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A Program for Graduate Women in Engineering Pursuing Academic Careers (iFEAT: Illinois Female Engineers in Academia Training)

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Rohit Bhargava is Bliss Faculty Scholar of Engineering and Professor at the University of Illinois at Urbana-Champaign. He is a faculty member with affiliations in several departments across campus (Primary – Bioengineering: Affiliated - Electrical and Computer Engineering, Mechanical Science and Engineering, Chemical and Biomolecular Engineering and Chemistry) as well as the Beckman Institute for Advanced Science and Technology. Rohit received dual B.Tech. degrees (in Chemical Engineering and Polymer Science and Engineering) from the Indian Institute of Technology, New Delhi in 1996 and his doctoral thesis work at Case Western Reserve University (Department of Macromolecular Science and Engineering) was in the area of polymer spectroscopy. He then worked as a Research Fellow at the National Institutes of Health (2000-2005) in the area of biomedical vibrational spectroscopy. Rohit has been at Illinois since as Assistant Professor (2005-2011), Associate Professor (2011-2012) and Professor (2012-). Rohit was the first assistant professor hired into the new Bioengineering department and played a key role in the development of its curriculum and activities. He later founded and serves as the coordinator of the Cancer Community@Illinois, a group dedicated to advancing cancer-related research and scholarship on campus. Research in the Bhargava laboratories focuses on fundamental theory and simulation for vibrational spectroscopic imaging, developing new instrumentation and developing chemical imaging for molecular pathology. Using 3D printing and engineered tumor models, recent research seeks to elucidate hetero-cellular interactions in cancer progression. Rohit's work has been recognized with several research awards nationally. Among recent honors are the Meggers Award (Society for applied spectroscopy, 2014), Craver Award (Coblentz Society, 2013) and the FACSS Innovation Award (2012). Rohit has also been recognized for his dedication to teaching in the College of Engineering (Rose and Everitt awards) and he is routinely nominated to the list of teachers ranked excellent at Illinois.

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Introduction

A casual scan of department websites in the college of engineering at most universities reveals an obvious imbalance in the ratio of male to female professors. According to data collected by the National Science Foundation, women were conferred roughly 40% of doctoral degrees in STEM fields from 2002-2012, yet in 2010, women accounted for only 27% of tenure-track assistant professorships in engineering.[1] While the gender gap in STEM fields remains an ongoing discussion,[2-4] programs that provide resources and support for female engineering doctoral students interested in pursuing academic careers may help to address this gap. The cause of this 'leaky pipeline' is likely the culmination of several factors including academic environment and lifestyle.[5]

While an academic career path is often a visible option for graduate students, there is a disconnect of information about this career path. Obtaining information about the faculty application process can be arduous and overwhelming. There are many types of institutions and careers paths within academia, so it can be difficult to distinguish between positions and determine a 'good fit'. Individuals in the academic job search commonly send out many applications, which frequently result in no interview or follow-up. Due to the high volume of submitted applications and low number of interviews per candidate, it appears that applicants are unfamiliar with strategies for developing application materials that stand out amongst competition.

The University of Illinois regularly hosts seminars and afternoon-long workshops for doctoral students to learn about the academic job application process. Although these seminars and workshops effectively disseminate information, they do little to encourage students to seriously consider, prepare for, and apply to faculty positions. Programs such as the Mavis Future Faculty Fellowship Program at the University of Illinois are designed for graduate students who show interest in and promise toward becoming faculty members.[6] This program focuses on developing the participants' research, teaching, and mentorship experiences but does not spend significant time assisting in the participants' development of application materials. Previously, a graduate-level course offered in the Department of Bioengineering addressed aspects of the faculty application process and required students to develop materials as part of the curriculum. This class provided a great resource to bioengineering students but has recently been discontinued. Other universities have similar programs or classes offered to train future faculty. Some of these programs are hosted through the university's teaching center and therefore the program focuses on documenting and developing teaching skills,[7-8] while other universities host intensive workshops that touch on aspects from the academic job search to preparing teaching statements to getting off to a good start.[9] There are also courses designed to prepare faculty that focus on technical writing, effective presentations, teaching techniques, and leading research groups.[10] Although great resources exist, there is a need for a program that assists in the development of faculty application materials at the University of Illinois.

To address the aforementioned issue and shortcomings of established programs, the Graduate Committee of the Society of Women Engineers (GradSWE) at Illinois developed the Illinois

Female Engineers in Academia Training (iFEAT) program. iFEAT is a multi-month program with seminars and panel discussions, which are geared toward informing participants about the academic job application process, and independent peer-review groups, which provide feedback on prepared application materials. By combining targeted information and peer review of application materials, this program stands apart from other resources offered on campus. The program's specific aims are for participants to demonstrate increased knowledge of the faculty position application process, to prepare tangible application materials, and to increase confidence in their application packages. *The goal of this work is to determine if the structure of iFEAT facilitated participant learning and satisfaction. We will analyze the program structure with respect to program content, pace, and climate. With the information learned, we remark on implementable changes for program improvement.*

Program Structure

iFEAT was designed to help advanced graduate women in engineering develop materials to apply for faculty positions. Programming for iFEAT began in October 2014 and continued until March 2015. A call for applicants was distributed in August 2014. The program offered a seminar or faculty panel discussion approximately every 3 weeks, with independent group meetings for peer revision of application materials between each major event. A graphical representation of the program structure can be seen in **Figure 1**. The program was designed to encourage frequent contact between participants to develop a sense of community. It was envisioned that as participants prepared their applications, they could rely on each other for information or to discuss best practice strategies. **Table 1** outlines the subject matter, and presentation style for the iFEAT program. All events were scheduled to last for 1-2 hours.

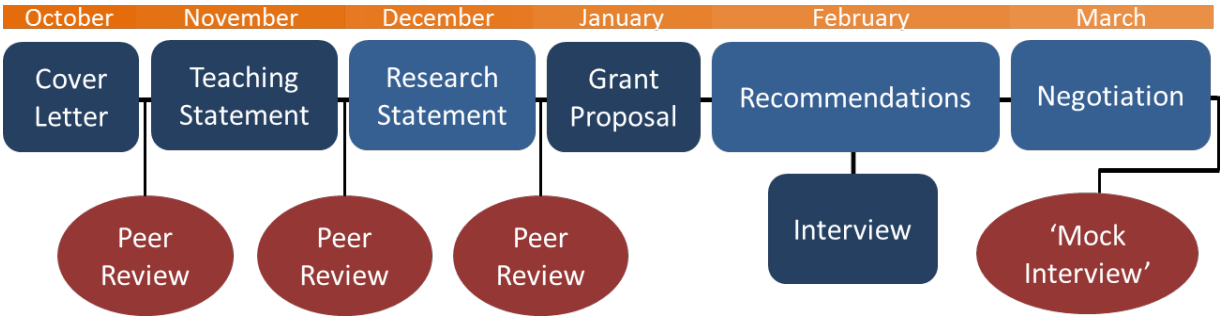

Figure 1. Schematic of iFEAT program structure with seminars in blue boxes, panels in light blue boxes, peer review in red ovals and timeline in orange.

Selection of applicants. Interested students were required to submit an application consisting of a CV and a statement of interest (up to 500 words), which included the applicant's projected timeline for applying to faculty positions. The program was designed to accommodate up to 20 applicants. A committee of 3 faculty members reviewed the applications. A total of 24 applications were received and thirteen applicants were chosen to participate in this program. Applicants were selectively chosen based on the following criteria: (i) commitment toward career in academia which included demonstration of activities in research, teaching, and mentorship and a competitive record of peer-reviewed publications, presentations, and/or patents (50%), (ii) commitment to attend all major programming events, though applicants with an anticipated conflict were not penalized (15%), (iii) involvement in GradSWE, defined as

attendance at one or more GradSWE events or supporting the mission of GradSWE (15%), (iv) advanced standing in a graduate program, defined as completion of an M.S. and/or preliminary exam (10%), and (v) 1-2 years from graduation from Illinois or faculty application process (10%).

Table 1. Summary of iFEAT topics and event format.

Event	**Format**
Orientation & Cover Letter	Seminar
Peer Review of Cover Letter	
Teaching Statement	Seminar
Peer Review of Teaching Statement	
Research Statement	Panel
Peer Review of Research Statement	
Grant Proposals	Seminar
Recommendations	Seminar
Interviews	Panel
'Mock Search Committee' Review of Cover Letter, Teaching Statement, and Research Statement	
Negotiations	Panel

Overview of iFEAT events. iFEAT events were developed with the assumption that most applicants would be interested in careers at research intensive or research-and-teaching-oriented institutions. All of the seminar speakers and panelists were professors or professionals at the University of Illinois.

The seminar on cover letters was included as an introductory topic. Often, we hear that cover letters are used to narrow the application pool. Writing a strong cover letter is the first step to consideration for a position. To demonstrate the importance of a cover letter, the speaker presented a 'call for application' solicitation and three cover letters in response to the call. Seminar attendees ranked the cover letters, and it was immediately clear that if a cover letter does not adequately address the call, then the application will receive serious consideration.

Next, the seminar on teaching statements was presented by an on-campus expert in teaching philosophies. She emphasized the importance of tailoring teaching statements for different institutions. The speaker also mentioned that all teaching experience can be elaborated upon, and in some cases, the teaching statement should include information about educational research based on teaching philosophy.

A panel of faculty discussed assembling a research statement to provide a broad outlook spanning various fields. A brief presentation about what to include in a research statement informed the audience and sparked questions for the open discussion that followed. The faculty members also discussed the challenges of writing research statements and proposals.

A seminar on grant proposals provided basic information on how to develop a grant proposal. This topic was selected because successful grants are often needed to support a research group and secure funding for research. In this seminar applicants received in-depth information about what to include in the project summary. The speaker was adamant that the project summary is the key to a winning proposal. After learning the essential information to be included in the project summary, the speaker provided poorly constructed summaries for critique.

The seminar about letters of recommendation provided insight on the type of individuals that should be asked to provide references and what content should be included in a recommendation. The speaker mentioned how to approach a recommendation writer and when is a good time to ask the recommender for their assistance. The speaker also spent time addressing specific problems that participants have faced.

The panel on interviews discussed topics ranging from first round phone interviews to campus visits. The panel consisted of professors at varying positions including a newly hired faculty, a professor, a professor leading a search committee, and an assistant dean for research in the college of engineering. Their wide perspectives on the hiring process were extremely informative and provided the participants with a well-rounded view of the interview process. The panel discussed best practice strategies for addressing sensitive topics.

Four female assistant professors made up the panel on negotiations. In this session the panelists discussed which aspects of a job offer they were able to negotiate and if they negotiated their start up package. The panelists also extensively talked about spousal hiring practices at the university.

Overview of peer-review group format. iFEAT participants were assigned peer-review groups, each consisting of 3 or 4 participants. The purpose of the peer-review groups was to provide peer feedback on application materials. Ideally, participants would use each of their designated peer-review group meetings to discuss and critique cover letters, teaching statements, and research statements. The peer-review sessions were not structured, so the participants were free to meet at convenient times for their assigned group. iFEAT organizers communicated with each group but had little influence over group meetings or activity. The peer-review groups were arranged based on strength of application. Participants who demonstrated the most dedication to an academic career and were closer to the application process were grouped together. Since the program was completely voluntary, this arrangement was chosen to maximize the benefits for the most pro-active participants.

Program Evaluation and Discussion

The program was evaluated based on program content, pace, and climate. The program structure was assessed through survey data and interviews conducted at the conclusion of the program. Survey data was collected at the beginning, midpoint, and end of the program.

Program Content. Content for the iFEAT program was developed based on the assumption that participants would be interested in positions at either research-oriented or teaching-oriented

institutions. To assess whether the program content matched the interests of the participants, participants were asked to indicate the type of institution(s) to which they plan to apply. Institutions were categorized into four groups: research intensive, research and teaching intensive, teaching intensive, and community college. Participants were also asked to indicate if they were interested in tenure or non-tenure track positions. As shown in **Figure 2**, participants' interests shifted throughout the program. Although no conclusive tends were observed with the participants' change in the type of institution to which they were interested in applying, this data does reflect the sentiment of indecision that was observed in the post program interviews. The majority of the participants interviewed commented that they were unsure of the type of academic institutions to which they were interested in applying. From this data, it is apparent that participants are interested in teaching-oriented institutions and more programming could be provided to accommodate their interests. Additionally, most participants indicated an interest in applying to tenure-track positions validating the focus of the program content.

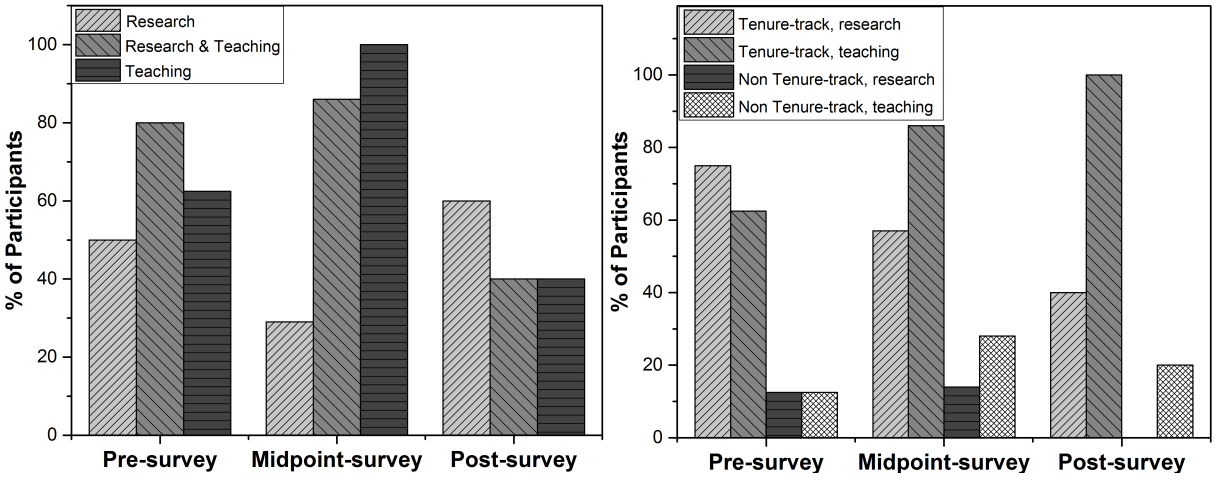

Figure 2. A majority of participants are interested in applying for positions at teaching-intensive or research-and-teaching intensive institutions.

To determine the usefulness of the program content, participants were asked to indicate with a yes or no if the seminars and panels that they have attended were useful. Participants were also asked to indicate on a scale from 1-disagree to 5-agree if the seminars provided a significant amount of information and panels provided a wide enough perspective on the topic. Additionally, participants were asked to indicate what aspect the program they found most valuable among seminars/panels, peer-review groups, interaction with faculty, or other.

Responses to the survey questions assessing the usefulness of each event are displayed in **Table 2**. All participants surveyed found the first seminar on cover letters and the subsequent peer-review group useful. Eighty percent of respondents found the seminar on teaching statements and the following peer-review group useful. One participant who indicated the teaching statement seminar was not useful had observed the same presentation at a similar event on teaching statements. To better suit all participants; this event might be restructured in an attempt to present new information that cannot be obtained through already established programs. The panel on research statements was not found to be useful for over half of the

participants. Comments indicated that panelists frequently strayed from the topic of discussion. Furthermore, none of the peer-review groups were able to meet to discuss the research statement in the suggested time due to time constraints with the end of the semester. These results are problematic, because the most participants indicated that they view the research statement as the most challenging aspect of the faculty application. Two-thirds of the participants found the seminar on grant proposals useful. The comments indicated that although the information was interesting, the topic my not be as relevant to the academic job search process. All participants found the seminar on recommendations and the panels on the interview process and negotiations to be useful.

Table 2. iFEAT events and percentage of participants that found the programming useful.

Event	% of Participants
Orientation & Cover Letter	100
Teaching Statement	85
Research Statement	43
Grant Proposals	66
Recommendations	100
Interviews	100
Negotiations	100

Participants were asked if the seminars provided a significant amount of knowledge on each topic (1-disagree to 5-agree). A resulting average rating of 4.2 indicates agreement with the statement. Most participants indicated that the seminars are useful and informative; however, it should be noted that the majority of iFEAT participants had not explored other resources on preparation for the faculty job search. In future programming cycles, we expect improved communication with the seminar speakers prior to their event(s) could tailor information for the specific iFEAT audience. It is conceivable that iFEAT participants have explored other campus resources related to faculty job applications, so it will be important to balance presenting fundamental information and offering a unique perspective. During the post program interviews, participants commented that the information iFEAT provided was more tailored to the group compared to similar program events they had attended.

Participants were asked if the panels provide a wide enough perspective on the topics (1-disagree to 5-agree). The average rating was 4.2, indicating agreement with the statement. Interestingly, participants appreciated the wide variety of perspectives on the research statement, even if they did not find the panel particularly useful. Questions had been prepared beforehand to lead discussion, but more strict moderation is recommended to prevent the conversation from drifting too far from the scope of the desired material. Also, a 15-minute presentation by one panelist prior to the open discussion was found to be useful for disseminating information and

sparking questions from the participants. This format for panel discussions will likely be continued.

One unique aspect of this program is the peer-review group format. The purpose behind the groups is to provide participants feedback on materials prepared throughout iFEAT. Although some peer-review groups meet regularly and find the discussion useful, other groups have not met. From this feedback, it is clear that more effort and structure is needed to successfully facilitate groups. Having a specified time and date for peer-review groups could increase accountability and develop a sense of community among participants. Only 25% of participants indicated that the peer-review groups are the most valuable part of iFEAT, even though the groups are the most unique aspect of the program. In the future, changes to the program will be implemented to increase the usefulness of peer-review groups. The participants who participated in the peer-review groups found them to be the most valuable aspects of the program.

Pace. iFEAT was designed to be a multi-month program to allow time for writing of application materials, specifically cover letters, teaching statements, and research statements. Seminars or panels were held approximately every three weeks, with peer-review groups convening between the scheduled events. Programming began in late October, and the three aforementioned documents were to be drafted by mid-January, allowing approximately 2.5 months for drafting these documents. The program structure dictated when certain application materials should be done, although there was no particular reason that the seminars were to be done in the chosen order.

Applicants were asked to rank the pace of the program on a scale of 1-slow to 5-fast. At the midpoint of the program, the majority of participants (57%) indicated that the program was an appropriate speed (3), and the remaining participants (43%) indicated that the program progressed slightly fast (4). Although the participants did not indicate that the program progressed too quickly, many of the participants had not completed the desired application materials. In future programming cycles, it may be easier for participants to develop materials if writing the materials was distributed throughout the entire program period. Also, consideration will be given to holidays and travel schedules when planning seminars and application material deliverable dates. In the past cycle, such conflicts hindered peer-review groups from meeting in a timely fashion.

All seminars were scheduled to begin at 4 pm on a Thursday for consistency and for speaker availability, but participants commented that 4 pm seminars were intrusive to a typical work schedule.

Climate. This program was designed to be a supportive environment that fosters relationships between participants with all female participants. Additionally, the majority of the seminar speakers and panelists were women. In the post interview, participants indicated an increased comfort by having all female participants and a majority of the speakers as women. They indicated that they felt more comfortable asking questions that they felt they would be judged for asking in a mixed audience. Additionally, all the participants interviewed mentioned that they appreciated the intimate size of iFEAT. One participant commented that when the group size gets too large, speakers become less candid and the information disseminated becomes more generic.

Conclusions and Future Outlooks

Moving forward, the program structure will maintain a similar format of seminars, panels, and peer-review groups, though some modifications will be made. The first seminar of iFEAT will introduce the program expectations and begin interaction within peer-review groups. At the beginning of each following seminar and panel, the peer-review groups will have time to share an interesting topic or comment from their independent meetings. This activity is intended to increase accountability; groups will want to meet and discuss in order to participate in the later conversation. This will also lead to the sharing of good ideas and conversations between groups. The peer-review groups will also be structured and loosely facilitated. Setting aside a day and time for peer-review will hopefully increase attendance. We hope that these modifications will promote a collaborative and supportive culture within iFEAT. Comments from the surveys indicated that the peer-review group discussions often raised questions based on the most recent seminar/panel, for which none of the participants would know the appropriate answer. In the next programming cycle, seminars may include a brief question-and-answer session to discuss material from the previous seminar.

We may also implement slight changes to the program content. One of this cycle's seminars was focused on grant proposals; while this information may be considered useful, it is not directly related to applying for a faculty position. We anticipate removing or changing this seminar. We also plan to hold the letter of recommendation seminar earlier in the program to better distribute seminars related to material preparation. This shift in timing will also encourage participants to develop relationships with future recommendation writers earlier in their tenure as graduate students. Due to the large interest in teaching oriented universities participants would greatly benefit from perspectives from other institutions, particularly teaching-oriented colleges and universities. As the program develops, we anticipate inviting external faculty to host seminars.

Since many of this year's participants are interested in applying to teaching-oriented institutions, it would be relevant and useful to invite a professor from this type of institution to lead a teaching statement workshop or discussion. A guest lecture from a visiting professor could be very informative, and it would greatly diversify the viewpoints provided in the program. If a campus invitation does not seem feasible, digital options should be explored (e.g. video conference).

Finally, we are interested in broadening the program's target audience by including postdoctoral female students in the college of engineering in the call for applications. Since postdoctoral students may be closer to the academic job search process, they would fit the iFEAT target audience. The size of the program would likely not change, so the target number of participants would still be approximately 20 students. This change could increase the competitiveness of the applicants, thereby enhancing the preparedness of students entering the faculty position application process.

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