Coaching to Augment Mentoring to Achieve Faculty Diversity: A Randomized Controlled Trial

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Abstract

Purpose—The Academy for Future Science Faculty (the Academy) is a novel coaching intervention for biomedical PhD students designed to address limitations in previous efforts to promote faculty diversity. Unlike traditional research mentoring, the Academy includes both group and individual coaching, coaches have no research or evaluation roles with the students, and it is based on social science theories. The authors present a qualitative case study of one of the coaching groups and provide statistical analyses indicating whether one year in the Academy effects students' perceptions of the achievability and desirability of an academic career.

Method—The authors have tested (July 2012-July 2013), with Northwestern University ethical approval, the Academy via a longitudinal randomized controlled trial. Participants were 121 latter-stage biomedical PhD students. The authors collected data via questionnaires, interviews, and meeting recordings.

Results—The case study shows how group career coaching can effectively supplement traditional one-to-one research mentoring; provide new role models for underrepresented minority students; and provide theory-based lenses through which to engage in open conversations about race, gender, and science careers. Repeated-measures analysis of variances showed perceived *achievability* increased in the Academy group from baseline to 1-year follow-up (means, 5.75 vs. 6.39), but decreased in the control group (6.58 vs. 5.81). Perceived *desirability* decreased significantly less ($P < 0.05$) in the Academy group (7.00 vs. 6.36), than in the control group (7.83 vs. 5.97).

Conclusions—Early results suggest that an academic career-coaching model can effectively supplement traditional research mentoring and promote persistence towards academic careers.

Among graduate students studying the biomedical sciences, interest in academic careers declines significantly during doctoral training.[1,2] This decline is due to a number of factors, including, primarily, the low availability of faculty positions and the challenges facing those who attain them.[3] Additionally, female students and students of racial and ethnic groups that are underrepresented in medicine and biomedical sciences (URM; African-American, Hispanic, Native American) often encounter stereotyping, discrimination, and isolation, which can serve as added deterrents to academic careers.[4] For developing scientists— especially those from URM groups and women—finding faculty role models with similar backgrounds is important but challenging at every stage of the academic pipeline.[5-10]

Traditional research mentoring, which takes place during PhD and postdoctoral research training, is highly variable across mentor and mentee pairs and is of inconsistent effectiveness. Research mentoring also is subject to a number of limitations (Table 1). Although recent approaches have improved the quality of traditional mentoring,[11-14] the effects are small. We argue that inherent limitations restrict the effectiveness of traditional one-on-one mentoring as the predominant construct for training researchers, especially for those from URM groups and women. We believe many of these limitations can be addressed by supplementing such mentoring with a group-based "coaching" model (Table 1). In this model (described in detail elsewhere[15]), specially-trained academic career coaches (described below) provide guidance for navigating graduate school and future academic careers.

Our coaching model builds on four theories from the social sciences, which reveal the social and cultural factors that impact all young scientists, particularly those from URM groups and women: Identity formation, Social Cognitive Career Theory (SCCT), cultural capital, and communities of practice. A full discussion of these theories is beyond the scope of this report, but we have described them in depth in our full study protocol,[15] and we have provided a brief discussion of each online (see Supplemental Digital Appendix 1 [LWW, please add link here]). *Identity formation*, as applied to biomedical science careers, focuses on the ways individuals come to view themselves as scientists based on the meanings they create about their experiences.[16-18] *SCCT* focuses on the ways individuals develop their career-related confidence (self-efficacy), interests, and goals.[17,19] *Cultural capital* focuses on how career promotion is influenced by how well an individual is perceived to fit within the "field" (social environment) of professional science, based on their "habitus"—that is, their embodied and culturally-ingrained skills, tastes, and dispositions.[20-22] Understanding communities of practice illuminates the social context in which students learn to be scientists.[23,24] Our coaching model was designed both to improve PhD students' perceptions of academic careers and to help them achieve such careers by addressing the identity, self-efficacy, and cultural capital that they must develop to navigate research communities of practice.[15]

In this report, we discuss early results from our longitudinal randomized controlled trial of the "Academy for Future Science Faculty (hereafter the Academy), a novel career-coaching

intervention for U.S. graduate students earning a PhD in the biomedical sciences.[154] In the first part of this report, we present an in-depth case study of one coach and the ten graduate students in her coaching group, to reveal how a coach, and the group of students, work together to provide support, to sustain interests, and to promote progress, particularly among URM and female students. In the second part, we provide statistical analyses to explore whether one year in the Academy influences students' perceptions of academic careers. We use the constructs of "perceived achievability" and "perceived desirability" as two important components that contribute to interest in academic careers.

Although our primary aim was to positively impact the perceived achievability of a career in academia, we also explored whether the Academy affected the desirability of an academic career. We expected that providing students with a supportive, carefully tailored environment within which they interacted with successful academic scientists and like-minded colleagues would have a positive impact on both perceived achievability and desirability; thus, our two hypotheses were (1) The Academy group will experience a positive impact on perceived achievability of an academic career, compared to the control group and (2) The Academy group will experience a positive impact on perceived desirability of an academic career, compared to the control group.

Method

As mentioned, we have provided in a previous publication[15] extensive details about the design and methods used in the Academy trial, which was reviewed and approved by Northwestern University's Institutional Review Board (Project STU00035424). The study period discussed in this paper was July 2012 to July 2013.

Participants

The Academy trial comprised two arms: one with students just starting their PhD programs, and one with students nearing the completion of their PhD programs. In this report, we present findings from the second arm of the trial only; we hoped to provide details of the intervention's effect on students about to make important decisions impacting their future careers. Future reports will explore the findings from earlier-stage students.

We solicited applications from students enrolled in biomedical PhD programs throughout the United States. We used a variety of electronic mailing lists, including that of the Graduate Research Education and Training (GREAT) group of the Association of American Medical Colleges and those from leaders of National Institute of General Medical Sciences-funded student development and training programs.

Eligibility criteria, decided a priori, for this arm were as follows:

(1)   enrollment in a PhD program in the biomedical sciences at a U.S. institution,

(2)   expressed interest in an academic career,

(3)   U.S. citizenship or legal permanent residence, and

(4)   presumed completion of the PhD program within approximately 18 months.

Overall, we received 340 applications from 113 institutions, and of these, we chose 121 eligible graduate (35.6% of the 340 applicants) students (from 74 institutions, including a mixture of public and private institutions with a range of range of rankings (based on level of National Institutes of Health [NIH] fudning), from a variety of geographic areas across the United States). Next, we allocated the selected students, using a random-stratified approach, into either the Academy intervention group (n = 60) or the control group (n = 61). The initial intent was to stratify so that both the Academy and control groups included approximately 30 men and 30 women, and 15 each of self-identified white, Asian, Hispanic, and African-American students, to allow comparisons by gender, race, and ethnicity both within the Academy group and between the Academy and control groups. However, we received insufficient applications from Asian, Hispanic, and African American students to fulfill this design. We opted to first fill the Academy group with 30 men and 30 women and 15 white, Asian, Hispanic, and African-American students to permit within-Academy comparisons of race/ethnicity and gender and to retain the diversity of the Academy community; however, in so doing, we were unable to achieve sufficient numbers of non-white students in the control group to make within-group comparisons between URM and non-URM students. In other words, for two racial and ethnic-gender groups (Hispanic males and African-American males) all those applying were allocated to the intervention group. For other groups for which more than a sufficient number of applicants were available to fill the intervention group's quotas (e.g., Asian male participants), we randomly allocated a sufficient number to the intervention, and the remainder to the control. We received a surplus of applications from white students, so we randomly allocated white male and white female participants into the Academy and control groups.

We recruited six "academic career coaches" (hereafter "coaches") from leaders of research training and diversity efforts in U.S. universities. We sought the coaches through announcements sent through program and organization electronic mailing lists (i.e. the same lists as used to recruit students)). One of us, (R.M., the principal investigator [PI]) and the team of social scientists involved in the study, trained the six coaches during an initial 2-day meeting in Chicago. More insights into the theories occurred through informal discussions between the social scientists and coaches throughout the in-person Academy meetings and occasional virtual Coaches meetings. A key element of the training was to teach the social science theories, as outlined in Supplemental Digital Appendix 1 [LWW, please add the link here]. To facilitate discussion and a greater understanding of the theories, we constructed a "theory decoder" to describe each theory and how it applies to biomedical research training and careers.[15]

Prior to the 2012 Academy meeting (see below), we divided the 60 PhD students in the Academy group into six groups of ten and allocated one of the trained coaches to each group. We stratified each coaching group such that no race/ethnicity or gender was a majority and so that PhD students from the same institution were not in the same coaching group.

Intervention

The Academy intervention was a two-day, in-person meeting that took place in Chicago, Illinois, in July 2012, and a year later in July 2013. All 60 Academy students and their coaches attended presentations and panels. The coaches presented the four social science theories to Academy students from the perspective of science and research training, drawing on and referring back to them as they became relevant during discussions (further details of the social science theories and how the coaches taught and operationalized them are provided in our study protocol[15]). Additionally, the coaches facilitated activities in their individual coaching group. For example, after Academy students completed practical activities and tools, such as an Individual Development Plan and a self-assessment tool, they subsequently discussed the results in their groups with their coaches. Control students received no intervention, and therefore received only the usual mentoring and guidance that may have been available to them via their own institution and mentor(s).

We encouraged the Academy coaching groups both to meet regularly during the meetings via Web-conferencing and to maintain group contact via e-mail and social media over the year between the two meetings. We also asked the coaches to maintain regular one-to-one communication with the graduate students in their group through e-mail and the telephone. Coaches and coaching group members addressed any issues they deemed relevant for professional and personal advancement (e.g., post-doctoral planning, completing and defending the dissertation, professional networking, interpersonal skills, and stress-reduction and coping skills). Discussions on diversity, difference, and discrimination within academic science careers—specifically identity conflicts and contingencies, assumptions and unequal treatment by lab group communities of practice, and the impacts of ongoing stereotype threat and imposter syndrome—began during the July 2012 Academy meeting among Academy coaches and students as a whole. Coaches continued discussing these topics, referencing the social science theories as relevant, in their groups.

Qualitative case study

We used a qualitative case study approach to examining the effects of the Academy because this method is particularly relevant for research questions that seek to explain and describe in detail how or why some social phenomena work.[25] One of the main novelties of the Academy lay in its use of small-groups as the focus of coaching compared to the one-to-one focus of traditional mentoring. As such, the most appropriate "unit of analysis" or "boundary" for our case study is the coaching group.[25] Looking at one coaching group of ten students allowed us to analyze the effects of the Academy in greater depth. Using criteria discussed by Yin, we chose our case based on sufficient availability of data that "will most likely illuminate your research questions."[25] As such, rather than choosing a coaching group at random, we chose the one that had met most frequently (they met online 11 times between July 2012 and 2013) and would thus provide the greatest amount of data. Notably, the findings we describe below apply specifically to the case from which they were derived; however, preliminary analyses of the other 5 coaches suggests that many of these themes will emerge as consistent elements of successful coaching groups.

At the July 2012 and 2013 meetings in Chicago, one of us (R.M., the PI) led the Academy activities while two of us (S.W. and B.T.), collected data during coaching group meetings via ethnographic observation, field notes and audio recordings. All three of us have extensive experience with qualitative methods. After the Chicago meetings, we observed and audio-recorded virtual coaching group meetings and tracked all e-mail conversations between students and coaches. We conducted in-depth telephone interviews with the Academy students before each Academy meeting, and we interviewed the coaches periodically. All audio recordings of meetings and interviews were professionally transcribed to enable qualitative analysis.

We analyzed and coded qualitative data using the qualitative analysis software NVivo Version 10 (Doncaster, Victoria, Australia). We used a coding architecture that all three of us developed initially through a grounded theory approach, which allowed us to start with larger, initial or "open" codes reflecting our larger objectives.[26] The open codes used for subsequent analysis in this report, were "relationship with coach"; "relationship with coaching group" and "how the Academy has or has not been useful or beneficial or impactful." (As described elsewhere,[15] individual interviews covered a wide array of topics related to personal, academic, and scientific experiences. Analysis of other research questions from those data will be the subject of future reports.) Subsequently, one of us (S.W.) performed further, more specific, "selective" coding. Also, iterative memos and discussions, among the three of us, following the Grounded Theory approach favored by Strauss and Corbin,[15,26,27] ensured a constant comparative approach.[27] In Results, we present these more specific selective codes, which were guided by our main aim of capturing the ways coaching group interactions disentangle challenges or address previously reported barriers[1-4] to achieving an academic career. The latter portion of the interview with each of the Academy students was dedicated to questions that sought to probe their perceptions of participating in the Academy, and it is from these questions that much of the data for this study emerged. We have provided for each theme one or two sample quotes that are representative of many other comments within each theme.

The case study coaching group comprised 1 URM male, 4 URM females, 3 non-URM males and 2 non-URM females. Students were working on PhDs from a range of disciplines (e.g. biochemistry, neuroscience, etc.), and no two students were from the same graduate institution. Nine of the students (all except one white male) were available for interviewing. The coach was a mid-career URM female academic scientist working at a medical school, with considerable experience in biomedical research and graduate student mentoring, and with a particular interest in promoting faculty diversity.

Quantitative survey

We administered on-line surveys to students in both the Academy and control groups just prior to the two phone interviews that took place before the July 2012 and 2013 Academy meetings. Key outcome measures of interest were the "perceived achievability" and "perceived desirability" of an academic career, both of which students marked on a 1-10 scale (with 1 being lowest). We considered students' race/ethnicity a dichotomous variable,

grouping students from with URM backgrounds (African-American, Hispanic, and Native American) together and students who self-identified as white or Asian (non-URM) together.

Statistical analyses

We applied one- and two-way analysis of variance (ANOVA) to explore possible differences between the Academy and control groups before the Academy started. We also conducted two separate 2-x-2 repeated-measures ANOVAs : one for perceived achievability (model 1) and one for perceived desirability (model 2) of an academic career. Both models included 1 within-group factor with 2 levels (*Time*: Baseline/Follow-up) and 2 between-subjects factors, both with 2 levels each (1. *Experimental condition*: Academy/control; 2. *Gender*: Female/male). We explored main effects and interaction effects (both for *Time* × *Experimental condition* and for *Time* × *Experimental condition* × *Gender*). We used SPSS Version 21 (IBM, Armonk, New York) for all analyses.

Due to the low numbers of students from URM groups in our control group (Table 2), URM status was not included in our repeated measures models.

Results

Participants

Of the 121 advanced-stage students in the two groups, 72 students (36 from each the Academy and control groups) returned surveys at both the start and the end of the first year, and are, therefore, included in our statistical analyses. Although the response rate was 60%, the X^2 test revealed no significant differences between responders and non-responders in terms of URM status or gender ($P > 0.05$); thus, we do not have reason to believe that our results are significantly affected by nonresponse bias. See Table 2 for the distribution of graduate students by gender, race, and ethnicity between the Academy and control groups.

Qualitative case study

What is career coaching in the Academy model?—In describing her role, the coach from the case study group discussed how her tasks—depending on the needs of each student—ranged from creating a safe and open environment for the students to providing specific career-related advice, personal and professional encouragement, and support. :

> I wanted to make them all comfortable, and to feel that our coaching group is a safe place for all of them.

> There are some of my students [who] know what they want, and the only thing I need to do is be the cheerleader, and be the one giving them the pep talk ... [then] there's some [who] are lost and have no idea what they want, and I have to be more of the listening ear.

She also discussed how the types of conversations she had as a coach supplemented the conversations students were having with their (non-Academy) mentors, and that her status as a professor from a different institution enabled these types of conversations:

> [T]he other thing that I'm finding is that the [non-Academy] mentors are really not creating the space for the students to feel comfortable to say, 'OK, what are your plans, your dreams, your goals?'... We [the Academy] are having those conversations.

> I feel very free with them because they are not directly linked to my work ... I am very free to just be a support.

Grounded theory analysis of the case-study communiques and interactions revealed six main themes that helped distinguish coaching support from traditional research mentoring (see Table 3). Overall, these themes display how the coach and the coaching group buffered challenges faced by students and provided tools and guidance to promote professional persistence.

Having difficult conversations about race, gender, and academic science careers—Analysis also revealed a seventh theme that was prominent among the students with URM backgrounds in the case-study group. In the diverse environment of the Academy, once a safe space had been established, coaching groups discussed diversity, difference, and discrimination in science (topics also covered at the live presentations at the meetings in Chicago). For several URM and female students in particular, this safe space, along with the new social science theories and concepts, helped reduce their anxieties concerning their identity as a scientist. As one African-American female student described:

> When you're an underrepresented minority, and I think it would be gender too, there's these whole theories like, Stereotype Threat [and] Imposter Syndrome that does [sic] play a part ... and [in the Academy] I was introduced to those two concepts and I thought, "Oh, I didn't know that this was called something ..." It's not just science, it's social influences ... because nobody likes to say this. You don't want to mention race because you don't want to feel like you are playing the race card... and when it comes to the whole identity type things, I always felt like I was at odds with 'who are you?' ... before the Academy I was so deathly afraid of not getting my PhD, because I feel like a lot of students along the way, some of them would be URMs have not gotten their degrees. They start with passion and diligence and you just never see what's coming... And you see all these battles and I was just so afraid... because I thought of these different identities you don't fit with what it is to be a scientist. ... And [my coach] told me it's OK to be more than one thing ... I think that really gave me peace.

As she neared the completion of her thesis, the student reflected on how the Academy had helped during her graduate school experience:

> I am defending my thesis in 2 weeks. As you all know, my time at [Graduate School] has been filled with many challenges. Approaching this milestone, I would like to say thanks for your support as I navigated a tough graduate school journey.

Quantitative analyses of perceived achievability of academic careers—Quantitative results and statistical analysis are provided in Table 4 and Table 5. At the start of the trial (July 2012), we detected no significant difference in perceived *achievability*

between men and women, or between URMs and non-URMs among all surveyed graduate students (those in both the Academy and control groups).

However, a repeated-measures ANOVA showed that perceived achievability *in*creased in the Academy group from baseline to follow-up in July 2013 (means, 5.75 vs. 6.39;), but *de*creased in the control group (6.58 vs. 5.81) ($P = 0.017$). Gender, did not make a difference; achievability increased in the Academy group and decreased in the control group similarly among men and among women.

Quantitative analyses of perceived desirability of academic careers—At the start of the trial, we detected no significant difference between men and women or between URMs and non-URMs for perceived desirability among all students, including those in both the Academy and control groups. However, males in the control group (mean = 8.60) had significantly ($P = 0.004$) higher desirability than males in the Academy group (mean = 6.69), which we consider an anomalous product of the randomization process.

A repeated-measures ANOVA showed that perceived desirability decreased among the students in both the Academy and control groups, but it decreased significantly less sharply from baseline to follow-up in the Academy group (7.00 vs. 6.36), than in the control group (7.83 vs. 5.97) ($P = 0.007$). This ANOVA also revealed a statistically significant interaction between the effects of the experimental condition and gender on perceived achievability over time ($P = 0.04$). For females, the decline in desirability in the Academy group from baseline to follow-up (7.17 vs. 6.61), was similar to the decline in desirability in the control group (7.24 vs. 6.38). For males however, the control group (8.60 vs. 5.40) experienced a greater decline in desirability compared to the Academy group (6.69 vs. 5.92). However, this difference was partly influenced by the high starting values for control males.

Discussion

The ultimate career paths of the Academy participants, and the long-term effects of the Academy, will take years to determine; we intend to track the participants' next (short-term) and future (long-term) career steps. However, these current analyses provide initial insights into how the Academy is impacting students' interests in academic careers as they complete their PhD. Our case study results support our argument that a career coaching model can effectively supplement traditional research mentoring. Additionally, for URM students, the Academy provided diverse role models, new theory-based "lenses" through which to interpret their experiences, and a safe space to discuss and validate the realities they experience related to difference, diversity, and discrimination within academia.

Baseline data show that URM and female students did not start out feeling an academic career was any less achievable or desirable than non-URM and male students did. The decline in desirability and achievability over the year for the control group aligns with other reports of declining interest over the course of the PhD.[1,2] In contrast, results show that the Academy students indicated significantly improved perceptions of the *achievability* of an academic career. Our survey results also show a significantly minimized the decline in perceived *desirability* among the students in the Academy group as compared to the control

group. The main objective of the Academy is to improve perceived *achievability* through exposure to a diverse and expert group of specially-trained coaches who provide the knowledge and skills necessary to make an academic career seem more "doable' to the students. Although the intervention had a positive effect on the Academy students' perceived *desirability* relative to controls, we were not surprised to see that the impact on perceived desirability was less than the impact on perceived achievability. Making an academic career more appealing is a broader and bigger problem than making it seem more possible. Structural factors, such as the long training period required, and the never-ending need to seek outside funding (especially while competition for available NIH funding continues to increase), [1-4] contribute to the perception of academia as an undesirable career. These structural barriers are beyond the scope of an intervention such as the Academy.

A decade ago, Pololi and colleagues demonstrated the effectiveness of a "collaborative peer mentoring program" for facilitating scholarly writing, and they argued for additional facilitated peer groups as a valuable, effective new paradigm for mentoring of junior faculty.[28,29] Group-based mentoring or career-coaching, as we have described it here and in earlier publications,[15] has not caught on in academic biomedical careers, perhaps due to the entrenched adoption of dyadic mentoring by one or more individual mentors as the prevailing model for developing the careers of biomedical researchers and faculty. Based on both sound social science theories and now, evidence from research, we believe significant progress in diversity within biomedical sciences will require a broader approach to professional development that goes beyond classical mentoring. As noted earlier, evidence indicates that the rise in structured approaches to developing research mentoring skills have had immediate and lasting positive effects on mentors.[12-14,30] The Academy extends the concept of faculty development for mentors to providing advanced training for skilled mentors to become coaches. Several advances are key to the training and deployment of Academy coaches, including a solid, explicit foundation on social science theories; a focus on group coaching; and the purposeful separation of coaches from traditional research mentoring in which mentors depend upon the research produced by their mentees.

One limitation of the study is the small number of URM students in the control group (n = 9). In particular, the current data do not allow us to compare quantitative findings between URM and nonURM men due to the absence of African-American and Hispanic males in the control group; however, we will continue to explore the effect of the Academy on URM students in future analyses by comparing them with other Academy students of a different races, ethnicities, and genders.

Currently, we are testing the Academy coaching model in only biomedical PhD students; however, a similar design could be implemented for other populations, including clinical trainees pursuing research careers. Although many institutional clinician scientist training programs (especially those supported by NIH research grant awards) do provide or allow variations of structured coaching processes, URM trainees in those programs are just as rare as they are in PhD communities and could benefit greatly from models like the Academy that bring them together in safe spaces to promote professional advancement.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

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Table 1

Key Differences Between Traditional Research Mentoring and Career Coaching Delivered Through "The Academy for Future Science Faculty"[a]

Limitations of traditional one-to-one research mentoring	Academic career coaching as a supplement
Experience, training, and skills vary widely among mentors; thus, the quality of mentoring that graduate students receive is idiosyncratic.	Experienced and highly skilled mentors are recruited and trained; they provide additional systematic and theory-based training.
Traditional mentors often have conflicts of interest (e.g., between their own research or grant-writing interests and students' career interests; deciding whom to promote or mentor within their lab).	Supplemental career coaches act as independent advisors and since they come from different institutions than their students and are bound by confidentiality agreements, they are much less likely to have any conflicts of interest.
Traditional mentors face growing demands on their time, which means they have time constraints on their mentoring. Mentors' focus mentees' navigation of graduate school and future scientific careers is variable/idiosyncratic.	Career-coaches provide students with dedicated time and space for discussions, particularly geared to successfully navigating graduate school and future scientific careers.[b]
Traditional mentors may lack an informed understanding of—and traditional mentoring may not offer a space to talk about—the impact of being different and the role that assumptions about race and gender play in science.	Career-coaches undergo special social-science-based training in diversity, and they provide students, particularly URM and female students, with a "safe space" to discuss sensitive issues related to "being different" within graduate school and academic careers.

Abbreviations: URM indicates groups traditionally underrepresented in medicine and biomedical sciences (e.g., African American, Hispanic, Native American).

[a] Unlike traditional research mentoring, career coaching is group-based, ensures students are matched with coaches from different institutions, and is based on social science theories

[b] Coaches agreed to partition a degree of their time (this amount of time varied according to individual coaches' availability and also according to the specific needs of each coaching group and individuals within it). Coaches are provided annual financial honoraria for their role as coach. Students and coaches met in dedicated spaces that were independent of their home PhD institutions. This included conference facilities in Chicago for in-person meetings and private online Webinar and discussion spaces set up by the Academy team.

Table 2

Characteristics of Participants in a Randomized Control Trial, Comparing Latter-Stage Biomedical PhD Students Enrolled in the Academy for Future Science Faculty and Similar PhD Students Not in the Academy, 2012-2013[a]

Characteristic	Total participating in the trial		Students who provided complete data and included in this analysis[b]	
	Intervention, no. (% of 60)	Control, no. (% of 61)	Intervention, no. (% of 36)	Control, no. (% of 36)
Gender				
Female	34 (57)	38 (62)	23 (64)	21 (58)
Male	26 (43)	23 (38)	13 (36)	15 (42)
Race/Ethnicity				
Asian	15 (25)	9 (15)	9 (25)	3 (8)
African-American	15 (25)	9 (15)	9 (25)	4 (11)
Hispanic	15 (25)	9 (15)	9 (25)	5 (14)
Native American	1 (2)	0	0	0
White	14 (23)	34 (56)	9 (25)	24 (67)

[a]Academy students received intensive "career coaching" in the form of professional development activities delivered in a two-day in person meeting, supplemented by regular Web-conferencing and e-mail and social media communications over a 12-month period. Control students received no intervention.

[b]Participants who "provided complete data" are those who completed the relevant questions in both the baseline and follow-up surveys.

Table 3

Qualitative Themes from Grounded Theory Analysis of Student Interviews and Group Discussions[a]

Themes derived from qualitative analysis	No. and gender/URM status of students mentioning theme	Summary	Illustrative quotation/s
Coach as independent advisor	9	Students discussed how they benefitted from having a coach who was not from their institution and, thus, gave "unbiased" advice. The students felt that they benefitted from having the coach available to provide advice and encouragement.	• "I have really enjoyed the benefit of having somebody who's not necessarily affiliated with my institution." (African American male) • "[S]he [the coach] was really accessible to me, even if I didn't always take her up on her offer. She said, 'You know, if you wanna text me or just e-mail me if you're feeling, you know down – I really want you to be successful'." (African American female)
Coaching as a supplement for mentoring	9	The students felt that their coach was able to fill in the gaps in their mentoring. Some students felt that their coach was a useful resource when their mentor was unavailable or unable to provide the career-related guidance and/or advice they needed.	"[S]ome of the things that I probably would have needed my PI for, [my coach] was there." (African-American female)
Coach as a role model for URM and female students	4 URM females and 1 non-URM female	The URM female students particularly identified with, and felt understood by, their coach. These URM students also felt they benefitted from discussions with their coach about both how she (the coach) managed her identity as a URM female in academic science and how she maintained work-life balance.	• "You as my coach are very inspiring because, you know, you're a wife, a mother, a woman of color, all these things ... that was also very reaffirming." (African-American female, as recorded talking to her coach) • "You know, I felt like my mentor didn't understand me the way that you [the Academy for Future Science Faculty Program {the Academy}] did. [The coach] is also from [Country], so we might have some things in common ... [this] probably was part of the reason but I felt like she understood me and supported me more than my mentor did." (Hispanic female)
Academy as a "safe place"	2 non-URM females, 1 URM female, 1 non-URM male and 1 non-URM male	Because of the diversity in the Academy, and because the students and coach were all from different institutions working in different fields, these 5 students felt that they were free to have the difficult conversations about race and gender in academic science that they could not have in their home institutions.	• "There's stuff that I say here that I would never say if I was ever at my lab." (African-American female) • "[I]t's very comforting to see such diverse perspectives and you know so many different backgrounds and discipline[s] and like this is a safe place ... I'm so happy to see other people of color in one place doing the same thing that I'm doing." (African-American female)
The usefulness of social science theories as lenses to understand graduate school	3 URM females and 1 non-URM female	These 4 students noted how the social science theories discussed in the Academy were new to them and gave them a new language and concepts through which to interpret their experiences, relationships, and interactions in graduate school.	"I think they [the theories] gave me the definition to explain what was going on in my life. ... The idea that the PIs like to replicate themselves ... I have been noticing it more after I learned the term." (Asian-American female)
Positive impact on perceived achievability	9	The students felt that the Academy helped to motivate them and enhanced their confidence in their ability to achieve an academic career. It helped them to acquire knowledge of what is required for success in academic science, and to reflect on their potential to achieve one.	"I just feel rededicated to my purpose I guess by being here [in the Academy]. ... I was strong, but I'm even stronger because I'm equipped with tools to get things done." (African-American male)

Abbreviations: URM indicates groups traditionally underrepresented in medicine and biomedical sciences (e.g., African American, Hispanic, Native American); PI, primary investigator.

[a]Interviewees were 9 Biomedical Science PhD students (1 URM male, 4 URM females, 3 non-URM males, and 2 non-URM females).

Table 4

Descriptive Statistics for Perceived Achievability and Desirability of an Academic Career[a]

Group	Subgroup	No. of PhD students	Mean score (SD), 2012	Mean score (SD), 2013	Change in score
Achievability					
Academy	Female	23	5.78 (2.26)	6.43 (2.27)	+0.65
	Male	13	5.69 (2.46)	6.31 (2.25)	+0.62
	URM	18	6.17 (2.23)	7.06 (2.18)	+0.89
	Non-URM	18	5.33 (2.35)	5.72 (2.14)	+0.39
	Total	36	5.75 (2.30)	6.39 (2.23)	+0.64
Control	Female	21	7.10 (2.36)	6.48 (2.82)	−0.62
	Male	15	5.87 (2.17)	4.87 (2.72)	−1.00
	URM	9	7.00 (2.65)	6.33 (3.08)	−0.67
	Non-URM	27	6.44 (2.31)	6.05 (2.28)	−0.39
	Total	36	6.58 (2.34)	5.81 (2.86)	−0.77
Desirability					
Academy	Female	23	7.17 (1.47)	6.61 (2.43)	−0.56
	Male	13	6.69 (2.13)	5.92 (2.41)	−0.77
	URM	18	7.17 (1.82)	6.67 (2.57)	−0.50
	Non-URM	18	6.83 (1.65)	6.06 (2.28)	−0.77
	Total	36	7.00 (1.72)	6.36 (2.42)	−0.64
Control	Female	21	7.24 (2.57)	6.38 (2.67)	−0.86
	Male	15	8.60 (0.83)	5.40 (2.16)	−3.20
	URM	9	6.89 (2.76)	6.33 (3.04)	−0.56
	Non-URM	27	8.15 (1.68)	5.85 (2.33)	−2.30
	Total	36	7.83 (2.04)	5.97 (2.49)	−1.86

Abbreviations: URM indicates groups traditionally underrepresented in medicine and biomedical sciences (e.g., African American, Hispanic, Native American).

[a]In the Academy, PhD students in the biomedical sciences received a "career coaching" intervention in which students took part in professional development discussions and activities geared towards successfully navigating graduate school and future scientific careers.[15] Control students received no intervention.

Table 5

Repeated-Measures Analysis of Variance (ANOVA) Results for Perceived Achievability and Desirability of an Academic Career[a]

Outcome measure	Factor(s)	F	P value
Achievability	Experimental condition	0.002	0.97
	Gender	2.104	0.15
	Time	0.114	0.74
	Experimental condition × gender	1.547	0.22
	Experimental condition × time	7.707	0.017[b]
	Gender × time	0.161	0.69
	Experimental condition × gender × time	0.110	0.74
Desirability	Experimental condition	0.470	0.50
	Gender	0.203	0.65
	Time	29.542	< 0.001[c]
	Experimental condition × gender	0.658	0.42
	Experimental condition × time	7.663	0.007[c]
	Gender × time	6.237	0.01[b]
	Experimental condition × gender × time	4.367	0.04[b]

[a]Experimental condition denotes Academy and control groups. In the Academy, PhD students in the biomedical sciences received a "career coaching" intervention in which students took part in professional development discussions and activities geared towards successfully navigating graduate school and future scientific careers.[15] Control students received no intervention.

[b]$P < 0.01$

[c]$P < 0.05$