-thirds of the women believed that these groups were generally supportive, while about one-fifth indicated that they were not. Aggregate analyses indicated that there were no significant differences in these responses over time for either the trend sample ( $p = 0.33$ ,  $d = 0.013$ ) or the panel sample ( $p = 0.27$ ,  $d = 0.17$ ). (See [Supporting Information Tables 16–18](#).)

### Promoting Women's Career Progress

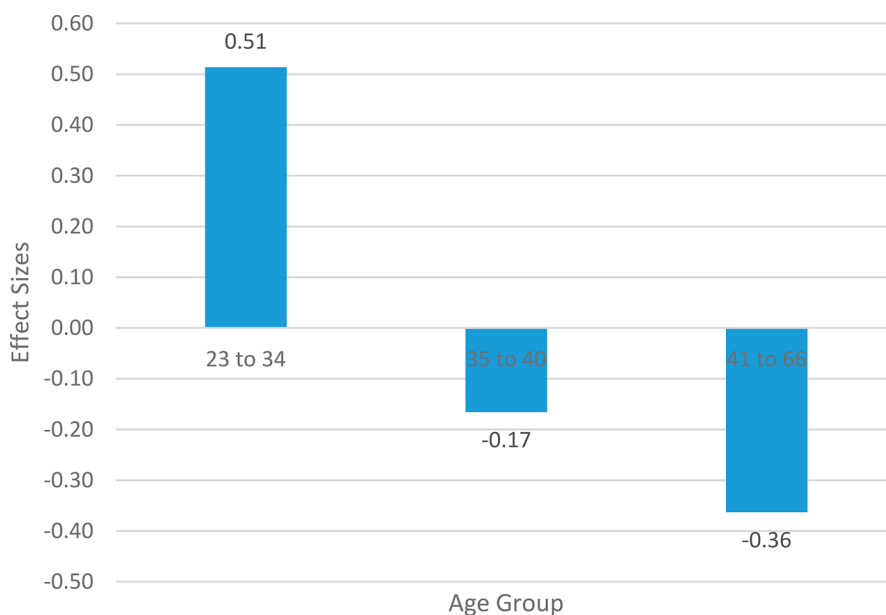
Two sets of questions in the preworkshop survey asked the respondents to indicate how important a variety of factors were in influencing the progress of women's careers within academic chemistry. The first involved a scale that incorporated issues broadly related to women's own actions, perceptions, or experiences. There were no differences in responses over time ( $p = 0.99$ ,  $d = 0.0$ ), nor were there significant relationships of demographic variables to responses. Over three-fourths of the women reported

that balance of work and family obligations, failure to market or self-promote one's accomplishments, and the accumulation of subtle biases over the years were at least moderately important factors affecting women's career progress. Fewer than 10% said that these areas were not at all important. About half of the respondents rated successfully obtaining funding and attracting good graduate students as at least moderately important, although one-quarter believed that neither of these issues were important. (See [Supporting Information Tables 19–21](#).)

A second measure regarding issues that affect career progress included items more directly related to the women's academic departments or the profession as a whole. Overall, half to two-thirds of the women reported that each of the following issues were at least moderately important in slowing women's career progress:

- Having few female colleagues





**Figure 4.** Effect sizes associated with changes in views regarding department/profession-related factors affecting women's career progress by age of respondent. Note: Items included in the scale were few female colleagues, women getting heavier teaching and/or service responsibilities relative to their male colleagues, unwelcoming departmental climate for women, women having fewer opportunities to be mentored by top chemists, women being excluded from important departmental and institutional decisions, and gender discrimination in the peer-review process of their papers and grants. Changes over time were statistically significant for those aged 23–34 ( $p < 0.05$ ).

- Having fewer mentoring opportunities
- Getting heavier teaching and/or service responsibilities relative to their male colleagues
- Being excluded from important departmental and institutional decisions
- Experiencing an unwelcoming departmental climate for women

Almost as many (45%) rated gender discrimination in the peer-review process as either moderately or very important. While younger respondents perceived that the issues were less serious in more recent time periods, older and more established respondents perceived that they were more difficult in recent years. (See [Supporting Information](#) Tables 22–24 and [Figure 4](#).)

#### Satisfaction with Career and Work

On balance, respondents were more likely to report that they were satisfied, rather than dissatisfied, with their workload, salary, and job, overall. Women who were more established in their careers were significantly more likely to express dissatisfaction in later years than in earlier periods. In addition, as would be expected, those who perceived more gender inequity related to recruitment, hiring, career progress, and allocation of resources and rewards expressed less satisfaction. When these views about gender equity were controlled, the relationship of seniority to satisfaction declined markedly. (See [Figure 5](#) and [Supporting Information](#) Tables 25–27.)

#### Gender-Related Climate Summary

In general, our results provide little evidence that the gender-related climate in chemistry became less chilly from 2006 to 2016. Significant improvements were found in the perceived allocation of resources such as funding for travel and equipment, but significant declines in the recruitment of potential women faculty. There were no significant changes over time in perceived support for women, perceptions of some factors related to women's career progress, or job satisfaction. With the other

three measures, changes over time varied between those who were more or less established in their careers. More senior women tended to see the climate as more chilly in recent years, with perceptions of factors affecting hiring, allocation of rewards and recognition, and departmental policies that influence women's career progress. However, even when these variations appeared, the differences in magnitude of concerns were relatively small. On almost all measures a substantial proportion of the over 400 faculty women who responded to the surveys reported that aspects of their work experience and climate were not receptive or welcoming of women. Changes over time in these perceptions were, in most instances, minimal.

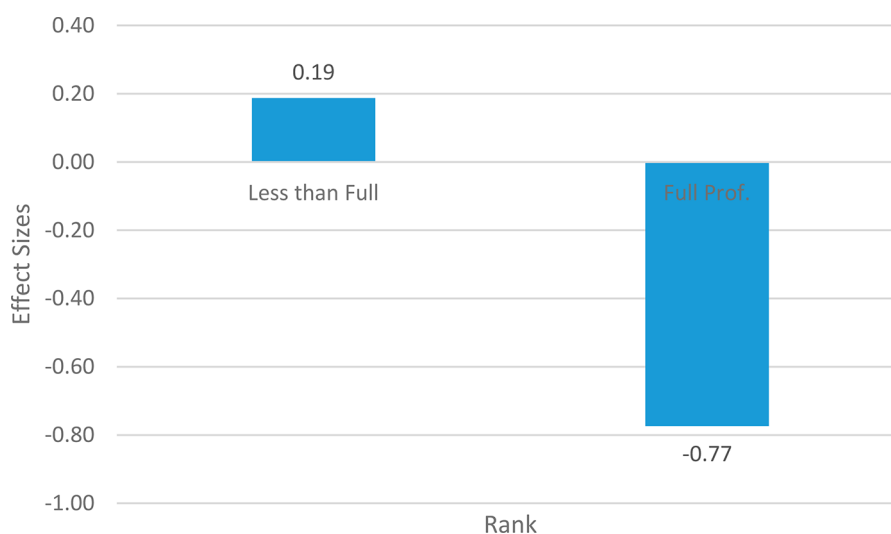
We return to these results in our final discussion section, but next examine the extent to which COACH workshops were seen as helping women cope with their work environments and whether the perceptions of COACH changed over time.

#### ■ DO SKILLS LEARNED THROUGH COACH HELP WOMEN ACADEMIC CHEMISTS?

The follow-up surveys included two series of questions designed to evaluate the impact of the workshops. One focused on how often participants used the skills that were taught, and the second asked how much the skills had helped in their interactions with others and in career-related issues. The surveys also included the opportunity for respondents to relay additional comments about their experiences and the impact of COACH. Our analysis focused on both changes over time in perceptions of the workshop and demographic and career-related variables that might be related to these perceptions.

#### Do COACH Attendees Use the Skills Taught in the Workshops?

The respondents were asked how frequently they used 13 separate skills taught in the communications workshops and 10 skills taught in the negotiations workshops. Half of the respondents reported using 11 of the communications skills



**Figure 5.** Effect sizes associated with change over time in career satisfaction by rank. Note: Scale of career satisfaction asked about satisfaction with workload, salary, and “job, overall”. Changes over time were significant for full professors.

and 6 of the negotiation skills “often” or “always”. Over one-third reported this frequency for all but one of the other skills. Even though the follow-up surveys were administered at least two years after attending the workshops, only a small minority reported not recalling specific skills (an average of 4% for communication skills and 6% for negotiation skills). There were no significant differences in the frequency of use in the two time periods and no consistent relationship of demographic or career-related variables to the use of the skills. (Effect sizes associated with the difference over time were 0.04 and 0.07 for the two scales for the trend analysis, and 0.08 and 0.00 for the panel analysis. See [Supporting Information Tables 28–31.](#))

#### Do Skills Learned at COACH Help Women Academics?

Other questions in the follow-up surveys asked how much the skills learned at COACH had helped in 19 different aspects of their careers and work setting, such as the quality of interactions with others, negotiating for themselves and others, feeling in control of their career, and addressing issues related to salary, committee and teaching load, and tenure and promotion. Half to three-fourths of the respondents reported that the skills had helped “quite a lot” or a “fair amount” in all but 3 of the 19 areas. Over 40% gave such high ratings to the remaining three areas (salary, teaching load, and research support). Respondents were slightly more likely to report that skills were helpful in recent years ( $p = 0.04$ ,  $d = 0.27$  for the trend sample and  $p = 0.22$ ,  $d = 0.19$  for the panel sample). Regression analyses indicated that the skills were seen as significantly more helpful when they were more frequently used (trend study only) but less helpful when they were in environments that they perceived as embodying more gender inequities (both trend and panel samples). (See [Supporting Information Tables 32–35.](#))

#### Open-Ended Reports of the Impact of the Workshop

The follow-up surveys asked respondents to “share any impressions you may have, either positive or negative” about their COACH experience. Over two-thirds of the respondents provided comments, and the responses in both years were exclusively positive. While some were more effusive in their praise than others, none were negative and almost all indicated that the program had been helpful. A full listing of the comments is in the final pages of the [Supporting Information](#).

#### Experience of COACH Summary

Data from the two follow-up surveys indicate that COACH participants had very positive reactions. The overwhelming majority remembered skills they had been taught, used them regularly, and believed that they had helped their work interactions and careers. Responses were very similar in 2007 and 2015–2016 apart from a slight tendency to see the skills as more helpful in the later time period.

#### SUMMARY AND DISCUSSION

Since 2006, the representation of women among recipients of Ph.D. degrees in chemistry and among faculty within academic chemistry departments has increased. Yet, the data summarized in this article indicate that the gender-related climate within academic chemistry changed very little during this period. Substantial proportions of women faculty continue to report serious obstacles to recruitment and hiring of women, greater allocations of rewards and recognition to male faculty, less than supportive work environments, a variety of conditions that hinder women’s career progress, and less than optimal satisfaction with their work situation. We used a variety of multivariate techniques to examine relationships between respondents’ demographic and career-related characteristics and their perceptions of inequities and found relatively few consistently significant relationships. The perceptions of inequity were reported by junior and senior women, those of different race–ethnicities and in all subfields of chemistry, those with and without administrative experience, and those with different numbers of women colleagues.

COACH was established to help women academic chemists navigate hostile work environments, and the results summarized above indicate that it continues to train women in important skills for meeting this goal. Given the lack of change in perceptions of gender equity it is not surprising that the skills learned in COACH workshops were used just as often in 2015–2016 as in 2007. In fact, skills learned through COACH were sometimes seen as even more helpful at the later time period. In addition, there was no relationship between the respondents’ demographic and career-related characteristics and their views of COACH.

### Limitations and Suggestions for Future Research

There are, of course, limits to this analysis. For instance, as noted by Greene and associates,<sup>4</sup> because the preworkshop data were gathered as part of the preparation for a workshop to address bias, the sample may include people who were especially attuned to the area. On the other hand, anticipation of the workshop could have promoted more forthcoming and considered responses, and as noted in the 2010 article, we have no reason to doubt the sincerity of the expressed views. However, comparisons of perceptions of faculty who did and did not plan to attend the workshops would be an important and interesting avenue for further research. In addition, the number of respondents from each workshop varied, and in some cases, demographic and career-related characteristics varied systematically from one workshop to another. To counter these variations, we aggregated the data across workshops, yielding a large number of participants. Our total sample of over 400 women represents a relatively large proportion of academic women chemists at all stages of their careers and in all subareas of the field. In addition, our use of multiple measures of perceptions of equity and views of the COACH workshops, as well as our use of a variety of analysis approaches, provided additional and extensive tests of our conclusions.

Future work should include both women and men to allow comparisons across all faculty members. It is possible that the negative climate documented in this article exists for others in the field who differ from the majority in demographic or other characteristics. Thus, it seems important to examine inequities related to areas such as race—ethnicity, country of origin, disability status, and age. It would also be important to examine the extent of any variations by the nature of the institution in which faculty were employed. While some of our analyses involved panel data and supported the results summarized in this paper, the panel sample was relatively small. More systematic sampling techniques could address those issues. They could also provide data to further explore variations in views by cohort and subfields within the discipline. Work in other academic areas has documented lower levels of prejudice among younger cohorts and in some subfields, and these could be important to examine within chemistry.

### Implications for Policy

Even though the representation of women in academic chemistry has increased in recent years, the pace of change is far less than needed to attain equity. Data summarized above indicate that barriers to women's full inclusion begin with initial recruitment into the applicant pool, continue through the hiring process, and then are apparent in the allocation of rewards and recognition as well as general support and facilitation of career progress. A recent report commissioned by the ACS on graduate students indicates that the negative gender climate also affects graduate students.<sup>6</sup> The 2013 American Chemical Society Graduate Student Survey found that women doctoral students were less likely than men to express serious interest in becoming a professor (p 11), to report receiving substantial support from their primary research advisor (p 19), to be supported with research assistantships (p 23), or to report that they would definitely finish their degrees (p 25). While the ACS report was limited to bivariate analyses, our multivariate analyses indicated that perceptions of a negative gender climate for faculty women persisted when numerous demographic and career-related variables were controlled.

The COACH workshops clearly have helped women develop skills to navigate in this chilly environment within their own departments, thus documenting how COACH is meeting its stated mission. While empowering and supporting individual faculty women is clearly necessary and important in helping these women remain and prosper within their careers, we believe that other actions are needed to directly address the chilly gender climate within academic chemistry. These must involve sustained and concerted action within departments and within the field as a whole.

Department and university administrators can do much to counter the issues that promote inequities and were documented above. They should begin with active encouragement and recruitment of potential candidates. Given the representation of women in graduate programs, most faculty now have women graduate students in their laboratories, and they should actively encourage them to pursue academic careers. Departments and administrators must also work to directly address the concerns of potential candidates, such as those expressed regarding balancing the demands of families and career. They must ensure that policies and procedures regarding allocation of resources, salaries, teaching assignments, rewards, and recognition are open and transparent and routinely monitored for equity. They must also actively work to make sure that the contributions of all faculty, not just those who are most vocal or demanding, are acknowledged and rewarded. They should periodically assess the extent to which all faculty believe that they are included and supported in ways that allow them to do their best work. Finally, it is clear that at least some chemistry faculty are openly hostile to the hiring and advancement of women in the field. These people must be openly challenged and steps taken to ensure that they do not unfairly hamper careers of women or of other faculty.

While the steps outlined in the previous paragraph can be taken within individual departments, much larger steps toward equity can be made if leaders within the field make strong commitments to fair and open processes and policies. Data on gender equity in areas such as hiring, promotion and tenure, availability of mentorship programs, and the inclusion of women in decision-making positions should be made public. Departments that enact strong policies to promote equity should be honored and held up as models to others. Those that are especially lax or hostile should be openly challenged.

We also strongly encourage the field to address the current method of peer review. Almost half of our respondents indicated that gender discrimination in the peer-review process was a moderate or very important factor in slowing women's career progress, and this view remained unchanged over the years in our analysis. In contrast to the practice in chemistry, many academic areas now use a double-blind peer-review system in which neither authors nor the reviewers know the identity of the other. They adopted this system to help ensure fairness and equitable treatment within the review process. Several extensive studies have shown that double-blind reviews can result in the acceptance of higher-quality work as well as work authored by a more diverse group of scholars.<sup>7–11</sup> A complete review of the relevant literature is beyond the scope of this paper. However, the fact that a substantial proportion of our respondents believe that the current policies regarding peer review of papers systematically harm women should make an open and full consideration of this issue a priority. At the very least, altering this policy could help promote greater trust in the fairness of

the peer-review process as well as the discipline's commitment to greater equity.

Developing a more open and accepting gender-related environment within academic chemistry will take time and effort. However, we believe that such an environment will benefit all who are involved, both faculty and students, and both men and women. It would help all chemists do better work and thus advance the field.

## ■ ASSOCIATED CONTENT

### 📄 Supporting Information

The Supporting Information is available on the ACS Publications website at DOI: [10.1021/acs.jchemed.8b00221](https://doi.org/10.1021/acs.jchemed.8b00221).

Details of the sample, measures, methodology, analysis, and results (including tables) summarized in the article, and open-ended anonymized responses from the follow-up surveys (2007 and 2016) regarding the impact of the COACH experience ([PDF](#)) ([DOCX](#))

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### Notes

The authors declare no competing financial interest.

## ■ ACKNOWLEDGMENTS

This material is based on work supported by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Grant DE-FG02-03ER46061, to do the research. Support of travel for participants to attend COACH workshops came from both the National Science Foundation and the National Institutes of Health under Grant CHE 1302986.

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