**COACH Career Development Workshops for Science and Engineering Faculty: Views of the Career Impact on Women Chemists and Chemical Engineers**

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Several recent publications have highlighted the importance of recruiting a diverse workforce to science and technological fields. The recent National Academies report entitled *Rising Above The Gathering Storm* argued that the leadership role that the United States has historically played in science and technology is eroding owing to the increased globalization of the past decade. To compete with emerging economies that have an advantage of a low-wage structure, the authors argue that the United States must optimize its knowledge-based resources. This climate requires that “we make the United States the most attractive setting in which to study and perform research so that we can develop, recruit, and retain the best and brightest students, scientists, and engineers within the United States and throughout the world” (1). An equally influential report from the National Science and Technology Council’s Committee on Science also emphasizes the critical role that a strong science, technology, engineering, and mathematics (STEM) workforce plays in sustaining and driving our economy. It emphasizes that “it is particularly important to increase the participation of women, Hispanics, African-Americans, and persons with disabilities” (2). These groups have the largest untapped potential, and jobs in the STEM workforce represent significant opportunities for career advancement. Similar views have been shared by STEM executives in the Fortune 1000 companies, noting significant company benefits in a diverse workshop, “namely increased innovation and the ability to better compete globally” (3).

Currently, there is a large disparity in the recruitment, retention, and promotion rates of women and minorities in STEM fields relative to their male and nonminority counterparts, particularly at the advanced-degree level. Academic chemistry departments in the United States exemplify this disparity (4–8). For example, whereas women today earn 33% of the doctoral degrees in chemistry, only 21% of the assistant professors in chemistry at the 50 most research-active universities are women (6). In the overall U.S. chemistry workforce, the profile of specialty by gender indicates relatively low percentages of women working in physical, polymer, organic, and inorganic chemistry, where they comprise 20% or less of the total. Women are better represented in biochemistry and chemical education, where they make up 37% of the workforce, and in analytical chemistry, where they constitute 32%. A recent detailed discussion of factors contributing to the gender disparity in STEM fields is available in the National Academies of Science Study, *Beyond Bias and Barriers* (7).

In 1999, a small group of senior women chemistry faculty from around the United States began meeting to discuss their concerns that women in their field were not moving up the career ladder at the same pace as male colleagues. With seed funding from the Camille and Henry Dreyfus Foundation, they formed an organization called COACH, the Committee on the Advancement of Women Chemists. The original goal of this group was to design and implement projects and strategies to advance the careers of women in chemistry, a goal that continues today. One of its first projects was to provide a series of professional development workshops to women faculty in the chemistry community to facilitate their career progress. It was also hoped that these workshops would provide a venue for them to network with other successful women chemists.

Since 2001, over 400 women chemistry faculty have attended COACH-developed workshops at national professional meetings. Over 30% of the women faculty that hold tenure-track positions at the top 100 chemistry departments in the country have undergone training at these workshops provided either at national meetings or at their home institutions. More than 200 additional women faculty from other chemistry departments and those in nontenure-track positions have also attended COACH workshops. As word of their value and quality has spread through the science community, women scientists and engineers in other disciplines have hired the COACH-workshop facilitators to hold COACH workshops at their home institutions and professional meetings. In total, over 2500 additional academic scientists and engineers representing the fields of physics, medicine, computer science, geology, and mathematics have attended these additional workshops.
The focus of this article is to describe the components of these workshops and participants’ views of their impact. The sections to follow include (i) a description of the workshops and their goals, (ii) participants’ immediate reactions to the COACh workshops, and (iii) participants’ reflections on their COACh experience several years after they attended a workshop. The results indicate that carefully developed and planned workshops for professional women can have impacts that are perceived as long lasting and extremely important for the participants. A final section discusses implications of these findings, especially for other areas in which women have faced barriers to their advancement.

The COACh Workshops

COACh and its workshops grew out of a collaborative process involving approximately a dozen senior women chemistry faculty over a period of several years. The formation began with an initial meeting of what would become the COACh Advisory Board, all of whom were senior women faculty in chemistry. Although aware of each other’s academic reputation prior to this meeting, few women in the group knew, on a personal level, more than two or three of the women in attendance. The group had invited two experts in leadership development to meet with them to discuss effective negotiation and leadership strategies for women professionals. The session provided a forum for these women to (i) discuss openly the difficulties that they were facing in their departments and organizations, (ii) develop and role-play effective strategies for changing organizational and individual behavior contributing to these difficulties, and (iii) understand the power that can come from networking with other highly motivated women scientists that have similar career aspirations and challenges.

This group of senior women faculty found that the half-day session had been transformative for them in ways not anticipated. When the group reconvened six months later, they shared the results of the implementation of strategies that they had learned at the initial meeting. The individual outcomes from that one-morning training session were so positive that the group decided that they needed to develop and offer these workshops to women in the broader chemistry community. In 2001, they offered the first set of professional development workshops at a national American Chemical Society (ACS) meeting in San Diego, and 29 women chemistry faculty from around the country attended.

Since then, many of the biannual COACh Advisory Board meetings have involved interviewing various leadership-development professionals and beta-testing potential COACh workshops on a variety of topics for women science faculty, graduate students, and postdoctoral associates. The Advisory Board selected facilitators based on the content of their sessions, their use of current research and documented best practices in these presentations, their understanding of practices and drivers in higher education, and their ability to work effectively with small groups of highly motivated women scientists. The facilitators tend to be experienced professional women in human resources, leadership training, teaching, and higher-education administration with extensive experience in many professional venues. COACh has continued to work closely with the workshop facilitators over the years to tailor these workshops to the needs of women scientists at all levels and disciplines.

COACh initially offered these workshops to women chemistry faculty, and later to female postdoctoral associates, in one-day sessions held prior to the biannual meetings of the ACS and the American Institute of Chemical Engineers (AIChE) meetings. More recently, workshops targeting women minority chemists have been developed and held at science conferences with high minority attendance: National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE) and the Society for the Advancement of Chicano and Native Americans in Science (SACNAS). A list of the dates, locations, and attendance at the workshops is provided in the supporting material. In total, more than 400 female faculty and over 120 female postdoctoral associates in chemistry-aligned fields have participated in at least one of these workshops.

The COACh workshops have been designed to (i) enhance communication and negotiation skills needed for effective teaching and career development, (ii) teach leadership techniques that are effective for women scientists in an academic setting, (iii) provide a forum for networking with other academic women chemists, and (iv) develop effective strategies for making institutional and departmental change that improves the climate, recruiting, and retention of underrepresented groups. Case studies, role-playing, and lively debate contribute to the learning experience for the approximately 20 participants in each session. Funding for the development, implementation, and research surrounding these workshops has come from the National Science Foundation, the National Institutes of Health, and the Basic Energy Sciences of the Department of Energy.

Several different workshops have been held at these national professional meetings. The content of three workshops that have most often been conducted are described in Table 1. The first combines the topics of negotiation and communication and is considered the entry-level workshop. Those that have attended this workshop are permitted to attend the leadership workshop at another meeting. A third workshop for postdoctoral associates and graduate students includes much of the material in the negotiations and communications workshop but is specifically oriented for those at the beginning of their professional careers. The research described in this article involves the feedback received from the negotiation and communication workshops.

Data Sources on the COACh Workshops

Our examination of participants’ views of the COACh workshops utilizes three sets of information. Before attending the workshops all participants filled out an online questionnaire that provided information on their demographic characteristics and career. We use these data to describe the 243 women who attended the communication and negotiation workshops held prior to ACS and AIChE meetings from 2001 through 2005.

The second source of data was obtained immediately after the workshops when participants provided feedback on the sessions. We reviewed responses from 11 communications workshops \((n = 163)\) and from 9 negotiation workshops \((n = 181)\). Questions on session content, format, and usefulness to future COACh mentees were asked in an open-ended format. One of the authors reviewed the written comments and coded the answers as positive, neutral, negative, or blank. There was also one close-ended question on the overall usefulness of the session.

The third data source was from a survey of former COACh workshop participants conducted in the summer of 2007 and
focusing only on those who had attended a workshop two or more years earlier. Former participants were contacted by email and invited to complete an online questionnaire to assess (i) the extent to which they used skills learned in the workshop and (ii) how much the workshops had affected their professional lives. Of the 243 past participants from 2001–2005, we had valid emails for 209. Of this group, 111 completed the online survey (response rate of 53%). This moderate response rate raises the question of bias in this sample. However, since the findings from this component are consistent with findings from the second source focusing on those who had attended workshops later surveys and had a smaller sample size (n = 76).

Former participants were also asked how much the workshop skills helped them improve specific career areas such as tenure, teaching load, and committee assignments. Finally, participants were asked several general, open-ended questions that probed how COACh had affected their professional life.

Results from the Questionnaires

Characteristics of COACh Women Participants

The COACh participants included women chemists at all stages of their careers, in all major areas of specialization, and with diverse demographic characteristics (Table 2). The participants ranged in age from their late twenties to mid-sixties and from those who were newly hired in their positions to those who had been in rank for over twenty years (Table 3). Almost one-third of the participants were untenured assistant professors, and another 14% held other untenured ranks. Among the tenured participants, slightly more (one-third of the total) were at the associate rank and the remainder (almost one-quarter) were at the rank of full professor. Three-fourths were non-Hispanic white, with relatively even representation of other racial and ethnic groups. Two-thirds reported that they were married. On average, the attendees reported having 1 child, although this value ranged from none to four.

Immediate Reaction to COACh Workshops

Immediately after the workshops, participants were asked to complete a short questionnaire intended to assess the workshops'
usefulness and provide constructive criticism to the facilitators. Respondents provided resoundingly positive feedback about both types of workshops (Table 4). Over 90% reported that the sessions were “very” or “quite” useful. Less than 1% reported that the workshops were “not at all useful” or only “somewhat useful”.

In the open-ended questions, participants were asked to comment on the content of the sessions and the format of the sessions. Again the participants provided overwhelmingly positive feedback. Approximately 80% expressed positive sentiments about the workshops’ content. There was similarly positive feedback on the workshops’ format. Respondents commonly commented on the “great” interactive approach, the “good” combination of theory and practice, and “helpful” role-playing. There were no negative comments on the content or the format.

When asked what participants liked most about the sessions, role-playing and learning about the importance of one’s posture were the key areas for the communications sessions. For the negotiation sessions, participants most commonly commented on specific negotiation skills including not taking things personally, picking battles, and doing prework in preparation. When asked what participants liked least about the sessions, the most common answers were “nothing”, a blank response, or that the sessions were too short.

Finally, respondents were asked how useful they thought the sessions would be for future COACh mentees, and here too the responses were almost unanimously positive. Almost 90% of the participants provided positive assessments such as “I will recommend COACh training to my grad students, postdocs, and colleagues” and “It will be useful for women at many stages of their careers.”

### Longer-Term Reaction

Two to six years after participating in the COACh workshops, the former workshop participants continued to have overwhelmingly positive attitudes toward the workshops. This can be seen in the follow-up survey reports of how often they use the skills that they learned, in their decisions to pursue leadership positions in their careers, and in their overall assessments of their experiences.

**Usefulness of Skills Learned in the Workshops.** The vast majority of the women chemists reported relying on many of the workshop skills they learned. To summarize their responses, we computed the mean number of skills that respondents said they “often” or “always” used in both communication and negotiation. Results indicated that the attendees often or always used the skills that they learned. To summarize their responses, we computed the mean number of skills that respondents said they “often” or “always” used in both communication and negotiation. Results indicated that the attendees often or always used half of the skills that were taught: six of the thirteen key skills taught in the communications session and five of the ten skills taught in the negotiation session. The three most commonly used skills from the communications session were “understanding the other’s position”, “preparing (research, pre-meetings, materials, allies)”, and “using allies and confidants”, while the three most commonly used skills from the negotiations session were “listening and responding”, “providing options for a solution”, and “identifying and meeting mutual interests”. The skills that were least likely to be used were holding breath steady and clarifications of purpose.

The vast majority of respondents reported that the workshop skills improved their communications and negotiations in their academic departments (Table 5). Overall, 87% reported that the skills they learned helped them in at least one area (“a fair amount” or “quite a lot”), and 68% reported it helping in at least
five areas. Most commonly, former participants said the skills helped them in feeling more control over their career, negotiating for themselves, negotiating on behalf of others, improving the quality of interactions with faculty, and reducing stress about meetings or negotiations. Over a half of respondents also said the skills were helpful in terms of career advancement and improving interactions with administrative staff, students, and research staff.

Besides feeling that the skills had helped them in general, almost all of the respondents also reported that the skills they had learned from COACh had helped in addressing specific career-oriented issues (Table 6). Over half said the skills had helped “quite a lot” or “a fair amount” with promotion, tenure, teaching load, committee assignments, improving climate, and developing supportive networks. Only 14% reported that the skills they learned had not helped them in any of the career-oriented areas.

We examined whether there were any differences in the respondents’ assessment of the workshop benefits based on their seniority. At the time of this follow-up data collection half of respondents were full professors, so we compared full professors’ responses to assistant and associate professors. With one exception, a result that could appear simply by chance, full professors and more junior faculty found the workshops to be equally valuable.

**Developing Leadership.** Changes in the respondents’ career positions provided another indication of the impact of COACh. Over a third (38%) of respondents reported that they held administrative positions after attending the COACh workshops. Most important, the overwhelming majority of those who had taken on a leadership position (86%) credited COACh with either the decision to take on the position or with helping with the effectiveness of their leadership.

The nature of this influence on assuming administrative positions was varied. For instance, several respondents said they responded to the emphasis COACh places on having women serve in academic leadership positions. One explained, “The arguments that women must take leadership roles in department or university for advancement of women in science, heavily influenced my decision.” Another explained that she had sought a leadership position after COACh because “It is easier to initiate change from an administrative position.” A number of women who credited COACh with helping them gain the confidence they needed to take on administrative responsibilities. One former participant said, “COACh helped me to see that I would be a good administrator.” Another explained, “I felt more confident [after COACh] about approaching colleagues with my intention to apply for chair and gaining the support of most of the faculty and staff.”

Many women also stressed that they became better leaders because of the skills they learned in the COACh workshops. One woman explained, “I could command more respect because of how I present myself and the fact that I am prepared for meetings. I am also a good mentor to others.” Another former participant said, “I think what I learned at the workshop helped me deal better with my colleagues in meetings, helped me work with students when they came to me with concerns about a faculty member in the department, and helped me go to our Dean to ask for help in seeking help in getting funding.”

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**Table 5. The Extent to Which COACh Skills Influenced Respondents’ Communication and Negotiation Skills 2–6 Years after the Workshop**

<table>
<thead>
<tr>
<th>To what extent have the COACh skills you learned:</th>
<th>Quite A Lot (%)</th>
<th>A Fair Amount (%)</th>
<th>A Little (%)</th>
<th>Not At All (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved the quality of your interactions with other faculty</td>
<td>19.6</td>
<td>52.3</td>
<td>23.4</td>
<td>4.7</td>
</tr>
<tr>
<td>Improved the quality of your interactions with students</td>
<td>12.4</td>
<td>42.9</td>
<td>32.4</td>
<td>12.4</td>
</tr>
<tr>
<td>Improved the quality of your interactions with administrative staff</td>
<td>24.5</td>
<td>38.8</td>
<td>29.2</td>
<td>9.4</td>
</tr>
<tr>
<td>Improved the quality of your interactions with research staff</td>
<td>15.0</td>
<td>31.2</td>
<td>31.2</td>
<td>15.0</td>
</tr>
<tr>
<td>Assisted in your career advancement</td>
<td>24.0</td>
<td>33.7</td>
<td>33.7</td>
<td>5.8</td>
</tr>
<tr>
<td>Helped you feel more in control of your career</td>
<td>30.2</td>
<td>42.5</td>
<td>18.9</td>
<td>8.5</td>
</tr>
<tr>
<td>Helped you negotiate for yourself</td>
<td>26.4</td>
<td>37.7</td>
<td>28.3</td>
<td>7.5</td>
</tr>
<tr>
<td>Helped you negotiate on behalf of others</td>
<td>21.2</td>
<td>42.4</td>
<td>28.3</td>
<td>8.1</td>
</tr>
<tr>
<td>Helped you mentor others in negotiation skills</td>
<td>21.6</td>
<td>41.2</td>
<td>27.5</td>
<td>9.8</td>
</tr>
<tr>
<td>Lessened your stress about meetings or negotiations</td>
<td>21.7</td>
<td>43.4</td>
<td>25.5</td>
<td>9.4</td>
</tr>
</tbody>
</table>

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**Table 6. The Extent to Which COACh Skills Influenced Aspects of Respondent’s Professional Situation 2–6 Years After the Workshop**

<table>
<thead>
<tr>
<th>To what extent have the COACh skills helped you in addressing issues of</th>
<th>Quite A Lot (%)</th>
<th>A Fair Amount (%)</th>
<th>A Little (%)</th>
<th>Not At All (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary</td>
<td>17.2</td>
<td>20.4</td>
<td>38.7</td>
<td>23.7</td>
</tr>
<tr>
<td>Teaching load</td>
<td>12.2</td>
<td>36.7</td>
<td>29.6</td>
<td>21.4</td>
</tr>
<tr>
<td>Research support</td>
<td>13.5</td>
<td>33.3</td>
<td>34.4</td>
<td>18.8</td>
</tr>
<tr>
<td>Committee assignments</td>
<td>18.4</td>
<td>45.9</td>
<td>30.6</td>
<td>5.1</td>
</tr>
<tr>
<td>Developing supportive networks</td>
<td>25.2</td>
<td>43.7</td>
<td>25.2</td>
<td>5.8</td>
</tr>
<tr>
<td>Improving climate</td>
<td>18.8</td>
<td>37.6</td>
<td>37.6</td>
<td>5.9</td>
</tr>
<tr>
<td>Work—family balance</td>
<td>11.7</td>
<td>36.2</td>
<td>34.0</td>
<td>18.1</td>
</tr>
<tr>
<td>Tenure*</td>
<td>21.5</td>
<td>29.2</td>
<td>15.4</td>
<td>33.8</td>
</tr>
<tr>
<td>Promotion*</td>
<td>28.0</td>
<td>24.0</td>
<td>26.7</td>
<td>21.3</td>
</tr>
</tbody>
</table>

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*a The sample size this item was 80 respondents, but for all other items the sample size was 111 respondents.

*b The sample size for this item was 70 respondents.

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*a The sample size for this item was 65 respondents.

*b The sample size for this item was 70 respondents.
Summary Impressions. The follow-up survey asked former participants to provide summary impressions of their experience with COACh. Three-quarters completed the open-ended question on COACh’s overall impact, and the responses were exclusively positive. Many described the COACh trainings as having provided important professional-development skills and some expressed gratitude for the opportunity to participate. The following quotes illustrate these positive sentiments:

COACh is a transformative program and is a brilliant model for other disciplines. It was very beneficial to me and I think has magnifying benefits for the university I’m at and at the national level.

COACh has been essential for helping me to find my voice in my department, and learn how to be an effective leader.

I often find myself in leadership roles, and I think I do a better job based on many of the skills I learned at the workshop.

As I am considering a new offer, I find my self thinking about what I learned at COACh as I prepare to negotiate my offer. Thank you COACh!

Discussion

COACh began offering workshops in communication and negotiation skills to women academic chemists in 2001 to provide them with tools for succeeding in a male-dominated field. These workshops appear to have filled an important void in professional training, drawing over 30% of women faculty members in the nations’ top 100 chemistry departments. Our analysis of the reactions of participants found that both junior and senior women faculty had uniformly and enthusiastically positive views of their experiences in the workshops. Several years after participating, the majority of women participants reported that the skills they learned helped them with promotion, tenure, working with colleagues, building supportive networks, and controlling their career and influenced them to accept positions of leadership.

Although it is not possible to identify specifically why the workshops were so successful, at least three elements appear to be important. First, the workshops were carefully planned and tested before implementation. The COACh board, composed of women chemists similar to the workshop audience, tested the workshops and chose the presenters. This helped ensure that the content of the workshops matched the needs of potential participants and that the style of presentation would be comfortable and appropriate for them. Second, the workshops have been presented numerous times. Whereas this is, in itself, testimony to their success, the numerous replications also added to the quality of the presentations and material, thus making their potential impact greater. Third, the workshops employed experiential teaching methods that have been increasingly adopted by the science community as an effective teaching model. Role-playing and group problem solving enacted in a supportive setting enhances the engagement and learning process for those in attendance.

The widespread interest in these training workshops, the high level of employment of the learned skills, and the positive impact of the use of these skills to enhance the careers of these female scientists and engineers are compelling reasons for COACh to continue offering and developing further workshops.

More recently, COACh has designed and delivered related workshops to graduate students and scientists and engineers in industry, with the initial evaluation showing a similar positive reception and impact. Increasingly these workshops are being requested and offered to groups of men and women. Given the growing need for scientists and engineers of today to work in a team-oriented environment and on group-collaborative projects, strengthening professional skills such as those learned in the COACh workshops can make a significant contribution to advancing scientific productivity that is so key to a strong U.S. economy.

Acknowledgment

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Notes

1. In addition, many workshops have been held at other academic institutions and professional meetings from other science disciplines. The data reported upon in this article focus only on women in chemistry to minimize the impact of disciplinary differences.

2. Data were not collected after two of the negotiation workshops.

Literature Cited


Supporting Information Available

A list of the dates, locations, and attendance at the workshops. This material is available via the Internet at http://pubs.acs.org.