

Preparation of Female and Minority PhD and Post-Docs for Careers in Engineering Academia (Experience)

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Abstract

Improving undergraduate STEM teaching for diverse students is dependent to some extent on increasing the representation of Black, Indigenous and People of Color (BIPOC) and women in the ranks of faculty in engineering departments. However, new faculty members, whether they had postdoctoral training or not, report that they were not adequately prepared for academia. To address this need, a professional development program was developed for underrepresented doctoral and postdoctoral students, which focused on various strategies to be successful in teaching, research and service aspects of academic positions. The program included an intensive two-week summer session, with follow-up mentoring during the academic year, and was conducted from 2017 to 2020 with three cohorts of fellows recruited from across the country.

To evaluate the impact of the program on the participants' perceptions of their preparation for academic careers, a follow up survey was sent in May 2021 to the three former cohorts of participants (n=61), and responses were received from 37 of them. The survey asked participants to reflect on areas that they felt most prepared for in their academic positions, and areas that they felt least prepared for. The survey also asked participants to discuss additional supports they would have liked to have been provided with to better prepare them given their current positions (academic, industry, etc.). Results from the survey indicated that 92% of participants found the professional development program prepared them for the responsibilities and expectations to succeed in academic positions. Over 90% agreed that the program prepared them for the application process for a tenure track search, and 89% agreed the program prepared them for the primary components of the startup package. In addition, participants reported that the program increased their preparation in developing teaching philosophy (100%), developing learning outcomes (97%), and using active learning strategies during teaching (91%). The majority agreed that the program helped prepare them to teach students with various cultural backgrounds, and to develop and use assessment strategies.

Participants were also asked to discuss the impact of the Covid 19 pandemic on their career trajectory, and most of them reported being somewhat impacted (65%) to extremely impacted (29%). Participants reported few or no job openings, cancelations of interviews, delays in research which impacted the rate of completing degrees, and publications, which affected the participants' application competitiveness. Furthermore, working from home and balancing family and academic responsibilities affected their productivity.

Based on the survey results, funds were secured to provide an additional day of professional training to cover any items not addressed during summer training, as well as any issues, challenges, or concerns they might have encountered while fulfilling their academic position. Thirty-three ACADEME fellows have indicated that they will participate in the new professional development, held in May 2022. Results from this analysis, and preliminary topics and outcomes of the supplemental activities are discussed. The findings contribute to the literature by increasing knowledge of specific challenges that new faculty encounter and can inform future efforts to support minorities and women in engineering doctoral programs.

Introduction

ASEE gathers and reports data on all engineering degrees and faculty each year [1]. As shown in Figure 1(a), the highest percentage of Hispanic tenured/tenure track (T/TT) faculty (male and female) was 5.1% in 2017 and decreased to 3.9% the following year. Similarly, the percent of African Americans in T/TT positions also “peaked” in 2017 at 3.1% and was 2.5% by 2020. The percentage of women faculty of all ethnicities have depicted a steady, albeit slight increase of approximately 0.5% each year. This data does not reflect the significant underrepresentation of women of color [2]. However, promotion rates have not increased at the same pace. For instance, in Fall 2019, 13.3%, 1.9% and 3.6% of the full professors in engineering were women, African American and, Hispanic, respectively. As shown in Figure 1(b), the percentage of women full professors in Fall 2020 had only increased by about 0.2%. Gumpertz et al. [3] found that women engineering assistant professors left academia at a higher rate than their male counterparts.

This lack of diversity in faculty ranks is concerning as a diverse faculty is needed to attract students from the U.S.’ changing student demographics [4]. In 2006, underrepresented groups comprised 28.5% of the population, but only 9.1% of the BS STEM degrees [5]. More than 10 years later, women, African American and Hispanics remain significantly underrepresented in STEM fields, especially in engineering [6]. Having T/TT faculty from underrepresented groups is critical to help students from all levels (B.S. through post-docs) to succeed in engineering [7]. Taking course(s) from faculty of the same demographic background has had a positive impact on the success of undergraduates from underrepresented groups [8]. Different perspectives from women and minorities are also critical for promoting innovation needed for the U.S. to compete globally in STEM fields [9].

Program Background

To address the lack of diversity in engineering faculty, a professional development program was developed that prepares doctoral and post-doctoral engineering students for how to be successful in academic careers. The use of workshops to increase diversity of engineering faculty is not a new endeavor. For instance, the University of California-Davis held a workshop to help faculty to understand and address issues that discourage female students in 1995 [10]. Table I contains a brief review of the attributes of some of the more recent workshop activities (please see references for full details on each workshop). As shown, most of the workshops either focused on one topic (i.e., teaching, networking, etc.), a specific discipline, or underrepresented group. Our approach was different in that it aimed to include teaching, research, and networking activities, and grew from a shorter workshop we implemented in 2015. The first workshop was 12 hours in duration (i.e., one and half days) with participants from only three institutions [11]. Although the workshop was well received, being only 12 hours limited the topics that could be covered. It also did not enable networking to be fully realized. The current approach expanded the previous activities to include recruiting participants from across the country and implementing a two-weeks summer intensive workshop and follow up mentoring activities during the academic year. The program exposed participants to various aspects of academic careers and strategies to be successful in teaching, research, and service, and was conducted with three cohorts from 2017 through 2020.

Hollomon et al. [12] analyzed the themes from national reports published from 1974-2016 on broadening participation in STEM. The analysis found that achieving a faculty body that reflects

national demographics would require the support from a wide range of stakeholders, as well as women and BIPOC PhD's pursuing (and succeeding in) an academic career. Using a multi-year, nation-wide recruitment approach enabled us to attract women and BIPOC participants that were highly interested in academic careers. We posited that having participants in different stages (i.e., PhD student close to graduation, recently graduated, or in post-doctoral position) would yield new engineering faculty over several years.

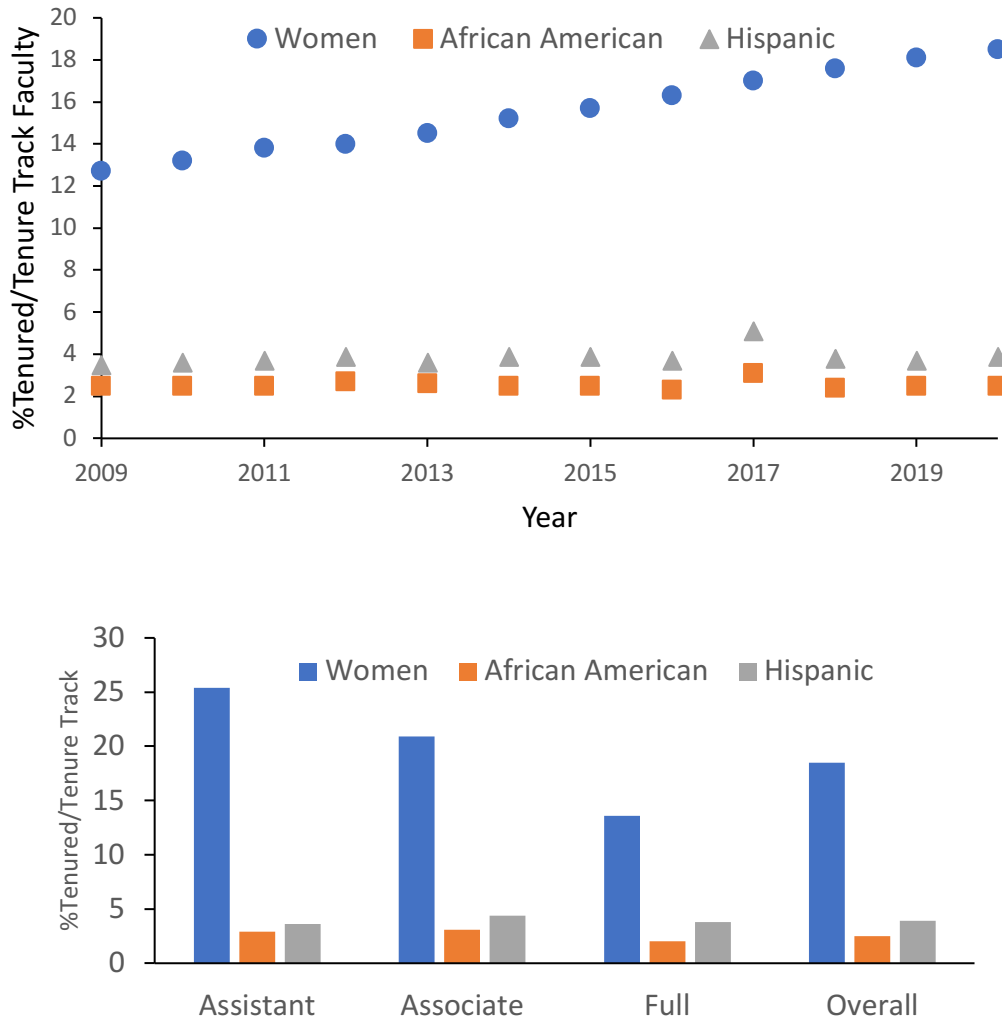


Fig. 1. Percentage tenured/tenure track engineering faculty from underrepresented groups by rank during (a) 2009-2020 and (b) by rank during 2020-2021 academic year [1]. Note: Women refer to women of all ethnicities, African American and Hispanic encompass both men and women.

Table I. Overview of Recent Workshops to Promote Diversity in Engineering Academia

Workshop	Goals/Approach	Key Aspects	Reference
ExCEED Teaching Workshop	- effective teaching, assessment, nonverbal communication	- teaching activities - all engineering faculty - not focused BIOPC	[13]
UW Advance Workshop	- quarterly, ½ day workshops for chairs, deans, campus leaders - extended to on-line toolkit	- how lead academic units, cultivate inclusive environment - indirect assistance of untenured faculty	[14]
LSUHSC-NO Workshop	- 6, 3 hr workshops over 1 yr - impart awareness, knowledge and self-perceptions to faculty and administrators teaching/mentoring biomedical engineering students	- focus on biomedical engineering - teaching and mentoring techniques	[15]
Faculty Recruitment Workshop	- 2 hr workshop for search committees - content on implicit bias, value of diversity - conduct more equitable search	- assists with hiring - does not provide tools for new hires	[16]
Engaging students in STEM classroom	- 3 day workshop - faculty from 3 institutions	- effective teaching methods	[17]
No name	- participants from 13 Hispanic serving institutions - two workshop	- teaching activities - non-tenure track only	[18]
ASME DED focused workshops	- series of yearly workshops - one topic per workshop - broaden participation in ASME design engineering division	- effective negotiation skills - networking strategies - navigating leading change - communicating technical ideas	[19]
Inclusive Excellence Workshop	- 2 day workshops, done 3 yrs - focus UCLA	-focus on culturally responsive teaching -content varied each year	[20]

We reported on prior results of evaluating the impact of the workshop on participants' knowledge and skills which showed that they increased their knowledge of expectations for new professors in academic positions, knowledge of aspects required for successful teaching, as well as aspects for research productivity [21]. Given that many of the participants over the three years were still in their doctoral studies phase, we were interested in conducting a follow up study to capture their perceptions of the impact of the professional development as they progressed in their programs and began the academic search process.

Methods

A follow up study using surveys as a data collection method was conducted in May 2021 to evaluate the long term impact of the program on preparing participants for the job search and academic careers. At the time of the survey, cohort one was within three years of completing the project activities, cohort two was within two years, and cohort three was within one year. As the pandemic presented challenges for finding academic positions, we were also interested in gathering data on how the pandemic influenced those career trajectories. The research questions that guided this study were: 1) What are former participants' perceptions about the impact of the professional development program on their preparedness for academic careers? and, 2) to what extent were academic career plans of recent doctoral engineering graduates affected by the Covid19 pandemic?

The survey was developed by the researchers in this study, using an evaluation framework to generate questions that were aligned with the goals of the program [22]. The questions included Likert scale items and open-ended questions, which covered on the following topics:

1. Areas of current or intended employment (academic, industry, government, etc.),
2. Aspects of academic work participants felt most prepared and least prepared for,
3. Engagement in academic activities after completing the program (publications, grant proposals, etc.), and
4. Impact of the pandemic on career prospects.

Participants

An online survey was sent to all former participants using contact information provided by the project's faculty. Three cohorts of participants completed the professional development program, with 13 doctoral level graduate students and no postdocs in the first year, 18 PhD and 7 postdocs participants in the second year, and 15 PhD and 8 postdocs in the third year (Table II). Cohort three participated in the summer workshop in June 2019, and completed program follow up activities in May 2020. Thirty- seven participants completed the follow-up survey, for a response rate of 61%. Of the survey respondents, 17% were from cohort 1 (3 years post completion of program), 44% from cohort 2 (2 years post completion of program), and 39% from cohort 3 (1 year post completion of program). Not all questions were answered by all participants, and thus, the number of participants reported in the results section may differ from the total number of survey participants listed here.

Analysis

Survey items were analyzed in SPSS using descriptive statistics at the item level to calculate frequencies. Multiple cycles of analysis were conducted to analyze the open-ended survey item responses. Open-ended question responses were entered into a computer software program (excel), then analyzed by assigning codes to each response inductively, using descriptive coding. The initial codes were later condensed into fewer codes based on program learning outcomes; those in turn were condensed into general themes. Direct quotations are reported verbatim (with limited editing for clarity) to provide examples of responses from participants.

Table II. Demographics of Workshop Participants

Academic Activity		Cohort 1	Cohort 2	Cohort 3
Level	PhD	13	18	15
	Post-doc	0	7	8
Gender	Female	9	19	16
	Male	4	6	7
Ethnicity	African American	2	4	5
<i>(all genders)</i>	White	3	5	5
	Asian	5	5	4
	Hispanic	1	9	4
	Middle Eastern	2	0	1
	Polynesian/Native American	0	1	1
	African American-Hispanic	0	0	3
Total Participants		13	25	23

Results and Discussion

This study's focus was to investigate the impact of a professional development program on participants' perceptions of their preparation for academic careers. Given this focus, results from analysis are organized by survey section, and focus on 1) participants' perceptions of how well prepared they are for academic careers, 2) participants' reports of engagement in academic activities post program, 3) participants' perceptions of the impact of the program on their preparation, and 4) the impact of the pandemic.

The current academic status of the survey participants (n=37) varied as outlined in figure 2, with six still enrolled in PhD programs, 11 employed in postdoc positions, and 14 employed in academic positions. Four participants indicated that they worked in industry, while two responded with "other", without specifying the industry. From the participants who were PhD students and Postdocs (n=17), 10 expressed interest in academic positions after completing their programs, two selected industry positions, and four selected both. One person chose "other" (government job). While not all participants are in academic positions, their feedback is still important to capture as the majority of them are interested in academic careers, and is thus included in the results.

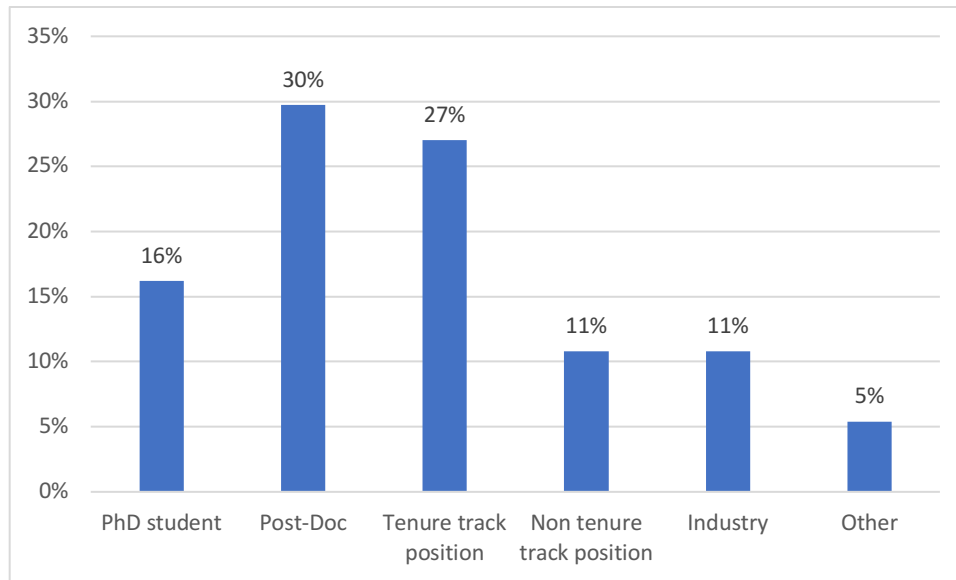


Fig. 2. Current academic and employment status of survey participants (n=37)

Academic Preparation

Participants who were employed in academic positions (n=13) were specifically asked to reflect on areas that they felt most prepared for, and areas of their jobs that they felt least prepared for using open ended questions. The responses were mixed, with some participants employed in academic positions reporting being most prepared in research and grant writing, while others reporting being not well prepared in these areas. The same pattern was observed in regard to teaching. However, several participants indicated that they were not at all prepared in the area of managing or mentoring students (recruiting, hiring, keeping students motivated), and managing budgets.

Other researchers also reported that new faculty felt they were underprepared for teaching and managing students [23]. Although having time to complete all activities expected in an academic position is a challenge faced by all faculty, the disproportionate service of BIPOC and women faculty can increase stress [24]. This was reflected in participants' responses as many listed that they felt unprepared to handle stresses of beginning an academic career which impacted their mental health. While all untenured faculty often feel stressed, the additional challenges of extra mentoring/advising, higher time pressures and experiencing more microaggressions faced by women and BIPOC tenure track faculty significantly add to stress [2], [25]. Table III presents a summary of the open ended responses with corresponding frequencies of each theme.

All participants were asked what the workshop might cover to better prepare them given their current positions. Twenty-eight participants listed suggestions for topics. The topics varied among participants, but several responses mentioned grant proposals, writing skills, recruiting and mentoring students, and preparing for interviews. Networking and mental health concerns were also areas that were listed. This is especially important as we consider how alienated women and BIPOC graduate students report feeling during their graduate preparation. For example, one participant wrote:

“The networking and communication should be more emphasized. In most of the postdoc positions that I applied, it seems that the advisors prefer to hire someone that they know somehow. The online networking is now critical since due to pandemic most of the interviews and communication are virtual and access to professors through virtual conferences is limited.”

Table III - Areas of Preparedness for Academic Positions with Frequencies of Responses (n=13)

Which aspects of your academic position do you feel you were most prepared for?	Which aspects of your academic position do you feel you were least prepared for?
<ul style="list-style-type: none"> • Grant writing (3) • Research (3) • Teaching (3) • Paper writing (1) • Other (1) 	<ul style="list-style-type: none"> • Managing or Mentoring students (4) • Teaching (3) • Grant Writing (2) • Managing budgets • Lab setup • Mental health • Remote learning • Service • Writing • Initiating collaborations

The feeling of isolation or alienation can negatively impact women and BIPOC’s initial academic career productivity [26] or work-life balance [27], [28]. Griffin et al [29] noted that BIOPC graduate students often develop their networks from advisors, faculty with whom they share identities and peers (inside and outside their programs). These systems help combat feelings of isolation [30].

Academic Engagement

Participants indicated that they engaged in various academic activities since completing the program. On average, participants submitted over four papers for publications, over three grant proposals, as well as attended and presented at professional meetings. In addition, they engaged in teaching and outreach activities, and served as reviewers for grant applications. The mean response for each activity is outlined in Table IV, including the minimum and maximum number of submissions. The activities with the highest means were the ones that involve graduate students, post-docs and faculty. It was not surprising that lowest means were associated with individuals from a specific education level. For instance, “applied for a graduate fellowship”, which is only applicable to graduate students had the lowest mean (1.75). Similarly, “serving as a grant reviewer” (2.91) and “secured a grant award” (2.86) would be associated more with participants in faculty positions.

Table IV - Academic Engagement (n=37)

Academic Activity	Mean	Min	Max	SD
Attended a professional meeting/conference	5.17	0	10	2.91
Presented at a professional meeting/conference	4.77	1	10	2.8
Submitted a paper for publication	4.62	1	10	3.35
Helped with a grant proposal submission	4	0	10	3.49
Submitted a grant proposal	3.57	0	10	3.69
Participated in educational outreach activities	3.31	0	10	2.82
Teaching courses or serving as TA	3.16	0	10	3.18
Served as a reviewer for a grant	2.91	0	10	4.36
Secured a grant award	2.86	0	10	3.29
Applied for a graduate fellowship	1.75	0	10	3.27

Program Impact

Survey responses indicated that fellows perceived the program to be highly impactful to prepare them for careers in academia, for teaching responsibilities, and to a lesser extent, for research activities. Thirty- six out of thirty-seven participants responded to Likert-scale items asking them to rate their agreement with how well participating in the program increased their preparation for specific academic activities, from strongly disagree to strongly agree.

For example, most participants agreed or strongly agreed that the program prepared them for the responsibilities and expectations to succeed in academic positions (92% and 97% respectively). Over 90% agreed that the program prepared them for the application process for a tenure track search, and 89% agreed the program prepared them for the primary components of the startup package. Table V shows the responses for each area of career preparedness.

Participants (n=36) also reported that the program increased their preparation in developing teaching philosophy (100%), developing learning outcomes (97%), using active learning strategies during teaching (91%), and using technology to support student learning (86%). The majority agreed that the program helped prepare them to teach students with various cultural backgrounds, and to develop and use assessment strategies. Increased preparation in culturally responsive teaching was encouraging as it has been identified as an area that assists with retention of BIPOC STEM students [31]. Similarly, O’Leary et al. [20] found that teaching practices that increase inclusion and cultural awareness would help provide pathways for BIOPC students to succeed in STEM degrees.

In the area of research, participants also agreed or strongly agreed that the program prepared them for finding opportunities in their research field (75%), addressing the requirement in an RFP (72%), and developing budgets for a grant proposal (69%). More participants chose the neutral option in research preparation than in career preparation, and a few participants disagreed or strongly disagreed that the program prepared them for these tasks. McConnell et al. [32] reported that feelings of career preparation were a significant factor to post-doc plans to pursue careers in academia, ranking higher than other factors such as number of publications as post-docs or hours worked per week.

Table V – Percent and Frequency of Perceptions of Impact of Program on Career Preparedness

Career Preparation (n=36)	Strongly agree		Agree		Neutral		Disagree		Strongly disagree	
	%	N	%	N	%	N	%	N	%	N
Responsibilities for a new assistant professor	47%	17	44%	16	8%	3	0%	0	0%	0
Expectations to succeed as a new assistant professor	47%	17	50%	18	3%	1	0%	0	0%	0
The application process for a tenure-track search	53%	19	39%	14	6%	2	3%	1	0%	0
Strategies for time management as a junior faculty member	25%	9	44%	16	31%	11	0%	0	0%	0
Interview process during a job search	44%	16	33%	12	19%	7	3%	1	0%	0
Primary components of a start-up package	58%	21	31%	11	8%	3	3%	1	0%	0
Effective negotiating strategies during a job search	36%	13	33%	12	28%	10	3%	1	0%	0
Developing a tenure portfolio	25%	9	47%	17	19%	7	8%	3	0%	0
Developing a research statement for a tenure track job search application	53%	19	28%	10	11%	4	8%	3	0%	0
Approaches used for networking with others in my field	28%	10	39%	14	25%	9	3%	1	6%	2
Initiating a collaboration for a research project	25%	9	39%	14	28%	10	6%	2	3%	1

The survey also asked participants to share their perceptions of the program using an open-ended question. The open-ended responses illustrated how impactful this program was on participants' academic preparation. Examples of responses from participants include:

- *“This is an amazing program. I have told several of my colleagues about it who are about to apply for academic positions. I think this program was one of the major keys to my success in securing my academic position...”*
- *“I really loved this program. I came into the professor role much more prepared than my colleagues. As a BIPOC woman I felt a hint of racism and sexism in multiple departments while I was interviewing. The workshop helped me know what I needed from an institution/department to thrive... I think that the workshop helped me get past a lot of the microaggressions and low expectations people had for me when I started.”*
- *“The information presented through the ... program was incredibly valuable. It really provided a "crash-course" and overview of almost every aspect of academic positions that no one ever really discusses with Ph.D. students.”*

Other programs have reported positive impacts of professional development on career preparation for minority engineering doctoral students and postdocs [33], and new faculty members [18], which highlights the need for these activities to support new faculty in academic positions, and increase diversity of faculty in engineering fields.

Impact of Covid 19 Pandemic

We also asked participants who were PhD students or doctoral candidates (17 out of 37) about the impact of the Covid-19 pandemic on their job search process, and the majority of them stated that they were impacted. Five participants stated that they were extremely impacted, and 11 stated they were somewhat impacted. Only one participant responded that they were not impacted. When asked how the pandemic impacted them, participants reported few or no job openings, cancelations of interviews, delays in research which impacted rate of completing degrees and publishing results, which in turn affected the participants' application competitiveness. Furthermore, working from home and balancing family responsibilities with academic ones affected their productivity. This is consistent with other research, as a study based in Canada [34] also reported that PhD students and post-docs were extremely concerned about job prospects. Numerous open searches have been put on hold indefinitely [35].

Similarly, findings from research studies conducted by the National Academies of Sciences, Engineering, and Medicine [36] indicated that COVID-19 has had both negative and positive effects on women careers in academic STEM. Consistent with the results of this current research, the COVID 19 pandemic has interrupted and exasperated existing issues relating to equity and inclusiveness in seeking employment, academic productivity, engaging effectively with students, and building relationships with colleagues. Particularly, maintaining work-life balance became more of a challenge as women are usually responsible for the major portion of the family's childcare and caring for elderly parents. The usual outside resources for these responsibilities were interrupted by the pandemic making it more difficult to set work and home boundaries [36], [37].

Furthermore, participants in the study who were currently employed (n=19) were asked about the extent the Covid-19 pandemic impacted their work. Six participants stated that they were extremely impacted, and 11 stated they were somewhat impacted. Two participants responded that they were not impacted. When asked how they were impacted, they mentioned setbacks to job searches, research productivity, and ability to network. These setbacks may impact the participants ability to secure research funding at the same rate as colleagues pre-pandemic [35]. Details of participants responses with sample quotations are listed in Table VI.

Given these results that indicated further needs of program participants, funds were secured for additional professional development activities, which will be conducted during May 2022. Thirty-three participants expressed an interest in attending and outlined various topics for discussion they would like the activities to address. These topics are outlined in Table VII, and focused mainly on networking strategies, and aspects of leading research teams related to recruiting, training, and working with students.

Table VI - Impact of Pandemic on Fellows' Academic Work

Category	Example	Sample Responses
Career	<ul style="list-style-type: none"> • Unable to secure post-doc position • Hiring freezes • Job loss 	<p><i>“Due to pandemic, I couldn’t find a postdoc position because of the large number of applicants. I am currently working in a part time job as a research staff.”</i></p>
Research	<ul style="list-style-type: none"> • Fewer opportunities for research • Research delays which affected tenure process • Remote post-doc did not provide necessary preparation 	<p><i>“I work with human subjects... This involves close contact with participants. I could not conduct any experiment during the pandemic, affecting data collection sessions, funding opportunities, collaborations, and grant proposal ideas.”</i></p>
Working with students	<ul style="list-style-type: none"> • Unable to work with students • Recruiting and retaining grad students • Training students remotely was challenging 	<p><i>“Training of students is difficult because of social distancing and limited access to facilities.”</i></p>
Networking	<ul style="list-style-type: none"> • Loss of connections and collaborations during post-doc positions; networking difficulties especially in a new job 	<p><i>“Difficulty in starting new job. Did not get to meet new people. Teaching with mask and being in mask could not actually see people’s face.”</i></p>
Teaching	<ul style="list-style-type: none"> • Teaching online affected evaluations • Challenge with online teaching 	<p><i>“Classes were switched to a virtual format immediately. The lack of preparation, the stress of the situation and the fact that for international faculty had a travel ban to visit family abroad was overwhelming. The impact on teaching course evaluation was evident. There were even fewer opportunities to improve our research and grant opportunities that were not linked to covid-19 research.”</i></p>
Other	<ul style="list-style-type: none"> • Mental health and burn out • Work life balance while working from home • Limited child care • Limited computing resources at home 	<p><i>“I felt burn out, fatigue, mental and emotional fatigue.”</i></p> <p><i>“Limited childcare options affected my working capability.”</i></p>

Table VII. List of Requested Discussion Topics for Additional Professional Development

General Area	Specific Question
Networking	Strategies for collaborating with faculty in college/department
	Strategies to build cross college teams
	Building and maintaining a network
	Building constructive peer network for those that do not have partners
Research group	How conduct research group meeting
	Recruiting trainees (undergrads, grads, technicians, post-docs)
	Strategies working with under/unprepared doctoral students in developing dissertation
	How integrate undergrads in research
	Supervisory issues (e.g., dealing with students, mentoring students in the lab)
	Facilitating research at PUI
	Competitive wages for students
Teaching	Dealing with student issues relative to the classes you teach - active learning strategies that students are not prepared to participate in
	How to balance with research
	How to deal with in-class student issues
Miscellaneous	Regulation
	How handle senior faculty trying to use junior faculty for own research
	How to evaluate good fit when you know very little about an institution
Career Planning	Differences between federal/private funding, tenure politics and how being too interdisciplinary can hurt tenure

Conclusion

The findings from this study indicate that women and BIPOC participants in targeted career preparation professional development perceived the program to be highly impactful on their career preparation, teaching, and to a lesser extent, research preparation, one to three years after completing the program. The results also indicate that seeking and preparing for grant proposals, and mentoring students are areas that new faculty in this study needed more support in. The participants in this study also highlighted the additional challenges of the Covid-19 pandemic, which delayed research productivity and limited job prospects.

These results are consistent with findings by other researchers who found that most new faculty members, whether they had postdoctoral training or not, were not adequately prepared for academia [38]. Similarly, participants in our professional development program reported during the summer workshops that they received limited preparation from their advisors on how to be successful in academic careers. One key factor was time management. Even though this topic was thoroughly covered in both the summer professional training and yearlong mentoring meetings, the participants still asked for guidance on how to balance teaching and research. Afonja et al.'s [39] survey of biological and biomedical post-docs described an academic career is “not just an occupation, but a lifestyle” due to the time commitment needed for success.

After implementing project ACADEME for three years, we learned that year-long mentoring activities were beneficial to assist participants' continued growth. This approach was effective at assisting several of the participants with negotiating their job offers. However, not all participants fully engaged in the mentoring activities, which was in part due to the time commitment of the participants. The supplemental workshop held in May 2022 will be used to provide additional guidance for participants within their first few years of an academic position. In addition, we found that networking was the least impactful aspect of the project. Informal networking was set up for each cohort during the summer workshops and all cohorts were informed that message board on the distance learning platform could be used for networking across the three cohorts. However, since the networking was not fully structured, it was not used.

Although initiatives to rectify the underrepresentation of BIPOC and women in STEM disciplines have increased diversity at the undergraduate level, it has not translated to diversity in engineering academia. Increasing preparation is important as BIPOC and female engineering faculty leave academia without tenure at higher rate than white and male counterparts, respectively [40], but it's also important to address the institutional environments that discourage these faculty from persisting [2]. The findings from this study shed some light on the specific challenges that new faculty encounter and can inform future efforts to support BIPOC and women in engineering doctoral programs, which in turn can support the success of STEM students at the undergraduate level. The findings also highlight the need for expanding professional development programs specifically focused on career preparation.

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