Preparing Women in STEM for Faculty Careers through a Job Search Workshop Series

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Abstract
Many graduate students and post-doctoral scholars find the process for applying for faculty positions is very specific, time-consuming, and stressful. While books and university resources are available to guide candidates through the search, many still struggle with the process and make avoidable mistakes along the way. Many universities offer short workshops for faculty job searches, but they generally disseminate information and may not be discipline specific. In the summer of 2021, a pilot program was created to assist women in STEM fields in creating a portfolio of documents to jump-start their faculty job search process.

Introduction
Women continue to remain under-represented in the STEM workforce, including academia. While women constitute 48% of the United States employed labor, only 34% of STEM-related jobs were performed by women in 2019. They earn approximately half of all doctorates in science and engineering in the United States, but women comprise 21% of full science professors and 5% of full engineering professors [1]. The unemployment rate was higher for women in STEM than for their male counterparts. They earn only 82% of what male scientists in the United States earn. Additionally, Black people, Hispanics, and American Indians or Alaska natives together represent only 30% of the U.S. employed population. Comparable demographics can be seen in the academic sector. These trends have been consistent for several decades [2].

The persistent lack of women in STEM and academia has been attributed historically to the "leaky pipeline"[3] and more recently the "hostile obstacle course" that traditionally underrepresented individuals often times face as their career progresses[4]. Women face gender biases in the academic recruiting process[5], [6]. Junior women faculty oftentimes settle for non-tenure track positions or a lower-status university[7]. Lack of access to technical resources and guidance for women and underrepresented minorities can also inhibit professional development [1], [8]. The problem of leaky pipelines persists the most among the women in their postdoctoral stage where they opt out of their academic careers for a variety of reasons. Two leading factors were identified: stress induced due to the absence of help through the critical and complicated academic application process[9]; and the lack of attention and guidance provided throughout their academic career [8], [10]. Hence, there is a need to address these problems to increase gender diversity in academia not only to increase women's representation but also to create a workforce that can guide the next generations.

Systematic programs can help increase the awareness of academic positions amongst early career women doctorate holders and doctoral students[5]. Many early career researchers still struggle and make avoidable mistakes even though books and university resources are available to help candidates with their job search. Some universities offer workshops for faculty job searches, but they have their limitations. For example, the Faculty Job Search Retreat at the University of Illinois Urbana-Champaign was a single day event that focused on information dissemination related to the job search, general across multiple fields versus being discipline specific, and did

not provide opportunities for candidate to receive feedback on their own application materials. In recent years, programs such as Michigan's NextProf workshop and CU Boulder's ACTIVE Faculty Development and Leadership Intensive, have emerged that bring together Ph.D. students and postdocs to network with peers as well as meet and learn from faculty at host institutions regarding the job search. Any review of faculty application materials happens briefly during these events, which does not allow scaffolding for the participants or application material revision opportunities. Other programs focus their preparation on certain types of institutions (e.g., Stanford's Preparing Future Professors and predominantly undergraduate institutions), disciplines (e.g., Rising Stars in Mechanical Engineering and the University of Chicago's Future Faculty Conference for chemists), or are restricted to their own students and postdocs (e.g., iFEAT). Prior studies have shown that the unavailability of the review process for the complicated academic application documents was discouraging women job candidates. Additionally, no platform was available to ask questions and resolve their doubts regarding their academic career. Thus, there is a need of creating opportunities where the participants can ask questions regarding their academic career as well as the application process [11].

Communities of Practice (CoPs) and peer mentoring are some approaches that may help overcome many of the aforementioned issues. They can help provide an outlet for participants to collaborate, share knowledge, and move towards a common goal [12]. CoPs are based on mutual participation and engagement as well as pooled resources [13]. Active learning and skill building is also promoted in CoPs due to emphasis on building community [14].

There is a need for informative programs and sessions where the early career faculty can share their own experiences to create motivation among their peers [15]. A prior aspiring faculty program limited to women at the University of Illinois Urbana-Champaign showed that the participants did not have enough familiarity with the academic positions and the application process. However, their awareness and familiarity increased by the end of the program [5]. Participation in these types of programs have been shown to improve participants' confidence as well as combat some of the barriers in the faculty application process [10]. Moreover, it can be challenging to create a faculty application packet and receive critical feedback. The research statement was one of the most difficult documents to prepare for the application process. Proper training and peer guidance can help improve the quality of one's research statement [11]. Tailoring professional development programs based on technical discipline and academic major can help participant identify their individual need based on the positions they are interested in [15]. Hence, to accommodate the need of a structured program that can be tailored to the participant's requirements, a pilot program was created to assist women in their faculty application process.

In this paper, we present a pilot program that was created to assist women in STEM fields in creating a portfolio of documents to jump-start their faculty job search process. Details on the program structure, formative early feedback, and follow-up feedback are provided in subsequent sections.

Methods

After a hiatus, the iFEAT program was restarted as a multi-institution online pilot program in 2021. It was open doctoral candidates or postdoctoral scholars who identify as women at any institution that were interested in obtaining a faculty position in the United States. The program structure was modified for the change in modality and a broader audience.

During the program we collected formative feedback from the participants and organizers. The formative feedback included short surveys after each session and a plus/delta (+/Δ) activity during the last session. During this activity participants were asked to list positive aspects of the program (+) and suggested changes (Δ). All feedback was anonymous. Additionally, the organizers met weekly to discuss how each session went and plan future sessions while incorporating any feedback received.

In the spring of 2023, we asked an evaluator to follow up with the participants of the pilot program to determine how their job search had progressed since completing the program and get feedback on the program after having participated in a faculty job search. This survey was administered in Qualtrics by the program evaluator. The quantitative data was analyzed using descriptive statistics and frequency distributions, while a content analysis was conducted on the qualitative data.

Results and Discussion

The pilot program was a success, and all participants were satisfied with the program. Eleven of the twelve participants completed the entire program and a draft of a complete faculty job application portfolio. This section includes the program structure, formative feedback summary, and evaluation summary.

Program Structure

Participants learned about different aspects of the job search over the course of 11 weeks (see Table 1).The program was structured with weekly large group discussions and separately scheduled smaller peer group meetings. The discussion sessions covered a range of topics including: the job application process; job posting searches and tailoring documents; cover letters; recommendations; teaching statements; interviews; research statements; job talks; and negotiations. Sessions were held weekly for 90 minutes via Zoom to discuss one of the topics.

The large group session format was tailored to the specific topic. Some sessions were in a panel format with newly hired faculty providing advice on the topic or participants from previous iterations of the program who have gone on to successfully obtain faculty positions. Other sessions were in a workshop format with the program organizers.

Twelve people (10 Ph.D. candidates, two postdocs) participated in the pilot cohort. The group spanned bioengineering/biomedical engineering (4), chemical engineering (1), computer science (2), electrical and computer engineering (2), engineering education (1), materials science (1), and mechanical engineering (1). Eight different institutions from the United States were represented: seven are very high research activity institutions, and one is a high research activity institution. A majority of participants were "most interested" in either tenure track (83%) or teaching/clinical track (50%) prior to the program's start (see Table 2).

Table 1 - Schedule of meetings, individual drafts, and peer reviews

Week	Discussion Topic	Individual Work	Peer review
1	Overview, CV	Update CV	
2	Job posting search, tailoring, planning	Find example job post	CV
3	Teaching statement	Draft teaching statement	
4	Recommendations	Make list of potential letter writers	Teaching statements
5	Research statement	Draft research statement	
6	Interviews	Draft list of questions to ask in an interview	
7	Other statements (Diversity, etc.)	Make notes for diversity statement	Research statements
8	Cover Letter	Draft cover letter	
9	Job talk/chalk talk/teaching demo	Draft job talk slides	Cover Letter
10	Negotiations	Review mock applications	Job talk slides
11	Mock search panel	Post-program survey	

Table 2 - Reported interest levels by position prior to start of program.

Position	Not interested	Somewhat interested	Most Interested
Postdoc	25%	42%	33%
Research Professor	-	83%	8%
Teaching/Clinical Track	25%	25%	50%
Tenure Track	-	17%	83%

Note 1: Percentage of participants interested in various post-graduate academic positions. Participants may have selected more than one option.

The cohort was divided into three peer review groups to provide feedback on each document. The groups were created based on self-selection of the type of position they planned to apply for: a tenure-track research focused position; teaching focused position; or a postdoctoral position. Since these types of positions have varying expectations for each document (e.g., length, content, audience), it seemed prudent to split the cohort such that each peer group was working toward similar expectations. Each peer group had a mentor from the organizing team to help coordinate reviews and answer more specific questions that came up during the drafting and reviewing phases. The mentor and peers all provided accountability to each other to complete and review drafts statements.

By the end of the program, each participant had a complete draft of documents that could be used as a starting point for a future faculty job search. The weekly format allowed for time in between sessions to draft and review statements, which is a feature that is not usually an option for workshops that last only one or two days.

Formative (Early) Feedback
Based on the informal feedback the part of the positive part program mentioned the most was the peer groups. One participant stated, "Good peer feedback from group members in a comfortable environment in our sub-group." Multiple participants also mentioned that they appreciated the

variety and openness of the panelists, specifically stating, "Having diverse perspectives from panel members. Enjoyed having multiple people come in. Appreciated having new people each week." The organization and resources provided, including complete sample statements, was also valued. One participant mentioned that the summer timing was ideal.

The participants also offered suggestions for improvements. There were multiple requests for more details and practice for during the interview, such as research talk or chalk talk slides and interview practice. Another suggestion was to include preparatory work about the topic before each panel. Additionally, participants asked for the opportunity to draft and review diversity statements. This was not included in the pilot because they were not as common during earlier iterations of the program. The participants also asked to continue meeting with their peer group into the fall to help prepare for specific applications. Some groups continued to self-organize meetings into the fall semester. Based on this feedback we plan to add a reference book and assign readings before panel sessions. We also plan to move the content into a learning management system to keep materials and drafts more organized. As the summer schedule is already full, there may also be an opportunity to add less frequent check-in meetings in the fall that could cover interview-related topics.

Follow up Feedback
The SPARK Follow-Up Survey includes both quantitative and qualitative items that were designed to capture the participants' perspectives on the program and experiences since participating in it. The survey was sent to participants during Spring 23, approximately a year and a half after their participation in the program.

Participants' Perceptions of their Job-Related Abilities Because of their Participation in the SPARK Program
On the follow-up survey, participants were asked to report the extent to which they agreed or disagreed with various statements about their job-related abilities because of their participation in the SPARK program using a five-point Likert scale (Strongly Disagree = 1, Disagree = 2, Neither Disagree Nor Agree = 3, Agree = 4, and Strongly Agree = 5). In addition, a "Not Applicable" option was provided. Because of their participation in the SPARK program, all participants strongly agreed that they know how to write a cover letter, write a teaching statement, and complete an academic faculty job application. They also have an up-to-date Curriculum Vitae (CV) and feel confident in making the best career decision for themselves. Table 3 provides further details on participants' perceptions of their job-related abilities because of their participation in the SPARK program.

Table 3 - Participants' Perceptions of their Job-Related Abilities Because of their Participation in the SPARK Program (n=7)

Because of my participation in the SPARK Program…	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree	Not Applicable
I know how to write a cover letter for a potential job.	-	-	-	-	100%	-
I know how to give a job talk.	-	-	14.3%	-	85.7%	-
I have an up-to-date Curriculum Vitae (CV).	-	-	-	-	100%	-
I feel confident when interviewing for a faculty position.	-	-	-	28.6%	71.4%	-
I know how to negotiate for better pay.	-	-	-	57.1%	42.9%	-
I feel confident navigating gender-related bias in the job search.	-	-	-	71.4%	28.6%	-
I know how to write a *teaching* statement.	-	-	-	-	100%	-
I know how to write a *research* statement.	-	-	-	14.3%	85.7%	-
I know how to write a *diversity* statement.	-	-	-	14.3%	85.7%	28.6%
I know how to search for *post-doctoral* positions in higher education.	-	-	28.6%	-	42.8%	-
I know how to search for *faculty* positions in higher education.	-	-	-	14.3%	85.7%	-
I know how to complete an academic faculty job application.	-	-	-	-	100%	-
I feel confident in making the best career decision for myself.	-	-	-	-	100%	-
I am a competitive candidate in the workforce.	-	-	-	14.3%	85.7%	-

Amount of Additional Editing Participants Engaged in after the SPARK Program

The participants were also asked to report how much additional editing they did for each of the following job application components after the conclusion of the SPARK program using a four-point Likert scale (None = 1, A Little = 2, Some = 3, and A Lot = 4). Overall, participants did the most editing to their research statement compared to the other components, and the least editing to their diversity statement compared to other components. Table 4 provides further details on the amount of additional editing participants engaged in after the SPARK program.

Table 4 - Participants' Perspectives on the Amount of Additional Editing after the SPARK Program (n=7)

	None	A Little	Some	A Lot
Curriculum Vitae (CV)	-	57.1%	28.6%	14.3%
Cover Letter	-	42.8%	28.6%	28.6%
Teaching Statement	-	42.8%	28.6%	28.6%
Research Statement	-	28.6%	14.3%	57.1%
Diversity Statement	-	71.4%	14.3%	14.3%

<u>Participants' Job Search Experiences since Participating in the SPARK Program</u>
Participants were also asked to report the number of applications, interviews, and offers related to STEM positions that have happened since they completed the SPARK program. They were given the ability to write Not Applicable (NA) when appropriate. Four participants completed an application during 2021-2022, one of whom is currently still applying during 2022-2023. Of the four participants who have engaged in the application process, three received an offer after applying and engaging in rounds of interviews. Of the three participants received an offer in 2022, two accepted a tenure track Assistant Professor position in Engineering and another accepted an Assistant Teaching Professor position.

Three participants have not applied for a STEM faculty position yet, including two who are completing post docs and one who has not graduated yet. Table 5 provides further details on participants' job search experiences.

Table 5 - The Number of Applications, Interviews, and Offers Related to Positions for SPARK Participants

STEM Positions	Number of Positions Applied For	Number of First Round Interviews	Number of On-Site Interviews	Number of Offers Received
Public University – Tenure Track				
Participant 1	5	3	1	1
Participant 2	15	2	1	1
Participant 4	2	-	-	-
Public University – Teaching/Clinical/Lecturer				
Participant 3	3	2	2	-
Private University – Tenure Track				
Participant 2	13	3	2	-
Participant 4	14	-	-	-
Private University – Teaching/Clinical/Lecturer				
Participant 3	2	2	2	1
Post-Doctoral Position				
Participant 3	1	-	-	-
National Laboratories Research Position				
Participant 4	4	1	-	-

Participants were asked if they would like to share anything else about their job searching process. All three participants who received an offer indicated that SPARK helped them with their application. Once participant mentioned:

"The program provided the resources and the structure for me to complete my application package. The program also connected me with applicants on the same timeline as myself. We met several times after the program to practice our chalk talks and to perform mock interviews. We used the information from the program (written resources and the Q&A panel info) to generate interview questions. I was very prepared for my Zoom interviews and for my in-person interviews. This provided me with the confidence (Underrepresented groups in STEM lack confidence during interviews)."

<u>Most and Least Useful Aspect of the SPARK Program</u>
After the program, participants were asked to report on the most and least useful aspect of the SPARK program. Key useful aspects that participants indicated were learning about what information each statement entails, receiving individual feedback on packages, having structure, and being able to ask personal questions. Areas of improvement included being put into the wrong sub-group, wanting more opportunities to network, needing a negotiations panel, and lack of feedback from mentors instead of peers.

Conclusions and Future Work
Overall, the pilot program was a success and had largely positive feedback from the participants. Seventy-five percent of our participants that went on the job market were successful in their first year. The feedback was overwhelmingly positive a year and a half after the program concluded (100% would recommend). Based on the feedback and evaluation of the pilot cohort, an updated program is planned for the summer of 2023.

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