


# Changing the Chairs: Impact of Workshop Activities in Assisting Chemistry Department Chairs in Achieving Racial and Ethnic Diversity

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 Supporting Information

**ABSTRACT:** To address the low levels of underrepresented minority (URM) faculty in top-ranked chemistry departments, the National Science Foundation, the U.S. Department of Energy, and the National Institutes of Health jointly sponsored a workshop for academic chemistry leaders in September 2007. The goal of the two-and-a-half-day workshop was to create an informed and committed community of chemistry leaders who will develop and promote programs and strategies to advance racial and ethnic equity in both the faculty and student body with the goal of increasing the number of U.S. citizens who are URM scientists. This paper reports the impact of this workshop on the attitudes of the department chair faculty members who attended the workshop. On the basis of surveys of the department chair faculty perceptions before and after the workshop, the results indicate that participants in the carefully planned intervention workshop changed their attitudes regarding reasons underlying the underrepresentation and barriers that minority faculty face in the field. These department chair faculty members also increasingly viewed the solution to diversifying chemistry departments as one in which they, their departments, and universities could play a role.

**KEYWORDS:** Administrative Issues, Minorities in Chemistry, Women in Chemistry

Over the last 20 years, university faculties in the United States have become more racially and ethnically diverse. Between 1987 and 2003, the percentage of faculty from underrepresented minority backgrounds (African American, Hispanic, Native American, and Pacific Islanders) increased by 66%, from 6 to 11%.<sup>1,2</sup> In the natural sciences, including chemistry, physics, biology, astronomy, and earth science, the increase was twice the average rate (147%), from under 4% to almost 9%. Yet, the absolute level of underrepresented minority (URM) faculty members remains quite low in these areas, only two-thirds that of the levels found among faculty in the social sciences.

In 2004, 8% of chemistry faculty members in the nation as a whole were from URM backgrounds, slightly below the average for the natural sciences.<sup>2</sup> African Americans made up 5% of all chemistry faculty members, Hispanics 2%, and those reporting two or more races, 1%. In top-ranked chemistry departments, however, the representation of URM faculty was substantially lower. A 2005 census of the top 50 chemistry departments found that fewer than 4% of the faculty members were of URM backgrounds. The percentages remained unchanged in 2007.<sup>3</sup>

One of the key concerns with having such low numbers of URM faculty members in chemistry departments is that there are few racial and ethnic-matched role models for URM students. Many consider having URM role models crucial to drawing students into these academic fields and into the professoriate.<sup>6,7</sup> They argue that students are unlikely to consider a career in academia if there are not people with similar backgrounds working in the field. Over the past 20 years, a handful of empirical studies have examined the importance of role models, finding that gender-matched and race-matched role models promote better academic performance, higher subjective teacher evaluations, and more

student interest in becoming a professor.<sup>4–6,8</sup> Currently, only 15% of undergraduate majors in chemistry are URM students, while URMs make up 31% of all Americans.<sup>9–11</sup> Graduate student URM representation in chemistry is substantially lower. Only 8% of master degrees in chemistry were earned by URM students and 4% of doctorates.<sup>11</sup> Experts report that minorities who earn doctorates are more likely to take jobs in industry than academia, because of the higher initial salaries and a more welcoming environment.<sup>12</sup>

Given the importance of science and technology in addressing key energy, environmental, and security issues facing the nation, it is important that more URM students become trained in chemistry and the natural sciences. This is not only because of broad concern about equity and opening opportunities to URMs in the knowledge economy, it is because URMs are increasing as a percentage of the U.S. population, and their involvement in the sciences will be crucial to maintaining the number of scientists trained in the United States.<sup>13,14</sup> This is important in order for the United States to continue in its preeminent role in science and technology.<sup>15</sup>

There are other benefits in having racially and ethnically diverse faculties. One recent study found that minority faculty members use more active and collaborative teaching approaches, emphasize higher-order thinking in the classroom, and interact more with their students than do non-Hispanic white faculty.<sup>16</sup> The article additionally found that on campuses with a greater percentage of minority faculty members, all faculty (not just minorities) require a higher level of cognitive activities in the

**Published:** April 13, 2011

**Table 1. Pre- and Postworkshop Responses on the Importance of Issues That Slow Career Progress of URM Faculty**

Issue Statements	Respondents Reporting Issues Are "Very" or "Somewhat" Important, % <sup>a</sup>		<i>p</i> Values ( <i>N</i> = 19) <sup>b</sup>
	Preworkshop <sup>b</sup>	Postworkshop <sup>b</sup>	
Few URM colleagues	70.0	78.9	0.12
URM getting heavier teaching responsibilities relative to their majority colleagues	15.8	27.8	0.06
URM getting heavier service responsibilities relative to their majority colleagues	73.7	84.2	0.06
Departmental climate not supportive of faculty	45.0	61.1	0.09
URM having less opportunities to be mentored by top chemists or chemical engineers	<b>35.0</b>	<b>68.4</b>	<b>&lt;0.01</b>
URM are less effective at promoting and marketing themselves	63.2	63.2	0.17
Subtle biases against URM faculty that accumulate over the years	<b>70.0</b>	<b>100.0</b>	<b>&lt;0.01</b>
URMs lack of success in obtaining funding	21.1	15.8	0.29
URM difficulty in competing for the best graduate students	<b>21.1</b>	<b>57.9</b>	<b>0.02</b>
URM being excluded from important departmental and institutional decisions	15.8	26.3	0.24
Racial–ethnic discrimination in the peer-review process of their papers and grants	<b>21.1</b>	<b>36.8</b>	<b>0.02</b>
Lack of mentoring from more senior colleagues	47.4	73.7	<b>&lt;0.01</b>

<sup>a</sup> Percentages reflect the number of respondents saying that an issue was a very or somewhat important barrier (scores 1–2 on a 4-point scale). <sup>b</sup> Values set in bold type reflect areas with statistically significant change from preworkshop to postworkshop. Probability values are based on a one-tail, paired *t*-test, using scale scores. Full results of the *t*-tests are available in the online Supporting Information, Appendix A.

classroom and integrate more diversity-related topics in their teaching.

To address the low levels of URM faculty in top-ranked chemistry departments, the National Science Foundation, U.S. Department of Energy, and the National Institutes of Health jointly sponsored a workshop for academic chemistry leaders in September 2007. The two-and-a-half-day workshop entitled "Excellence Empowered by a Diverse Academic Workforce: Achieving Racial and Ethnic Equity in Chemistry" was attended by 43 faculty members serving as chairs or representatives of their departments from the top-50 ranked institutions, as well as by other leaders in academic chemistry. The goal was to create:<sup>17</sup>

[A]n informed and committed community of chemistry leaders who will create, implement and promote programs and strategies to advance racial and ethnic equity in both the faculty and student body with the goal of increasing the number of U.S. citizen underrepresented minorities participating in academic chemistry at all levels, with particular focus on the pipeline to chemistry faculty.

Workshop participants were presented with data on the trends of URM faculties of chemistry departments. High profile presenters discussed factors that challenge URM faculty careers in sessions on implicit bias, aversive racism, and isolation among chemists from minority backgrounds. Sessions also took place on effective strategies used to improve diversity in specific departments. In breakout sessions, participants discussed strategies to overcome current barriers for URM graduate students, postdoctoral scholars, and faculty; they also discussed how chemistry departments can support a diverse workforce. After the workshop, each participant was asked to commit to taking specific action to increase the number of URM on the faculty of his or her department. The design of the workshop was based upon a prior successful workshop model intended to increase gender diversity in academic science departments, which was supported by the same federal agencies.<sup>18,19</sup> Further details about the equity workshop, including the full agenda, final report, and speaker summaries, can be found on the University of Oregon Chemistry Chairs Web site.<sup>20</sup>

This paper examines the short-term impact of the equity workshop on chemistry leaders' attitudes and awareness. We conducted a survey of their attitudes toward the challenges URM faculty face and obstacles to hiring more URM faculty in their departments prior to the workshop and soon afterward. Each of these topics was covered in the workshops. We found that the workshop achieved its intended goal of creating academic leaders in chemistry who were more aware of the obstacles URM faculty face and are more committed to addressing the problems.

## METHODS

To assess changes in chemistry leaders' attitudes and awareness after attending the workshop, we conducted an Internet-based pre- and postworkshop survey. All participants were e-mailed an invitation to complete the preworkshop survey one month prior to the workshop. Two weeks after the workshop, participants were e-mailed an invitation to complete the postworkshop survey, and they received several reminders until participation was cut off in early 2008. Of the department leaders who participated in the workshop, 19 completed both pre- and postworkshop survey (a response rate of 44%). This suboptimal response rate may have introduced bias, as the impact of the workshop may have differed for the respondents and nonrespondents.

The survey questions involved the chemistry leaders' views about the representation of URMs in academic departments. One set of questions asked about issues regarding factors that affect careers for URMs, another asked about recruiting URM job applicants, and the third set examined factors that would help ensure hiring a URM faculty member in the next five years. The first two sets of questions were based on items developed for the gender equity department heads' workshops, while the third set was developed specifically for this assessment. An expert panel composed of steering committee members for the equity workshop reviewed all the questions. Specific items and the Likert response scales are included in Tables 1–4.

To examine change in attitudes from pre- to postworkshop, we conducted paired *t*-tests. We used one-sided hypothesis tests,

Table 2. Pre- and Postworkshop Responses on the Potential Factors That Make Recruiting URM Faculty Difficult

Factors	Respondents Reporting Factors Are “Serious” or “Moderate” Limitation, %		
	Preworkshop <sup>a</sup>	Postworkshop <sup>a</sup>	<i>p</i> Values ( <i>N</i> = 19) <sup>a</sup>
Small numbers of URM applicants for advertised positions	90.0	94.7	0.50
URM candidates are in such high demand, they have been hired by other institutions	65.0	57.6	0.93
URMs are not in a field that is of high demand	27.8	26.3	0.85
Disinterest of department faculty members in increasing the number of URM faculty	<b>5.3</b>	<b>15.8</b>	<b>0.02</b>
Some current faculty members are opposed to hiring URM faculty	5.3	0.0	0.96
Not enough financial support from the higher levels of administration for making a competitive offer to URM candidates	25.0	10.5	0.76
Some current faculty members view steps suggested to increase hiring of URM faculty as unfair to others	10.0	26.3	0.08
Inability to provide employment for spouse/partner	40.0	52.6	0.39
The geographic location of our university is unattractive to URM candidates	40.0	36.8	0.33
There are few other URM faculty at our university	52.6	50.0	0.61
There are few other URMs in our community	25.0	38.9	0.07
We already have a diverse department, so there is little perceived need to hire additional URM faculty	0.0	0.0	0.50

<sup>a</sup> Values set in bold type reflect areas with statistically significant change from preworkshop to postworkshop. The *t*-tests were calculated with scale scores. Probability values are based on a one-tail, paired *t*-test, using scale scores. Full results of the *t*-tests are available in the online Supporting Information, Appendix A.

which test how likely it would be to obtain our findings if there were no change from the pre- to postworkshop survey or a reduction in awareness. We used a significance level of  $p = 0.05$ . For the 31 *t*-tests, we would expect 1–2 to be significant due to chance alone. A higher number of significant *t*-tests would suggest an actual change in attitudes.

For ease of interpreting our results, we present the percentage reporting two categories of the Likert scale (“very important” and “somewhat important”) rather than the mean scale scores. Because of the small cell sizes, we did not conduct  $\chi^2$  tests. The average scale scores at pre- and posttest, *t*-test results, and effect sizes are available in the online Supporting Information, Appendix A.

Also in the online Supporting Information are supplementary factor analyses. Factor analyses were conducted to reduce the number of items examined, which was to reduce the possibility that we observed significant findings due to chance alone rather than owing to workshop impact. In these analyses, we examined the factor structure in both the pre- and postworkshop data. Where the factors were stable, we examined change from pre- to postworkshop using paired *t*-tests. Our results using this approach are consistent with our results presented here using the specific items.

## RESULTS

Table 1 presents the perception of faculty members serving as chairs regarding the importance of 12 factors in hindering the career progress of URM faculty. Prior to the workshop, the factors that were considered “very important” or “somewhat important” limitations by at least two-thirds of respondents were:

1. URM getting heavier service responsibilities relative to their majority colleagues
2. Too few URM colleagues
3. The accumulation of subtle biases against URM faculty over years Few viewed the possibility that URM faculty had

heavier teaching loads or that URM were excluded from important departmental and institutional decisions as important issues in slowing the career progress of URM faculty.

The postworkshop survey results suggest that the equity workshop impacted the sensitivity of the faculty member department chairs toward the obstacles that URM faculty members face in academic chemistry. After the workshop, these department chair faculty viewed 10 of the 12 factors as more important in slowing the career progress of URM faculty than they had beforehand. The differences from pre- to postworkshop were statistically significant for five factors (with effect sizes all over 0.50). The percentage that viewed the lack of opportunity for URMs to be mentored by top chemists as an important limiting factor increased by 33 percentage points. Similarly sized increases in awareness were observed for the percentage of respondents who viewed subtle biases against URM to be important limitations, and difficulty for URM faculty in competing for the best graduate students. The faculty member department chairs were also significantly more likely to view racial and ethnic discrimination in the peer-review process as slowing career progress of URM faculty.

Table 2 presents attitudes about what makes recruiting URM faculty members challenging. At baseline, almost all respondents (90%) reported that the small pool of URM faculty applying for positions was a “serious” or “moderate” limitation. The majority of respondents also reported that the high demand for URM applicants from other institutions and having too few URM faculty members at their own institutions were limitations. Current faculty opposition and disinterest in hiring URM faculty were only viewed as a limitation in hiring by 5% of respondents. Slightly more (10%) reported that faculty members who viewed steps to increase hiring of URM faculty as unfair presented a limitation.

Overall, the faculty member department chairs did not change their perception of the factors that make recruiting URM faculty

**Table 3. Pre- and Postworkshop Responses on the Probability of Hiring URM Faculty in the Next Five Years**

Probability of hiring URM in next five years (mean scores on scale of 1 = <10%, 6 = 100%)	Pretest Descriptives <sup>a</sup>	Posttest Descriptives <sup>a</sup>	<i>p</i> Values ( <i>N</i> = 19) <sup>a</sup>
Mean values of reported probabilities	3.6	4.5	<0.01

<sup>a</sup> Values set in bold type reflect areas with statistically significant change from preworkshop to postworkshop. The *t*-tests were calculated with scale scores. Probability values are based on a one-tail, paired *t*-test, using scale scores.

**Table 4. Pre- and Postworkshop Responses on the Factors Affecting the Likelihood of Hiring**

Importance of factors for increasing probability of successfully hiring URM faculty (factors are "very" or "somewhat" important, %)	Pretest Descriptives <sup>a</sup>	Posttest Descriptives <sup>a</sup>	<i>p</i> Values ( <i>N</i> = 19) <sup>a</sup>
Additional funding	75.0	73.7	0.28
Changing attitudes of current faculty	<b>11.1</b>	<b>47.4</b>	<b>&lt;0.01</b>
More aggressive efforts to increase diversity of applicant pool	<b>65.0</b>	<b>89.5</b>	<b>0.05</b>
Support of higher administration for diversity and minority hiring	<b>40.0</b>	<b>78.9</b>	<b>0.03</b>
Larger national pool of possible URM faculty members	90.0	89.5	0.14
Having a substantial number of our current faculty retire or resign	<b>0.0</b>	<b>31.6</b>	<b>&lt;0.01</b>

<sup>a</sup> Values set in bold type reflect areas with statistically significant change from preworkshop to postworkshop. The *t*-tests were calculated with scale scores. Probability values are based on a one-tail, paired *t*-test, using scale scores.

challenging as a result of the workshop. Only 1 of the 12 items showed significant increases from preworkshop to postworkshop. After the workshop, respondents were three times as likely to perceive that current faculty members' disinterest in increasing the number of URM faculty presented a challenge for recruiting (5% in the preworkshop survey to 16% at postworkshop; effect size of 0.49).

The faculty member department chairs did report after the workshop that they would be more likely to hire an URM faculty member in the near future (Table 3). Prior to the workshop, respondents estimated the probability was less than 50% that they would hire an URM faculty member in the next 5 years, but the average moved to greater than 50% postworkshop.

Preworkshop, the majority of respondents reported that the following factors would be "very important" or "somewhat important" in increasing the likelihood of hiring URM faculty: having a larger pool of URM applicants, having additional funding, and being more aggressive in efforts to diversify the applicant pool (Table 4).

For four of the six factors that might increase the probability of hiring an URM faculty member, there were significant increases in how the respondents viewed the importance of these factors from pre- to postworkshop (effect sizes ranging from 0.44 to 0.94). Notably, a 36-point increase occurred in the percentage reporting that changing the attitudes of current faculty would improve the likelihood of higher URM faculty. A similarly sized increase was found in the belief that higher administration's support for diversity hiring would boost the likelihood of successfully hiring URM faculty.

## DISCUSSION

National data on the racial and ethnic diversity among faculty in academic chemistry departments show that only 8% of faculty are from underrepresented minority backgrounds, and that the rate is less than half that level in the top-ranked departments. Our baseline survey from fall 2007 suggests that leaders in academic chemistry largely viewed the low representation in their departments as something outside their control. Most reported the greatest limitations in hiring URM faculty members were having small numbers of URM applications, having URM candidates

hired by other institutions, and having few URM faculty members at their institutions. Almost none of the respondents reported that opposition to hiring URM faculty members or disinterest were limitations in recruiting.

Our study results suggest that the September 2007 workshop (Achieving Racial and Ethnic Equity in Chemistry) affected the attitudes of department chair faculty members about both hiring URM faculty members, and the obstacles URM faculty face in chemistry departments. Consistent with the workshop's goals, the department chair faculty members increasingly viewed the solution to diversifying chemistry departments as one in which they, their departments, and universities could play a role. For instance, four times as many respondents viewed changing current faculty member attitudes as important for increasing the likelihood of hiring an URM faculty, compared to prior to the workshop. Respondents were also far more likely to view as important aggressive efforts to diversify the applicant pool and getting support from higher administration.

As a result of the workshop, the department chair faculty members increasingly viewed dynamics within chemistry departments as slowing the career progress of URM faculty. Awareness increased regarding the problem of lack of mentoring of URM faculty by both senior colleagues and top chemists. Significant increases also occurred in the percentage acknowledging the negative impact of not getting the best graduate students and discrimination in the peer-review process on URM faculty careers.

While the workshop appears to have been successful in changing the attitudes of department chair faculty members, it remains unknown whether and how these changes in attitudes have translated into action. Our findings are also limited by the small number of participants in the study. Our sample included 44% of the total population of participants, and it is possible that the survey participants were differentially impacted by the workshop as compared to the survey nonparticipants. However, the fact that we were able to detect statistically significant changes in such a small sample suggests that the changes were substantial in magnitude among the survey respondents.

In sum, our findings are encouraging. The workshop on diversity funded by the National Science Foundation, U.S. Department of

Energy, and the National Institutes of Health appears to have improved attitudes among academic chemistry leaders. Not only did these leaders become more aware of the obstacles that URM faculty members face, they also increasingly viewed department policies and norms as potential levers for improving recruitment of URM faculty members. Future research is needed to ascertain whether the attitudes were maintained over a longer period of time and whether changes in policies were made.

## ■ ASSOCIATED CONTENT

### Supporting Information

Additional data tables; details of data analyses; further narrative explanations. This material is available via the Internet at <http://pubs.acs.org>.

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## ■ ACKNOWLEDGMENT

The authors gratefully acknowledge the support of the National Science Foundation, the National Institutes of Health (CHE-0514176), and the Basic Energy Sciences of the U.S. Department of Energy (DE-FG02-03ER46061) for support of this project.

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