# An Analysis of the FORWARD to Professorship Workshop – What Works to Entice and Prepare Women for Professorship?

Catherine Mavriplis
University of Oklahoma
(Norman, Oklahoma, USA) Catherine.Mavriplis@noaa.gov

Cheryl Beil[†], Kim Dam[†], Rachelle Heller[†] and Charlene Sorensen[*]
[†]George Washington University and [*]Gallaudet University
(Washington, DC, USA)

## (1) Introduction

A significant fraction (43%) of the scientists and engineers in research and development in the US are in academia[1,2]. American women scientific and engineering researchers tend to be more often in academic and non-profit settings[1,3]. Over the 1973-2003 period, doctoral women employed in US science and engineering academia increased from 9% to 30% or 754,600[1]. In engineering, the academic workforce was 15.5% female in 2003[1]. In that year, women made up 4.6% of the engineering faculty at the rank of full professor, 8.9% at the associate rank and 22.8% at the assistant rank for a total of 2,300 women engineering professors[1]. Academic professors conduct research as a significant component of their efforts. At top-tier research-intensive universities[4], the balance of intended effort between research, teaching and service can be as high as 100%-0%-0%, but is typically considered to be 40%-40%-20%. At less research-intensive institutions, such as liberal arts colleges and primarily undergraduate institutions, the balance tends to be closer to 5%-80%-15%, however many institutions of higher education in the US are pushing for more research by their faculty members. 41% of academic science and engineering doctorate holders in academia reported research as their primary activity and 69% reported research as their primary or secondary activity in 2003[1]. Indeed, 68.4% of engineering academic doctorate holders report receiving federal support in 2002[1]. In this case, women are fairing better than men: 68.4% of the women are funded vs. 63.4% of the men[1]. When broadened to all science and engineering fields, however, only 35.8% of the women are supported vs. 45% of the men[1].

Thus a large percentage of the US women in engineering research are professors. Certainly they are faced, at the end of their doctoral research studies, with the difficult choice of pursuing an academic

[1] National Science Board (NSB), *Science and Engineering Indicators 2006,* NSB 06-01, Arlington, VA: National Science Foundation, 2006.

[2] National Science Foundation, Division of Science Resources Statistics, *Federal Scientists and Engineers: 1998–2002*, NSF 05-304, Project Officer, John Tsapogas, Arlington, VA: National Science Foundation, 2005.

[3] National Academy Press, From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers. Washington, DC, 2001.

[4] The Carnegie Foundation for the Advancement of Teaching, Basic Classification Description, http://www.carnegiefoundation.org/classifications/sub.asp?key=791 2007.

career, working in private industry or government or some other career or life path. Many women doctoral students report that they have no intention of pursuing an academic career based on what they have seen at their own institutions[5]. Two issues arise: the one of small or inexistent numbers of women which may deter them from pursuing such a career and the observations they make of the few academic women they do see at their institutions. Then, for all the efforts to attract, train and fund women in science and engineering to pursue careers in research, much of that is "lost" at this important junction of doctoral degree to professorship[6]. While there were 7,073 engineering doctoral degrees awarded to women in the period 1994-2002 in the US[7], only 1,200 women with less than ten years since their doctorate were engineering professors at US institutions in 2003[1]. This represents a yield of about 17%. This may of course be due to several reasons, including the possibility that women are not being hired as tenure-track professors. Indeed, Nelson has shown that the pool of doctoral scientists and engineers is underutilized in academic hiring[8]. Furthermore, many drop out or are marginalized[9,10,11,12] in the career stage before tenure is achieved (or not achieved), typically seven years after the first tenure-track professorship appointment.

The FORWARD to Professorship workshop[13] was developed to provide women with the knowledge, contacts and advice to excel in the role of professor in science, technology, engineering or mathematics (STEM). As a US National Science Foundation (NSF)-supported project[14], FORWARD aims to increase the participation and the advancement of women in STEM academia, congruent with the goals of NSF's ADVANCE program[15]. The workshop has been held six times since 2003 and has had over 250 participants. This paper reports on the results of a survey administered in the summer of 2007 to the participants of three national 2.5 day workshops held in Washington, DC, USA in May 2003, 2004 and 2005, and two shorter 1.5 day workshops held at the Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts, USA in October 2005 and 2006. 173 participants were polled and 81 responded for a response rate of 46.8%.

The transition from graduate student to professor is indeed a daunting experience.[16,17] Graduate students may have little teaching experience and virtually no experience in raising research funds and

[5] Thomson, E.A., Study points to career/family concerns among women engineering faculty, Massachusetts Institute of Technology News Office, http://web.mit.edu/newsoffice/2000/women-0329.html 2000. http://cheminfo.chem.ou.edu/~djn/diversity/briefings/Diversity%20Report%20Final.pdf

[6] A.E. Preston, Leaving Science: Occupational Exit from Scientific Careers, New York: Russell Sage Foundation, 2004.

[7] National Science Foundation, Division of Science Resources Statistics, *Science and Engineering Doctorate Awards: 2003,* NSF 05-300, Project Officer, Joan S. Burrelli, Arlington, VA: National Science Foundation, 2004.

[8] Nelson, D.J., A National Analysis of Diversity in Science and Engineering Faculties at Research Universities, Norman, OK, 2005. http://cheminfo.chem.ou.edu/~djn/diversity/briefings/Diversity%20Report%20Final.pdf

[9] Sandler, B.R., The Campus Climate Revisited: Chilly for Women Faculty, Administrators and Graduate Students, Washington: American Association of Colleges, 1992.

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[13] Mavriplis, C., Heller, R.S., Sorensen, C.C. and Snyder, H.D., The "FORWARD to Professorship" Workshop, ASEE Paper 2005-1352, 2005.

[14] NSF ADVANCE Leadership Awards 0123582, 0123454, 0540801, 0540800, 0540016.

[15] National Science Foundation, ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers, National Science Foundation, http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5383

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writing proposals. Many are unaware of the requirements for service and are new to faculty politics. Universities have been notoriously bad at stating clear policies for tenure and promotion, but in recent years many institutions have worked to put some sort of policy in place. New faculty members often feel isolated in their departments and lack social interactions with their colleagues[18,19,20,21,22].

Women and other members of underrepresented groups in STEM disciplines face added stresses such as what Moody calls the "solo effect"[23]: being the "token, novel" person on the faculty whose behavior and performance may be judged more harshly due to their uniqueness in a more homogeneous group. Women suffer from the well-documented "chilly climate"[9], as well as gender schemas[24], and may experience acute stresses of egregious hazing and sexual harassment[25]. There is plenty of evidence[21,26,27,28] that women in academic careers earn less than their male counterparts, are promoted less frequently and publish less frequently. They also are sometimes excluded from valuable personal and professional networks in STEM fields[29]. At the same time, women and others from underrepresented groups are often "overused" on committees and taskforces needing diversity[23]. Women with families also suffer from overwork at home, in comparison with their male counterparts[11,30,31]. All together, these factors present significant barriers to women entering the academy.

The purpose of the workshop is therefore to prepare women for this step, from graduate student or postdoctoral researcher or other occupation to professorship. The workshop covers the three basic pillars of the job: research, teaching and service, while addressing work/life balance. Additional skills such as negotiation and writing are addressed to help the prospective professors secure a tenure-track

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[18] Trower, C. A. and Bleak, J.L., Study of New Scholars. *Gender: Statistical Report* [Universities], Cambridge, MA: Harvard Graduate School of Education, 2004. Press Release title: Major Universities Discourage Women Seeking Tenure, http://www.gse.harvard.edu/news/features/trower04122004.html

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[25] Fitzgerald, L., Shullman, S., Bailey, N., Richards, M., Swecker, J., Gold, Y., Ormerod, M., & Weitzman, L., The incidence and dimensions of sexual harassment in academia and the workplace. *Journal of Vocational Behavior*, Vol. 32, 152-175, 1988.

[26] National Science Foundation, Division of Science Resources Statistics, *Gender Differences in the Careers of Academic Scientists and Engineers: A Literature Review,* NSF 03-322, Project Director, Alan I. Rapoport, 2003. http://www.nsf.gov/sbe/srs/nsf03322/

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[31] Drago, R., Crouter, A.C., Wardell, M., Willits, B.S., Final Report to the Alfred P. Sloan Foundation for the Faculty and Families Project The Pennsylvania State University, 2001. http://lsir.la.psu.edu/workfam/FFFinalReport.pdf

position and thrive in their careers. Most of all, the networking between like-minded career women is extremely important.

## (2) Description of the Workshop

The FORWARD to Professorship workshop is described briefly here: more details are available in Ref. [13]. The FORWARD workshop was designed as a national workshop bringing together participants from a wide geographical area (across the US), a wide array of STEM disciplines, and a range of career levels: from doctoral student, to postdoctoral level, non-tenure track professors and research scientists, tenure-track assistant professors, tenure-track or tenured associate professors and some non-academic scientists and engineers. The organizers strive to achieve a 50%-50% balance between scientists and engineers both for participants and speakers. They also strive to include as many members of underrepresented groups such as ethnic minorities as possible. The national workshop is held at Gallaudet University, the US' only university for the Deaf and Hard-of-Hearing and includes at least a handful of Deaf or Hard-of-Hearing participants every year. Every formal and informal session of the workshop is facilitated by American Sign Language (ASL) interpreters and the non-Deaf participants are urged to learn a bit about Deaf culture and challenges for Deaf scientists and engineers. The workshop is open to men and women. Approximately 5% of the participants are male and are often spouses of women participants. A great majority of the participants are from Research Universities as defined by the Carnegie classification[4].

The workshop at MIT has a compressed format: a 1.5 day workshop runs Friday evening and all day Saturday and almost entirely skips the session on teaching (at MIT's request). Furthermore, the participants are all from the same institution (MIT) and are more predominantly doctoral students with a significant fraction at the postdoctoral level. The MIT workshop includes only women participants. MIT is also a premier research-intensive institution[3].

The workshop is designed to address the critical aspects of a modern-day tenure-track STEM faculty position. The three traditional legs of a faculty member's responsibilities, namely research, teaching and service, are discussed. Acknowledging that these are the three main areas of accomplishment upon which a faculty member's performance is evaluated, we also discuss the many challenges of interacting with other academics and setting up an academic career for oneself: sessions on writing research statements, teaching statements and cover letters, negotiation, interaction with administrators and work/life balance round out the 2.5 day experience. The work/life balance panel presents specific data from dual career couple research, examples of women who have found creative solutions to their work/family balance challenges and information on career breaks. One of the main aims of the workshop is to create a community of women in STEM fields, so much of the first day's events are aimed at creating a collegial and supportive atmosphere. The strategy is to showcase a variety of models/paths so that all can find the strength and resources to build their own paths to a successful and rewarding STEM career or other life choice.

The workshop is evaluated every year and feedback is used for improvements. In the final day evaluation forms, participants rated the overall workshop experience highly: 4.9/5 (where 1 is poor, 2 fair, 3 average, 4 good and 5 excellent). The organization, the selection of speakers and the activities in relation to meeting the participants' needs and expectations were also highly rated. Detailed comments on the evaluation forms reflect the high approval rating and sense of empowerment that many participants felt, e.g.

"Probably the most inspiring and confidence building thing I've ever done as far as science goes."

100% of the evaluation form respondents said they would recommend this workshop to their friends and colleagues. And many did! The following quote is typical of unsolicited emails received after the workshop:

"I must say that the experience has reinforced my decision to enter academia and I feel more knowledgeable about how to proceed. I'm already sharing what I've learned with my colleagues here at [XXX][32] and the information is being well received. I'll be sure to keep you posted on my PhD completion."

## (3) Survey Methodology

A web-based survey consisting of 18 questions was administered by email to participants of the five earliest offerings of the workshop: the national workshop in Washington, DC at Gallaudet University in May 2003, 2004 and 2005 and the MIT workshop in October 2005 and 2006. The survey collected standard demographic data (e.g. gender and minority status) as well as data and written comments about the participants' career development, experiences and achievements since their attendance at the workshop, elements of the workshop that influenced their careers, perceptions of their competence to perform key activities for a research and/or academic career, perceptions of their likelihood to achieve significant milestones, and experiences in and outlook for balancing personal and career goals. The survey was sanctioned by the George Washington University's Institutional Review Board[33], indicating that those being asked to respond to the survey could be assured of anonymity and of the adherence to federal research compliance regulations regarding the protection of human subjects. A request to complete the online survey was sent by email to 173 past workshop participants, using the email addresses they had given us at the time of their workshop participation. Some effort was made to find new email addresses (using Google) for the 20 participants for whom the messages were undeliverable. At least 12 participants remained uncontacted. A reminder was sent after three weeks and the survey was closed out ten days later.

## (4) Survey Results

N=81 responses were obtained for a response rate of 46.8%. The breakdown by workshop attendance is given in Fig. 1. We note that there are fewer respondents from the first workshop, as expected, since it is harder to reach these people because they may have moved on and are hard to find. Some general demographics and results are summarized first in Sec. 4.1 and then specific issues will be examined in Sec. 4.2.

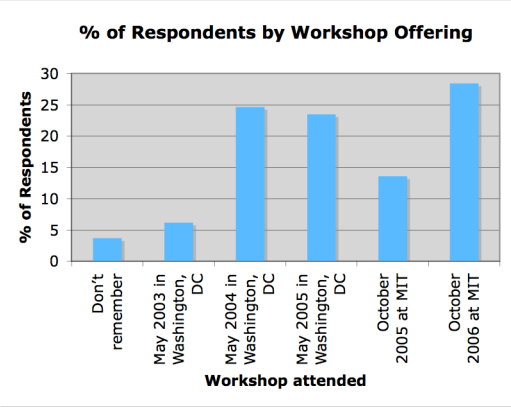


Fig. 1. Workshop attendance by year and location of the respondents

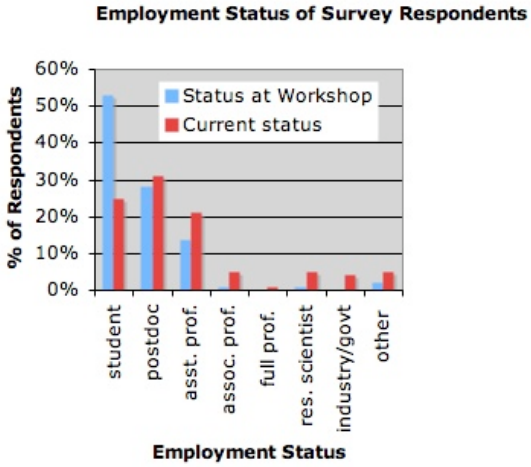


Fig. 2. Employment Status of Survey Respondents at the Time of the FORWARD workshops and a the time of the survey

[32] deleted to maintain anonymity

## (4.1 ) General Characteristics

Although we had some male participants at the workshops (approximately 5%), 100% of the respondents were female. 26% of the respondents identified themselves as being part of a minority group in the US. Only one identified herself as Deaf or Hard-of-Hearing, therefore no conclusions may be made about this group. Respondents were predominantly doctoral students (53%) at the time of the workshop: this makes sense since this group is easiest to locate if they have not moved on too many times from the last known address. For the other respondents, 28% were postdoctoral researchers at the time of the workshop, 13.5% assistant professors, 1% (n=1) associate professors, 1% (n=1) research scientists and the rest identified as "other". At the time of the survey however, only 25% remain students, 31% are postdoctoral researchers, 21% are assistant professors, 5% associate professors, 1% (n=1) full professor, 5% research scientists, 4% in industry or government and 5% indicated "other". A comparison between the employment status at the time of the workshop and at the time of the survey is given in Fig. 2.

## (4.2 ) Specific Topics

**Employment and Success Indicators**

The respondents seem very confident about their abilities to secure employment of their choice. Of those who had not already achieved[34] these types of employment typical to or possible in a research or academic career, at least half and often much more than half indicated that they were likely or more than likely (i.e. ≥4 range 4-7 on a scale of 1-7 with 1 being "not likely at all" and 7 being "very likely") to achieve these. These are given in Table 1. Note, however, that they were less confident in obtaining employment in industry or government. It is not clear if these respondents wish to do so or not.

The respondents also seem quite confident about their level of competence in performing key activities to secure a position and launch a successful career in research or academia. Overwhelmingly, a large majority indicated that they felt competent or very competent (i.e. ≥4 range 4-7 on a scale of 1-7 with 1 being "not at all competent" and 7 being "very competent") in the areas listed in Table 2.

The respondents are confident perhaps because they have already achieved a lot and have been well trained. The following table (Table 3) summarizes some of the major research milestones they have achieved and, of those who have not achieved them, how confident they are in achieving them (using the same definition as above). An astonishing 88% of those who have not attained tenure yet[34] feel confident that they will. It is exciting to also see that 77% of those considering administrative roles are confident that they will.

In terms of professional development, the respondents seem to be engaging in a variety of activities to broaden their networks and lines of research and improve their skills. For each of the following activities a substantial majority of the respondents report having done these: attending professional development sessions provided by the employer as well as outside the place of employment, attending professional meetings, reading professional articles in their field, working with peers and/or mentors in side as well as outside their department and even outside their research field (86%! which may indicate the growing interdisciplinarity of research). The written comments in this section on professional development are all positive. Again, they underscore confidence and proactive behaviour, e.g.

"I pursued two significant programs after Forward →one inside my organization ([XXX][32] Leadership training) and one outside ([XXX][32] Executive Management training). I think the Forward program helped me realize the importance of this sort of professional development → these have significantly positively contributed to my career advancement."

[33] George Washington University Institutional Review Board IRB #040734

[34] and had not indicated this activity as "not applicable".

| **Respondents** | **% confident likely or more than likely to achieve** | **# (n) of respondents for these questions** |
|---|---|---|
| Obtain a postdoctoral or research position | 83% | 6 |
| Obtain a tenure-track position at a research university | 89% | 37 |
| Obtain a tenure-track position at a liberal arts college | 62% | 21 |
| Obtain a non-tenure-track position at a univesity or college | 50% | 14 |
| Obtain a position in industry | 33% | 18 |
| Obtain a position in government | 20% | 15 |

Table 1. Respondents' Confidence in Their Ability to Obtain Employment

| **Respondents** | **% confident competent or more than competent to** | **# (n) of respondents for these questions** |
|---|---|---|
| Negotiate a salary | 85% | 59 |
| Negotiate a start-up package | 84% | 50 |
| Write a grant proposal | 90% | 62 |
| Write a teaching statement | 89% | 65 |
| Write a research statement | 94% | 71 |
| Teach | 95% | 64 |

Table 2. Respondents' Confidence in Their Competence to Perform Key Activities for a Successful Research or Academic Career

| **Respondents** | **% that have achieved (n = # of respondents to this part of the question)** | **% of those who have not achieved that feel confident they are likely or more than likely to achieve (n = # of respondents to this part of the question)** |
|---|---|---|
| Completed dissertation | 73% (n=73) | 100% (n=17) |
| Presented research findings at a conference | 99% (n=79) | 100% (n=1) |
| Prepared an article for publication | 95% (n=80) | 100% (n=4) |
| Has had article accepted for publication | 87% (n=79) | 100% (n=10) |
| Has obtained funding for research | 50% (n=68) | 94% (n=34) |
| Has obtained tenure | 7% (n=56) | 88% (n=52) |
| Has taken on administrative role | 10% (n=50) | 77% (n=44) |
| Has participated in grant review process as a reviewer or panelist | 31% (n=58) | 82% (n=39) |

Table 3. Respondents' Achievements Related to Research and Moving Toward Tenure and Confidence in Their Competence to Achieve These if Not Yet Achieved.

**Negotiation**

Of those who have secured university or college positions (n=30), 77% indicated that they did negotiate the terms of their positions. Specifically, 74% negotiated salary, 56% negotiated space, 65% negotiated start-up funds, 43% negotiated research student fellowships, 35% negotiated their teaching load, 35% negotiated time flexibility and 22% negotiated other terms of their own choosing and creativity! When asked if "there was something [from the workshop] particularly useful to [their] career[s]", negotiation was the most often cited topic. Many of the respondents reported using the advice gained at the workshop to negotiate their first tenure-track positions, not only for salary as in this example:

"I have now achieved tenure myself and am about to be promoted again within months. I think this program was a critical component of this success. The negotiation session was really key. There was a GWU law professor as I recall and this was instrumental to me negotiating the salary for my first position."

but also to accommodate work/life balance issues as in this example:

"I wish I had taken more advice on negotiating my contract but I must admit that at the time I was so focused on negotiating the start date that I ended up not negotiating on the salary and start-up. The issue was that I was pregnant at the time and wanted to start after the birth of my child. Even with that negotiation I was only able to delay 2.5 months after his birth rather than the 10 months I was hoping for. Nevertheless, I was given a light course load my first semester in its place."

**Tenure Criteria**

Those who have secured tenure-track or tenured academic professor positions were asked if they were informed about the criteria for tenure. 79% of the (n=19) respondents to this question said they were informed, 74% said the criteria were made clear to them and almost all (95%) of them had discussed the criteria with an administrator or committee. A handful of these respondents wrote in comments, many of them still expressing uneasiness with the ambiguity of the tenure process.

**Work/Life Balance**

When asked about their personal development, the respondents were also optimistic. While 52% of the respondents said they had already achieved a well-rounded lifestyle, 86% of those who had felt they were likely or more than likely to (using the same definition as above). 62% of the respondents felt they were able to deal with stress effectively, and of those who did not feel that way yet, 83% felt they were likely or more than likely to. Overall though, the respondents feel stressed: 88% of the respondents felt a moderate to high level of stress (rated ≥4 (or in the range 4-7 on a scale of 1-7 with 1 being "not at all stressed" and 7 being "very stressed")).

51% of n=77 respondents said they had already achieved a career/family balance. 74% of those who had not yet achieved that balance felt confident they were likely or more than likely to (using the same definition as above). 35% of n=46 respondents said they had taken time off for childrearing. And 57% of n=30 respondents said they were likely or more than likely (using the same definitions as above) to do so.

68% of the respondents are part of a dual career couple. 51% of these have partners in a similar career path. 67% of these have encountered employment or geographic location problems. These people were asked for written comments about how their employment or geographic problems have been resolved. The tone is understandably far less positive on this topic. Overwhelmingly the responses indicate huge struggles to stay together, unhappiness and stress. However, the respondents realize the sacrifices they may have to make or have already made and seem to accept them. Furthermore, some recount the ins and outs of their perseverance and connect it back to the examples

they heard at the workshop, e.g.

"Initially we had offers that were not even in the same city or state (closest was 5-7 hour drive away and the job for my spouse was mediocre). We had to choose a large, urban area […] where there were multiple potential options. When we first chose, my spouse did not have a job offer. When an offer did come, it was *hours* away from my place of employment. Then another offer came a bit closer and my spouse took the offer. Two years later I was offered a position (completely independently!) at the same place as my spouse. Now we have a good situation but there was a lot of STRESS involved. The story that the University of Cincinnati math professor told at Forward though gave me hope → one has to work through some difficulties before solutions arise. My closest colleague and friend had a similar 2-3 year period of 'angst' where she and her husband were in the same town, etc. but just hadn't achieved anything close to stability with two good jobs."

**Networking**

While the respondents were 38% in contact with people they met through the workshop, 91% said the workshop did not broaden their network much (rated ≤4 (or in the range 1-4 on a scale of 1-7 with 1 being "not at all" and 7 being "very much")). For the MIT respondents, where the participants were perhaps better able to continue their relationships while being on the same campus and for whom less time has elapsed, 53% were still in contact with people they met through the workshop. Furthermore, MIT has continued some interim activities throughout the year. The written comments in several of the sections of the survey seem to be in contradiction to the numerical result of the respondents feeling their network was not broadened. A consistent theme in the comments is the appreciation for and impact of the "stories" and "experiences" offered up by our speakers in many different areas of the workshop. For example:

"I remember being quite taken by real life personal stories of several speakers at the workshop. Determination and passion for work allowed these women to succeed in their professions. I have to say the workshop was more than I expected it to be – I left it being confident and inspired and for ME this was very important."

Perhaps the respondents are taking the "networking" term more literally as a long-lasting relationship. Many expressed regret at their inability to keep up contacts with fellow participants and suggest that we organize a second workshop: several of the respondents even volunteered in the survey to help organize it. Others seem to have understood the benefits of such networking and are since then practicing more networking skills to advance themselves.

**Overall**

Overall, the respondents were positive about their career progress: 90% indicated that they thought their careers were progressing moderately to very well **(**rated ≥4 (or in the range 4-7 on a scale of 1-7 with 1 being "not at all well" and 7 being "very well")). Regarding the workshop itself, the response has been overwhelmingly positive, best summed up in one of the respondents' quotes:

"The FORWARD to Professorship workshop was extremely beneficial for me. I learned skills for negotiating the job I wanted as well as had a forum to discuss specific issues facing women in academia. Hearing the experiences of women at different stages of their career was helpful. While I chose a position at a small liberal arts college for work/life reasons, I was also offered a position at a R1 research institution. I strongly feel my experience at the workshop helped me both in the application and the interview process to obtain job offers at these diverse institutions. I felt more prepared for the process than many of my fellow graduate students. I have recommended such workshops to many of my fellow graduate students."

## (5) Discussion

Since as many as four years have passed from the workshop experience to this survey, it is difficult to indicate a direct link between the workshop and the current status of the participants. That said, as noted in the research literature, this group of women are, by and large, more focused than their peers on their careers, less daunted by the concepts of negotiation and employment. Results from surveys of participants before the start of a workshop indicate that fewer felt likely or very likely to obtain a position of employment than the participants surveyed in the years after their workshop. Their personal expectations for delivering papers at conferences, publishing and obtaining grants were high before the start of the workshop and are even higher afterward. For those considering academic careers, their outlooks for achieving tenure and taking on administrative roles are very positive.

The most outstanding aspect of change, whether directly or indirectly related to the workhsop is in relation to negotiation. More than 2/3 of the most recent (2007) participants had no negotiation experience before the workshop and in these post workshop reports that same fraction indicate they have negotiatied a salary, package, space or other aspect of their academic life. More importantly, pre-workshop, over 3/4 indicated that they had little or no confidence in doing so. This fact is reflected in many of the respondents' comments e.g.

"The workshop on negotiating over your contract for your first faculty job was extremely informative, and something I would not have thought about otherwise."

The high percentage of women who have, or are considering having, children indicates another confidence among the former participants. While research studies have found that women who have children early in their academic careers are less likely to achieve tenure than men with children, and that many academic women have sacrificed the number of children they would have liked to have for their career[11], this group seems confident in their abilities to juggle the demands of an academic career with family repsonsibilities.

## (6) Conclusions

Overall the survey respondents seem to be a very confident and successful group of female scientists and engineers. They have achieved many of the traditional markers of early success for research and/or academic careers in these fields. They are also confident in their abilities to balance demanding career work with family and personal responsibilities and lifestyle. While it is possible that this is a self-selecting group: those who were trained at some of the best institutions in the world, sought out the workshop, and have actively pursued other opportunities to advance themselves, there is certainly a different tone coming through this survey than those we see in other publications describing the post-PhD experience (e.g. Ref.[35]). These women are confident and successful. While it is possible that the training and the climate are improving for doctoral students and, in particular for women, we believe that programs like the FORWARD to Professorship workshop can aid tremendously in motivating and advancing these women in STEM research and academic careers through: fellowship (collegiality and networking), information delivery (transparency), exposition of many different examples of how to navigate the career path, and empowerment.

[35] Rosser, S., *The Science Glass Ceiling: Academic Women Scientists and the Struggle to Succeed*, New York: Routledge, 2004.

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