



Programmatic Interventions for Developing Diverse Global Eminent Faculty Scholars Through International Collaborations

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Introduction

Although the United States has made progress increasing the representation of women in STEM, women remain vastly underrepresented in engineering, comprising 15.5% of faculty employed in universities and 4-year colleges. The situation for women of color in engineering is extremely bleak. Out of 27,700 engineering faculty employed in universities and 4-year colleges, only 200 are women assistant professors from Black or Hispanic groups. The numbers of women assistant professors from American Indian or Alaska Native, and Native Hawaiian or Other Pacific Islander groups are so small that the numbers are suppressed to avoid disclosure of confidential information. The numbers are suppressed for the same reason across all underrepresented minority groups at the ranks of associate and full professor. The same situation exists for women in underrepresented groups across all ranks in computer and information science. This means that the numbers of women professors in engineering from underrepresented groups are so small in the U.S. (less than 1%), that most of them can be readily identified [1]. Increasing the representation of women and diversifying the field of engineering has become a national imperative, which is closely aligned to the United States's ability to maintain its global competitive edge [2], [3]. Initiatives that facilitate women's access to mentoring relationships and research networks have proven successful in providing women engineers with the academic capital necessary for career advancement [4]. Research demonstrates the direct relationship among career advancement, mentoring relationships, research networks, and collaboration, in particular international collaborations [5]. While these initiatives accelerate the advancement of women engineers, women from majority groups are reaping the most benefits. Women of color are at a comparative disadvantage when forming these critical mentoring relationships and networks due to racial and cultural structural barriers, which compound already existing gendered barriers [6]. Consequently, women of color are less likely to participate in mentoring relationships, research networks, and to engage in (international) collaborative research. Over time, these disadvantages translate into women of color having fewer opportunities to accumulate the academic capital required for career advancement.

To address this issue, the University of Maryland, Baltimore County (UMBC) is implementing the Global Engagement Eminent Scholar Network (GEESN), a programmatic intervention which aims to advance the careers of women of color engineers by developing them into diverse global eminent faculty scholars. To accomplish this goal, a cohort of women of color engineers will participate in international mentoring relationships, networks, and research collaborations, while they learn strategies for mindful intercultural communication. The GEESN builds upon UMBC's highly successful Eminent Scholar Mentoring program and International Engagement for Women of Color project. The initiative has two main components: a 2-year formal international mentoring project that pairs U.S. women of color in engineering with a prominent international engineer in their field and the participation of a delegation of GEESN participants at two

international conferences 1) The Latin American and Caribbean Consortium of Engineering Institutions (LACCEI) and 2) the World Engineering Education Forum (WEEF). This paper provides an overview of the literature and promising practices that inspired the formation of the GEESN initiative, as well as the development of both project components. To conclude, the paper discusses the next steps for the GEESN and reflects on the potential for expanding and replicating this model at UMBC and other higher education institutions.

Women of Color: Mentoring Relationships and Research Networks

Participation in formal and informal mentoring networks is a critical mechanism through which individuals accumulate the global academic capital necessary for career advancement [7], [8], [9]. In order for faculty researchers to advance in the fields of engineering, computer science, and information technology, they must gain visibility in the national and international scientific community. Often, due to their underrepresentation, the resulting isolation, and gendered structural barriers, female faculty have less access to mentoring relationships than their male counterparts [10], [11], [12], [13]. Although we have made progress in facilitating mentoring relationships for female faculty, this approach fails to account for the double-bind, which Latina and African American women often face as a result of the intersection of their ethno-racial and gender underrepresentation in these fields. This double-bind exacerbates their isolation and puts them at an even greater disadvantage than women from majority groups in obtaining mentoring relationships within the U.S. [14], [15], [16]. As a result of the gendered, ethno-racial, and at times, cultural barriers women of color already confront in the United States, they are even less likely to have access to critical international mentoring relationships to advance their career on a global level.

Mindful Intercultural Communication Skills and International Collaborations

Developing mindful intercultural communication skills is a secondary goal of the GEESN. As the STEM workforce becomes more diverse and globally-oriented, it is imperative that we provide engineers with opportunities to develop mindful intercultural communication skills. Ting-Toomey explains that “in order to communicate effectively with dissimilar others, every global citizen needs to learn the fundamental concepts and skills of mindful intercultural communication” [17]. It is commonplace in industry for employees to receive intercultural communication training to learn the skills necessary to work effectively with international clients and with diverse colleagues at home. Indeed, Karen Gregson, an L&D and Talent Manager, for Military Air and Information at BAE Systems, a global defense, aerospace, and security company, reports that “by providing our employees with cultural awareness support we can maximise our export opportunities and develop strong relations with our international customers” [18]. In academia, aside from the trainings offer by Kathleen Wong (Lau), Director of the Southwest Center for Human Relations at the University of Oklahoma, STEM faculty receive little if any intercultural communication training to prepare them for intercultural encounters [19]. In engineering, where career advancement is a function of publications and grant awards, implementing intercultural training has the potential to heighten faculty members’ intercultural awareness and competence, their ability and confidence to negotiate cultural differences, and ultimately enable them to engage productively in the necessary international mentoring and networking relationships and collaborations for advancement. And, while such training is beneficial for all engineering faculty, providing intercultural communication training

to women of color engineers facing gendered, racial, and cultural barriers at home, will empower them with additional skills to negotiate intercultural misunderstandings and conflicts, decrease intercultural stress, and ultimately engage in more productive international relationships and collaborations. Subsequently, intercultural communication training will afford women of color engineering faculty with an additional capital at their disposal when navigating intercultural differences in their career advancing international mentoring relationships, networks, and collaborations.

Promising Practices at the University of Maryland, Baltimore County

UMBC is a nationally recognized leader in preparing underrepresented minority (URM) students for careers in science and engineering through its Meyerhoff Scholars program and also for increasing the number and diversity of Ph.D. graduate who go on to academic careers through its NSF-funded PROMISE: Maryland's AGEP program, and the NIH Meyerhoff Graduate Fellows program. UMBC is also a recipient of a now institutionalized NSF ADVANCE Institutional Transformation Grant (2003) and a Partnership for Adaptation, Implementation, and Dissemination (PAID) grant (2012) to increase the representation of women and underrepresented minority faculty in STEM. Our newest initiative, the Global Engagement Eminent Scholar Network (GEESN), builds from our success described below to create programmatic interventions that encourage international collaborations that lead to the career advancement of women of color engineers.

ADVANCE Eminent Scholar Mentoring Program

In 2003, UMBC received a 3.2 million dollar ADVANCE Institutional Transformation grant from the National Science Foundation to increase the representation of women and underrepresented minorities in STEM. In male-dominated disciplines such as STEM, women's exclusion from the "the old boys network" precludes their access to the crucial information and invaluable networking relationships required for career advancement [24]. To facilitate female STEM faculty's connection to their larger scientific community and enhance their success as they advance through the ranks of academia, in 2005, UMBC-ADVANCE launched the Eminent Scholar Mentoring program. This initiative pairs all new female assistant professors in STEM, and at the program's inception, some associate professors, in a 2-year formal mentoring relationship with a prominent U.S. researcher in her field (male or female). Working together with the Chair and Dean, the new faculty member identifies a potential mentor. The Dean sends an invitation letter to the proposed mentor, explaining the Eminent Scholar mentoring program and provides background information about the mentee. The Chair also sends a follow-up letter of invitation. Once established, each mentoring relationship receives \$3000 in funding. These funds cover travel, hotel, meal, and honorarium expenses over the course of 2 years. During the first year of the relationship, the mentor visits UMBC gives a distinguished departmental seminar and spends a substantial amount of time with the mentee. In the subsequent year, the mentee visits the mentor's home institution and gives a research seminar. In addition to the campus visits, the mentee and mentor are expected to be in regular contact (e.g., at least one time per semester).

An evaluation of the Eminent Scholar Mentoring program at UMBC demonstrated its success in addressing women's exclusion mentoring relationships. Program participants report receiving

advice from their mentors about grant writing, networking at conferences, research collaborations, research presentation opportunities, nominations for research awards, mentoring students, and work-life balance. The Eminent Scholar mentors have also provided mentees with letters of support for tenure. Recognized within the ADVANCE community as a best practice, other ADVANCE institutions have replicated the Eminent Scholar Mentoring program (e.g., The External Mentoring Program at Washington State University). At UMBC, the high-impact of the program has resulted in its institutionalization across the entire university for all new assistant professors.

International Engagement for Women of Color Project

PROMISE: Maryland's AGEP is designed to be a support program that promotes a pathway to the professoriate, providing underrepresented graduate students in STEM with mentoring, professional development, and opportunities that facilitate consideration of a faculty career. Our work with the PROMISE AGEP showed that graduate students from underrepresented backgrounds had limited experiences with international engagement. Our NSF ADVANCE project with universities in Puerto Rico revealed that there was a similar lack of engagement among the women faculty from the campuses on the island, which are classified as minority-serving institutions. Recognizing that the lack of global engagement could include both underrepresented graduate students and faculty, we decided to embark upon a project that could address the gap in international participation. In 2014, we launched a program called the "International Engagement and Broadening Participation in STEM from a Family-Friendly Perspective for Women of Color" with funding from the National Science Foundation. This project was designed to take a group of 15 underrepresented faculty and graduate students on an excursion that would provide an international experience, professional development, exposure to global networks, and an opportunity to chronicle the events of the trip through the lens of NSF's Career-Life Balance initiative. The excursion was a 1-week trip to Guayaquil, Ecuador for the annual conference of the Latin American and Caribbean Consortium of Engineering Institutions (LACCEI). The participants were from the University of Maryland Baltimore County (UMBC), the University of Maryland College Park, Bowie State University, Jackson State University, the University of Puerto Rico Rio Piedras, and the University of Puerto Rico Mayaguez. With the exception of UMBC and the University of Maryland College Park, all of the institutions involved are minority-serving institutions.

The participants on the trip were asked to discuss their experiences within the context of career-life balance. The participants blogged daily and answered questions about reasons why STEM researchers of color may not engage in international opportunities. Several reasons emerged. Among them were lack of awareness regarding available opportunities for global engagement, concern about juggling current work tasks at their home universities, and balancing family responsibilities. There were additional concerns about perceptions of difference (culture, skin tone), communication barriers, if the participant does not speak the language of the host country or if the language that an international conference uses is not English, and issues of gender bias. The participants re-examined their positions daily, and reflected upon their experiences and interactions throughout the visit. The trip included a visit to a university, interaction with faculty and undergraduate students from local universities in Ecuador on a local university campus, interaction with conferees at the conference site, engagement in the "Women in STEM" activities that were held during the conference, and an external scientific excursion. The

participants had a productive visit, and recommended that a similar organizational structure could be useful for engaging more women and underrepresented minorities in international research activities. The development of a cohort or group that could travel together was highly recommended. The participants were able to share challenges that they were experiencing regarding approaches to career advancement at their home institutions, and as a group they took time to develop solutions. They also discussed ways that their international experience inspired their desire to increase collaborations, both in the U.S. and abroad.

The data from this project, the scarcity of women from underrepresented groups in faculty positions, and the fact that building an international reputation for scholarly activity is required for faculty advancement, suggest that an intervention that includes international engagement could assist women of color with developing a stronger global network. Our university decided to develop a plan for involving women of color in an international experience, based on some of the best practices that were developed through UMBC's National Science Foundation projects for broadening participation in engineering, PROMISE: Maryland's AGEP, and the ADVANCE projects from women faculty at UMBC and in Puerto Rico.

Global Engagement Eminent Scholar Network

In 2014, UMBC, Universidad Metropolitana, The University of Puerto Rico, Rio Piedras, and the University of Puerto Rico, Mayagüez applied for a National Science Foundation (NSF) Partnership for Learning, Adaptation and Network (PLAN) grant, Broadening Horizons for Participation of Women of Color in Engineering. As part of the grant proposal, UMBC developed the Global Engagement Eminent Scholar Network (GEESN), as a mechanism to increase women of color's accumulation of academic capital through the establishment of a 2-year formal mentoring relationship between a cohort of women of color faculty in engineering, computer science, and information technology and a prominent international researcher in their field. The GEESN builds upon the Eminent Scholar Mentoring program by incorporating Critical Race Theory (CRT) [20] and Critical Race Feminism (CRF) [21], [22], [23], to account for and address the intersectional racial and gendered experiences of women of color in STEM in establishing international mentoring relationships.

The GEESN will bring together a cohort of 10 women of color engineering faculty from institutions in Puerto Rico and the U.S. mainland. The primary goal the network is to connect women of color with international professional networks, train them for global leadership through their exposure to these networks, while at the same time, acknowledging each woman's unique politics of location. Developing mindful intercultural communication skills is a secondary goal of this initiative, which will prepare participants to negotiate the cultural differences they encounter in international collaborations. The GEESN consists of two components: a 2-year formal international mentoring project that pairs U.S. women of color in engineering with a prominent international engineer in their field and the participation of a delegation of GEESN participants at two international conferences 1) The Latin American and Caribbean Consortium of Engineering Institutions (LACCEI) and 2) the World Engineering Education Forum (WEEF).

International Eminent Scholar Mentor Initiative

The International Eminent Scholar initiative builds upon UMBC-ADVANCE's highly successful Eminent Scholar Mentoring program to establish a 2-year formal mentoring relationship between the GEESN cohort of 10 women of color faculty and a prominent international researcher in their field. The women will work individually with the Broadening Horizons team and members from their home institutions (i.e., Deans, Department Chairs) to identify potential international mentors. After the woman identifies a mentor, GEESN leaders and the home institution will send a formal invitation to the prospective mentor, explaining the initiative and introducing the prospective mentee (CV, research profile etc.).

Once a mentoring relationship is successfully established, during the first year, the international mentor will visit the mentee at her home institution, give a research seminar, and meet with the mentee individually, and also meet with the students in the mentees lab. In the second year of the relationship, the mentee will visit the mentor's home institution where she will conduct an Eminent Scholar Research Lecture, and also meet with faculty and students. In addition, over the course of the two-year relationship, it is expected that there will be regular contact (e.g. at least one time per semester) between the mentor and the mentee. The mentoring relationship will be monitored through semesterly mentor and mentee reports, and also through interviews with the cohort members and mentors to assess impact of the relationships and effectiveness of the intercultural communication training. This data will be used to determine the effectiveness of the network and to sustain the initiative after the funding period.

International Conferences/Networks/Workshops

The second component of the GEESN plugs women into international networks such as the World Engineering Education Forum (WEEF), the Latin American and Caribbean Consortium of Engineering Institutions (LACCEI), and activities that are sponsored by the International Federation of Engineering Education Societies (IFEES) and the Global Engineering Deans Council (GEDC) where they will meet scholars from their disciplines from around the world. Participation in these conferences is slated to increase the women's levels of international cultural competence, facilitate collaborations, increase the flow of creative ideas for research, and allow for additional planning of ways to manage career-life balance. UMBC will facilitate the participation of and host a delegation of our participants at the LACCEI conference and the WEEF conference (in concert with the annual meeting of the IFEES). Prior to the international conference, cohorts of women in the project will come to UMBC for a few days of training and mentoring from UMBC faculty. When they come to UMBC, they will receive:

1. Training on the International Eminent Scholar Mentor program
2. Initial "pre-travel" orientation about the various international engineering networks and conferences
3. Development of a mentoring plan that includes identification of an international mentor, and plans for engaging collaborators during the international conference
4. Training on intercultural communication skills receive copy of Schaetti, B., Ramsey, S., & Watanabe, G. (2008). *Making a World of Difference. Personal Leadership: A Methodology of Two Principles and Six Practices*. Seattle, WA: FlyingKite Publications
5. Development of an international career-life balance portfolio that will allow for planning for ways that global engagement will fit into current job and family responsibilities.

Given the success of UMBC's domestic, US-based Eminent Scholar Mentor program, and the successes of other small scale international projects that resulted in collaborations, the teams at UMBC and the universities in Puerto Rico believe that the GEESN model can be successful, and eventually replicated for the purpose of academic advancement, and life-long learning.

Conclusion

This project is designed to be a strategic intervention that can be used to increase the numbers of women professors from underrepresented groups in engineering, computer science, and information technology who will advance through faculty ranks. We have based the project on the knowledge of requirements to achieve the rank of full professor, and the data that show that there are so few women in these fields from underrepresented groups that the National Science Foundation does not provide numbers. Further, through two ADVANCE programs, we have experienced the success of working with women to achieve tenure and promotion through organized activities that provide mentoring, information regarding methods for achieving milestones, motivation, role models, career planning, and opportunities for collaboration. We believe that an internationally-focused project that includes these elements will fill the gap of global engagement, encourage opportunities to update and continue training on the latest advanced in the field, and facilitate a wide-range of collaboration. We will be observing and evaluating the success of the GEESN using a logic model developed for this project by Dr. Angela Byars-Winston of the University of Wisconsin-Madison. Dr. Byars-Winston, noted for her expertise in "Career Development for Faculty and Students in Science, Medicine, and Engineering," has included ideal benchmarks for long-term achievement, including attention to publications, external awards, institutional recognition, public reception, and positions in professional societies. The project will not take a passive approach. It will instead invite and actively engage women in a process that will give them opportunities to not only participate in research on a global level, but will allow them to grow and develop into internationally-recognized leaders within their spaces, who can influence the next generation of female researchers. At the conclusion of our project, we intend to assess what worked, what did not, disseminate our results to a broad audience, and share what we believe will be a model for success that is highly adaptable, replicable, and sustainable at other institutions of higher education.

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