ADVANCE-ENG Success at the Intersection of Formal and Informal Networks for Women of Color (WOC) Engineering Faculty

Dr. Christine S Grant, North Carolina State University

Dr. Christine S. Grant joined the NC State faculty in 1989 after completing her M.S. and Ph.D. (Georgia Institute of Technology) and Sc.B. (Brown University) all in Chemical Engineering (ChE). One of less than 10 African-American women full ChE professors in the country, her research interests are in interfacial phenomena and recently biomedical systems. She is the first Associate Dean of Faculty Advancement in NC State’s College of Engineering. Awards/service include 2015 AAAS Mentor Award, Fellow in American Institute of Chemical Engineers Board of Directors, NSF Presidential Award for Excellence in Science, Math and Engineering Mentoring, Council for Chemical Research Diversity Award. She is the founding director of the Promoting Underrepresented Presence on Science and Engineering Faculties (PURPOSE) Institute.” A certified coach, Grant consults and empowers STEM individuals at all levels in the academy towards excellence in career and professional development. Her workshops on mentoring and academic career development for NSF ADVANCE programs at Purdue, Cornell, Texas A&M, University of Toledo, UVA, Prairie View A&M, and the ADVANCE Annual PI meetings promote STEM faculty development while providing diverse role models for students. She has mentored and empowered hundreds of faculty, students and postdocs.

Ms. Barbara E Smith, North Carolina State University

Barbara Smith joined NC State University as Assistant Director of Faculty Advancement in the College of Engineering in 2008. She has a background in business operations, investment portfolio and budget management as an assistant vice president at JP Morgan. Barbara also brings her training in education and experience in teaching and mentoring high school and undergraduate students to faculty advancement. She provides her knowledge and experience in the corporate sector as well as in education to the successful strategic planning and execution of the faculty development program.

Julie Simmons Ivy, North Carolina State University

Julie Simmons Ivy is a Professor in the Edward P. Fitts Department of Industrial and Systems Engineering and Fitts Faculty Fellow in Health Systems Engineering. She previously spent several years on the faculty of the Stephen M. Ross School of Business at the University of Michigan. She received her B.S. and Ph.D. in Industrial and Operations Engineering at the University of Michigan. She also received her M.S. in Industrial and Systems Engineering with a focus on Operations Research at Georgia Tech. She is President of the Health Systems Engineering Alliance (HSEA) Board of Directors. She is an active member of the Institute of Operations Research and Management Science (INFORMS), Dr. Ivy served as the 2007 Chair (President) of the INFORMS Health Applications Society and is a past President for the INFORMS Minority Issues Forum. Her research interests are mathematical modeling of stochastic dynamic systems with emphasis on statistics and decision analysis as applied to health care, public health, and humanitarian logistics.

Dr. Jessica T DeCuir-Gunby, NC State University

Dr. Jessica T. DeCuir-Gunby is a Professor of Educational Psychology and University Faculty Scholar in the Department of Teacher Education and Learning Sciences at NC State University. Her research interests include race and racial identity development, critical race theory, mixed methods research, and emotions in education.

Dr. Coleen Carrigan, California Polytechnic State University, San Luis Obispo

Professor Coleen Carrigan is a feminist anthropologist and an Assistant Professor of Gender, Race, Culture, Science and Technology at Cal Poly San Luis Obispo. She investigates the historical and cultural dimensions of underrepresented groups’ participation in science, technology and engineering and the reasons why white males still dominate these fields.

Saejin Kwak Tanguay, University of Washington

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ABSTRACT

Underrepresented Minority (URM) women engineering faculty are leading change in the academy through outstanding research and leadership endeavors. A 2005 ADVANCE Leadership award entitled, “Peer Mentoring Summits for Women Engineering Faculty of Color” convened the first ever set of summits focused on URM women engineering faculty. Using a “where are they now” approach, we will highlight the accomplishments of participants in this initiative started 12 years ago. While this group does diversify the faculty, their roles in the academy are not focused solely on issues of diversity. For example, as administrators, it is critical to recognize their intellectual contributions to academic policy, research and pedagogical advancements in higher education. Given the increasing number of workshops, summits and publications focused on Women of Color (WOC) STEM academicians, we will present experiential perspectives and summarize these efforts for WOC STEM faculty. The subsequent development of cross-cultural collaborations in a new multi-university NSF-ADVANCE project entitled, “Launching Academics on the Tenure-Track: An Intentional Community in Engineering (LATTICE)” will also be presented. While intersectionality defines unique issues at the intersection of race and gender, this paper explores the expansion of formal networks of our diverse LATTICE team building on the success of previous faculty development initiatives. The paper will also discuss how ongoing informal networks continue to incorporate mentoring and coaching to empower women engineering faculty.

Underrepresented Minority (URM) women engineering faculty are leading change in the academy through outstanding research and leadership endeavors. There are currently at least three African American women engineering deans, a number of associate and assistant deans and more full professors than ever in the engineering academy. This does not, however, mean that our work is done in terms of the intentional actions required to obtain both diversity and inclusion in the engineering academy. Thirty-five Years after "The Double Bind" by Shirley M. Malcom, et. al (1976), obstacles remain for minority women in STEM (Malcom and Malcom, 2011). Numerous studies show that women of color in STEM disciplines face a host of challenges, the authors say, "feelings of invisibility and isolation in their home departments, challenges to their authority, teaching competency and scholarly expertise in the classroom, and the emotional toll of negotiating a landscape of obstacles for minority women.”

The “data does not lie” and a number of studies indicate that both women and people of color are underrepresented in engineering (Moore, 2006; Nelson, 2007). The National Academies indicate that women actually earn only 15% of the doctorates in engineering, a necessary prerequisite for a tenure-track faculty position (National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, 2007). In 2007, Nelson found that people of color were less likely to be faculty members or instructors in engineering; with women of color professors being the most underrepresented (Nelson, 2007). Research has also shown that women of color
engineering faculty are less likely to be awarded tenure and become full professors when compared to all other groups (Nelson, 2003). Women of color are only 5.7 percent of those with STEM doctorates who are assistant, associate, or full professors at four-year colleges, universities, and affiliated centers and institutes, but they are 15 percent of the working-age population in the United States. In contrast, white men with STEM doctorates are 58 percent of assistant, associate, and full professors, but only 35 percent of the working-age population (Hess et. al., 2013).

While Vargas asserts that the literature does not provide reasons why WOC are underrepresented on engineering faculties (Vargas, 2002); there have been several recent studies focused on reasons and potential solutions. In addition to lacking mentors and role models, they are often treated differently (National Research Council, 2006), and are more likely to encounter prejudiced attitudes and sexist treatment (Kaiser & Miller, 2004). Unique to this group are the issues associated with intersectionality, the myriad microaggressions, inequities and unconscious bias. A recent chapter in the book “Changing the Face of Engineering” entitled, “Socializing African American Females into Academic Careers: The Case of the Cross-Disciplinary Initiative for Minority Women Faculty” presented a case study of a group of faculty in which the participants learned a variety of skills including time and laboratory management in addition to the “unwritten rules” required for career success (Leggon and Barabino, 2015).

We could spend a great deal of time defining the problem and assigning blame. There have been plenty of excellent studies focused on framing the critical historical, climate and economic issues in the past (National Research Council, 2006; 2010; Committee on Gender Differences in Careers in Science, Engineering, and Mathematics Faculty, Committee on Women in Science, Engineering, and Medicine, Policy and Global Affairs, Committee on National Statistics, etc., 2007). The purpose of this work is to highlight a set of efforts focused on providing career enhancing opportunities for WOC engineering faculty to learn from each other in “safe spaces”. While the authors provided leadership in one of the first National Science Foundation (NSF) supported gatherings for WOC engineering faculty, they acknowledge the fact that there have been a host of initiatives that have built upon each other in support of the upward career trajectory of these faculty. We will spend the remainder of this paper: (i) summarizing initiatives and suggested recommendations, (ii) highlighting the career progression of WOC engineering faculty (and leaders), (iii) identifying current initiatives that build on the important concept of allyship between all women in the engineering academy and finally, (iv) providing commentary on necessary next steps.

ADVANCE-ENG peer mentoring summits

A 2005 NSF ADVANCE Leadership award entitled, “Peer Mentoring Summits for Women Engineering Faculty of Color” convened the first ever set of summits focused on URM women engineering faculty (Bowles, et. Al., 2010; Grant et. al., 2010). The goal of the NSF ADVANCE Program is to develop systemic approaches to increase the representation and advancement of women in academic STEM careers. The outcomes should contribute to the development of a more diverse science and engineering workforce. Our NSF ADVANCE Leadership Award was a three year initiative focused on connecting a group of over 120 URM women engineering faculty; it was collaboration between faculty in engineering, educational psychology and adult
education. A series of four professional development peer mentoring summits were convened at North Carolina State University (NCSU) and California Institute of Technology. The summits took as a premise the fact that the utilization of peer faculty groups to coach, mentor, encourage and advise each other can have a positive role in the success of individual faculty.

In the first year, 70 women attended a 2-day summit convened at NC State for all engineering disciplines. Evolving from the identified needs of the senior women faculty, the second summit took place NC State and was a mini-summit specifically structured for senior underrepresented minority women engineering faculty interested in leadership; 25 full professors and faculty 2 years away from full professor attended. The senior women focused on identifying best practices in cross-cultural mentoring, leading in the academy, professional development activities (e.g., NSF program director, AAAS Fellows) and developing a collective voice in the academy for issues that go beyond diversity and mentoring, and laid the groundwork for the final summit.

![Figure 1: Participants in second summit held at California Institute of Technology in 2009](image)

The third summit for 60 women of all ranks, was co-sponsored by California Institute of Technology (CalTech); the culmination of the summit series included a strategic planning meeting to plan to move the connecting activities out to the disciplines through professional societies, and more broadly, NSF, NIH and other governmental funding agencies. The final interdisciplinary summit was held at NC State focused on connecting for collaborative research and had over 60 women faculty in attendance. In each summit, the women faculty interacted with faculty at the host institution to discuss mutual research interests and explore potential collaborations in both technology and education. In addition to the primary summits, there were two additional events: (i) a targeted day workshop on obtaining large scale (e.g., center level) research funding held at NC State and (ii) a co-sponsored event, the Women’s International Research Engineering Summit (WIRES) held in Orlando, Florida.

**WIRES 2011** was an international summit for women (including engineering faculty, graduate students, postdoctoral fellows, researchers from industry, and program directors from funding agencies) interested in pursuing international collaborative research opportunities. The main
objective of WIRES was to enable meaningful and sustainable research exchanges between female engineers from around the world, while identifying issues faced by females pursuing careers in engineering that could benefit from a global strategy. While the summit participation was limited to 50 US and 50 non-US women engineers, we partnered with the organizers (on another NSF funded project) to diversify the US participants with our summit WOC faculty. WIRES focused on three research "clusters" or themes looking at engineering systems to deliver: Sustainable Energy, Health Care and Clean Water. (Source: http://wires.gatech.edu/WIRES-2011.php: Accessed 1/21/18)

Figure 2: Participants in WIRES Summit held in Orlando, Florida in 2011

An earlier ASEE paper provides detailed insights into the unique issues faced by URM women in the engineering academy and the Peer Mentoring approach to provide positive reinforcement and a network of personal, professional and academic support (Grant et. al., 2010).

The following is a summary of accomplishments and broader impacts of the summit series:
- Provided networking opportunities for over 120 URM women engineering faculty
- Assisted with creating mentor relationships for URM women within and across disciplines
- Provided unique professional development discussions that are relevant to URMs
- Encouraged URMs to engage in leadership and motivated URMs to stay in academia
- Showcased accomplishments of URM women engineering faculty
- Solidified the critical voices and associated leadership roles in national areas such as workforce, global technological needs and university governance
- Catalyzed interest and desire to commit to a permanent networking group
- Broadened the foundation for an organization of URM women engineering faculty
- Facilitated connections for scheduled sabbaticals and scholarly seminars
In our paper, “Exploring Career Trajectories for Women of Color in Engineering: The Experiences of African American and Latina Engineering Professors” (Decuir-Gunby and Grant, 2013), we examined the experiences and subsequent career trajectories of African American and Latina engineering professors. Using the stories of 11 women, through a critical race feminism (CRF) lens, we focused on how critical events, people, and situations influenced their career trajectories in engineering. We began with a discussion of women of color’s career choices in engineering followed by an examination of racial and gender influences on women of color’s experiences in academia. We then describe our theoretical perspective of CRF; the discussion of our findings included suggestions to promote girls of color’s interest in engineering.

The results of this study confirmed as well as expanded upon the findings of the research literature. Previous research has indicated that women of color choose careers in engineering for a variety of reasons. Specifically, this study found that African American and Latina’s career trajectories in engineering were influenced by their aptitudes/interests, family support, high school experiences, university experiences and relationships, and industry experiences.

In a related book chapter entitled, “The Emotionality of Women Professors of Color in Engineering: A Critical Race Theory and Critical Race Feminism Perspective”, we articulated the experiences of the women from the summit using established frameworks of critical race theory and critical race feminism in educational psychology (DeCuir-Gunby et al., 2009).

Rooted in the foundations of intersectionality, a strong set of initiatives for Women of Color in STEM has emerged. Intersectionality is a critical aspect of the experiences of WOC engineering faculty. One of the authors (Grant) had an opportunity to advise Armstrong and Jovanovic on a study that examined institutional interventions that were both intersectional and designed to support URM women in a set of 18 NSF ADVANCE Institutional Transformation (IT) grants. In their paper entitled, “The Intersectional Matrix: Rethinking Institutional Change for URM Women in STEM,” they reported that intersectionality theory emerged out of the fields of critical race studies and women’s/gender studies in the 1980’s (Armstrong & Jovanovic, 2015). These critical race studies resituate critical thinking about social identities difference, and the distribution of power. They stated that, “An intersectional analysis can help us understand and reconceptualize the experience of URM women, but it can also open roads to new and tangible approaches to institutional change. Intersectionality can enable policy-makers, institutional change agents, and campus leaders to achieve new understandings of campus dynamics of privilege and bias, and to discover new structural interventions that empower URM women in STEM” (Armstrong & Jovanovic, 2015, p. 150).

“Where are they now?” How have summit participants progressed in the academy?

It has been over ten years since the first summit was convened with over 70 women engineering faculty. Since that time, there have been other initiatives and programs that these women have attended as part of their career development. While we cannot take full credit for the success of the women in the following table, we continue to celebrate the progress of the women that participated in our series of summits. The other positive aspect of this career continuum information is to provide a way to encourage the women that are both aspiring faculty and
actively pursuing promotion in tenure-track and non-tenure-track engineering faculty positions at a range of institutions. Table 1 provides a snapshot of the careers of summit participants. One should note that several faculty appear in multiple columns, indicating a steady career progression.

Perhaps the most exciting component of this table is the fact that the women are leading change as administrators in a number of different positions. Several of the leaders were present at the second summit focused on moving senior women into engineering leadership positions. It is critical to recognize the intellectual contributions of administrators to academic policy, research, climate development and pedagogical advancements in higher education. While this group does diversify the faculty, their roles in the academy are not focused solely on issues of diversity. They are sitting at the table as full professors and providing input on tenure and promotion cases for all faculty.

Table 1: Partial listing of career accomplishments of summit participants
（-> denotes institution change, *participated in second Peer Mentoring Leadership Summit）

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<thead>
<tr>
<th>Promoted to Associate Professor**</th>
<th>Promoted to Full Professor**</th>
<th>Administrative Leadership</th>
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<tr>
<td>Norma Alcantar (CHE) USF</td>
<td>**</td>
<td>Robin Coger: Dean (NCA&amp;T)*</td>
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<tr>
<td>Jessica DeCuir-Gunby (Ed.Psy) NCSU</td>
<td></td>
<td>Karen Butler-Purry (TAMU): Associate Provost for Graduate &amp; Professional Studies*</td>
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<tr>
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<td></td>
<td>Monica Cox (Ohio State) Dept. Head</td>
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<td>Jennifer Lukes (ME) UPenn</td>
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<td>Lesia Crompton-Young: (TSU) Associate VP Research &amp; Sponsored Programs; Chief Research Officer*</td>
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<td>Iris Rivero (IE) TexasTech- &gt;Iowa State</td>
<td></td>
<td>Christine Grant (NCSU) Associate Dean Faculty Advancement*</td>
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<tr>
<td>Sylvia Thomas (EE) USF</td>
<td></td>
<td>Stephanie Adams (VA Tech) Dept. Head, Engineering Education; (Old Dominion) Dean*</td>
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<tr>
<td>Chekesha Liddell Watson (MSE) Cornell</td>
<td></td>
<td>Annie Anton (GA Tech) Chair School of Interactive Computing*</td>
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<td>Leigh Winfrey (NE) UF</td>
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<td>Kim Jones (Howard) Chair Civil &amp; Env. E</td>
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<td>Janet Rutledge (UMBC) Vice Provost &amp; Dean Graduate School*</td>
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<td>Julie Ivy (ISE) NCSU</td>
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Finally, what is not represented in Table 1 is the leadership that they have had in the research arena. Several of the women are leading large scale research efforts, including institutes, center level activities, international conference development and agency program directors. There are also a number of faculty who are leading change in professional societies as board members, fellows, committee chairs and national officers. We could also highlight the plethora of awards, distinguished lectures and global recognitions received by the group. At the same time, this is just what is expected of engineering faculty in the academy; hence one should not be surprised at the success of this group. The challenges, however, remain and now the more senior faculty are having dialog about the remaining challenges and opportunities for impactful change. A recent NSF grant entitled, “African American Female Engineering Faculty in the Academy: What Does it Take To Succeed? A Workshop of Senior Women in the Academy” focuses on advancing knowledge and understanding of evidence-based strategies for increasing the entry, retention and advancement of African American women in the engineering academy with the express goal of implementing organizational change strategies to address inequities (Source: https://nsf.gov/awardsearch/showAward?AWD_ID=1745132&HistoricalAwards=false).
The summits resulted in the development and continuation of several informal coaching and mentoring networks among the participants. For example, at the annual meeting of the American Institute of Chemical Engineers (AIChE), in addition to the formal diversity related meetings, the WOC faculty periodically meet informally to discuss both professional and personal issues. This group has been instrumental in keeping a finger on the pulse of the careers of many WOC chemical engineering faculty. One key difference between chemical engineering and other engineering disciplines is the fact that the AIChE culture is steeped in the active participation of all ChE faculty at the annual meeting. It is a hub of activity in the awards, leadership development and of course technical presentations for chemical engineering academics. In this regard, there is usually a strong showing of WOC ChE faculty at the AIChE meeting each fall. This facilitates the ability to convene formally as well as informally. It enables the senior faculty (included in this group are academic administrators) to stay connected; the group routinely collectively explores different career options for the faculty at all ranks. It informally provides a “safe space” for dialog and an opportunity to continue to learn about the often unspoken nuances associated with being the “only one” in an engineering department. In an article entitled, “Counterspaces for women of color in STEM higher education: Marginal and central spaces for persistence and success”, Ong et. al. (2018) explore the struggles of women of color that can threaten their persistence in STEM, leading to the creation of counterspaces. The article indicates that for WOC in STEM higher education, the counterspaces function as havens from isolation and microaggressions; supporting the action that this particular group of women faculty discovered for themselves.

One of the authors (Grant) and other senior faculty also provide ongoing informal coaching and mentoring to a number of the summit participants. Some of the faculty have done sabbaticals at the California institution as a result of the summit held there. In addition, the WOC engineering faculty have: collaborated on research, invited each other to present seminars at their universities, written letters of support, and convened other conferences. Another exciting outcome is the fact that these women are leading, coordinating, hosting and acquiring funding for initiatives that meet the needs of the next generation of WOC faculty. There are also publications that promote success strategies from women in STEM as a resource that were informed by this project (Pritchard and Grant 2015); with contributions from some of the summit participants. Most importantly, a community has formed and we continue to connect across a variety of venues and platforms.

Other WOC STEM faculty initiatives

As mentioned earlier in the paper, there are a number of different initiatives that have emerged to cultivate and grow the connection with WOC STEM faculty. Successful and empowered STEM women in academia, industry and government have provided strategic leadership in this arena in the initiatives outlined below. This is not an exhaustive listing of funded and unfunded activities (see Table 2); for example, institutions may have “in-house” initiatives that are connected to ADVANCE grants, or as part of an on campus faculty development initiative. There are also online initiatives that foster working groups for faculty; there is, however, a need for discipline-specific coaching and mentoring to address the culture/climate issues. The only potential downside of all of these initiatives that we have heard is the fact that there are only so many conferences that WOC STEM faculty can attend each year outside of their technical and other
professional meetings. Hence, the wide range of meetings causes some women to make difficult choices, resulting in the community of engineering faculty being spread out across several events.

Table 2: Synergistic WOC STEM faculty initiatives

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<tr>
<th>Initiative/Program</th>
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<tr>
<td><strong>NSF ADVANCE Program</strong>&lt;br&gt;-(In addition to the programs listed here, several ADVANCE grants include components for URM or WOC STEM faculty)</td>
<td>1. Peer Mentoring Summits for WOC Engineering Faculty (NC State University)&lt;br&gt;2. Transforming the Climate and Advancing STEM Women at Jackson State University, an HBCU in the South&lt;br&gt;3. Cross-Disciplinary Initiative for Minority Women Faculty (Georgia Institute of Technology)&lt;br&gt;4. Women of Color Faculty in STEM as Change Agents (Howard University)&lt;br&gt;5. ADVANCE Women of Color Faculty in STEM Conferences. The 2013 conference was entitled, “HEAR OUR HEELS: Succeeding in Academia to Tenure and Beyond” (Purdue)&lt;br&gt;6. ADVANCE-IT (Howard University)</td>
</tr>
<tr>
<td><strong>Society for STEM WOC</strong></td>
<td>8. Women of Color Conclaves: <em>bring together the largest national assembly of women faculty of color, representing all academic STEM disciplines</em> (Source: <a href="http://conclave-swoc.net/">http://conclave-swoc.net/</a>)</td>
</tr>
<tr>
<td><strong>Institute for Women’s Policy Research</strong></td>
<td>9. Accelerating Change for Women Faculty of Color in STEM: Policy, Action, and Collaboration Conference (Hess et. al., 2013)</td>
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There were a number of recommendations to increase the positive outcomes for WOC STEM faculty that resulted from the aforementioned initiatives. The following recommendations were selected from initiatives in the above table; they assert that it is critically important to:

- Engage more women of color in **leadership positions**; to improve self-empowerment; and to recognize women of color’s accomplishments and achievements.
- Have better and more mentoring, including more resources for building the **mentoring network**, and to provide role models.
- Build, develop and sustain a **community** for women of color.
- Build awareness of the issues related to **recruitment, retention and advancement** of women of color in STEM, and to call for attention on the issues from the entire institution.
- Identify mentors, sponsors, and coaches. Today, young women of color don’t have to become someone they’ve never seen. **Senior women have a responsibility** to make the path visible and easier for junior scholars.
- Increase **accessibility of information**, raise awareness of status of women of color STEM faculty.
• Develop institutional leadership that values diversity and ensure that hiring policies require that those being hired can demonstrate cultural competence.

The work by Armstrong and Jovanovic (2015) studying the impact of a large group of NSF ADVANCE IT grants indicates that it is important to: (a) Create accountable leadership: Institutional leaders (provosts, deans, department chairs) must take active roles as co-change agents, (b) Understand the (N)umbers Game: Majority faculty must listen to URM women's voices and learn to be effective allies, (c) Enable community structures: this includes connecting URM women via consortia, coalitions, conferences, understanding URM women as primary actors, and providing URM women with space to define their own needs and to create communities.

**Launching Academics on the Tenure-Track an Intentional Community in Engineering (LATTICE): an intentional initiative to engage academic allies**

In “Unlikely Allies in the Academy: Women of Color and White Women in Conversation,” Karen Dace presents a compilation of essays that explore the unique challenges and opportunities for the development of true allies (Dace, 2012). In a chapter entitled, “Too Much History Between Us,” Peggy McIntosh explores how the original exclusion of women and persons of color as faculty has manifested itself in the relationships between White women and Women of Color. She observes that, “Whiteness gives me an undeserved edge in the competitions of the academy as in the society as a whole. Being persons of color usually gives my colleagues an undeserved disadvantage. Allying can feel personally workable but the deep impediments to it are systemic, psychological and historical” (p. 91). She continues to discuss how the “sharing of power” does not always occur and that, “When I speak the academy’s language I tend to perpetuate its policies of exclusion, consciously or unconsciously” (p. 94). After sharing her experiences in both formal and informal interactions, she asserts that, “.letting the stories and experiences that we carry within bond us, give us systemic insight and embolden us to work as allies for social justice, in schools and in the world” (p. 100). McIntosh’s ongoing journey can form an important framework for women across the academic STEM continuum to work together for systemic change in the experiences of Women of Color faculty. The next stage in our formal networks for Women of Color engineering faculty has started with a step back to explore a new partnership with a group of women who were working to empower academics beyond the engineering realm.

**A new collaboration: LATTICE Initiative**

The Launching Academics on the Tenure-Track an Intentional Community in Engineering (LATTICE) is an NSF funded program that seeks to broaden participation in the engineering faculty ranks through intentional programs supporting women faculty. This initiative to foster faculty diversity is a joint effort between eight women scholars representing three different academic institutions; University of Washington, North Carolina State University, and California Polytechnic State University, San Luis Obispo. The diverse team consists of scholars from industrial, electrical, and chemical engineering, ecology, sociology, anthropology, and education working in concert to impact the career trajectories of early career women in engineering. The
team represents a range of institutions including two public research universities and one public comprehensive teaching institution in different geographical areas of the US. Half of LATTICE team members are Women of Color (two African American women, two Asian American women) and four White women, one of whom also identifies as Jewish American.

The primary deliverable of LATTICE is a set of symposia that will engage early career women: (i) in both Electrical Engineering and Computer Science and (ii) underrepresented minority women with an interest in engineering faculty careers. The multi-day symposia programming and associated peer mentoring circles, are adapted from previous successful efforts at the University of Washington: WEBS (Women Evolving the Biological Sciences: professional development symposia for early career women in ecology and evolution) (Horner-Devine et al. 2016) and BRAINS (Broadening the Representation of Academic Investigators in NeuroScience: for early career URM neuroscientists) (Margherio et al. 2016).

The overall goal of LATTICE is to significantly increase the retention and advancement of women in academic careers in addition to creating greater diversity in academic engineering leadership. A partnership with a PI (Grant) on the ADVANCE-ENG Summits for URM Women engineering faculty will result in a unique blending of both programmatic and participant knowledge. Two co-authors on this paper (Grant and Ivy) have a collaborative NSF ADVANCE grant to partner on the LATTICE project. A key concept here is that we strive to become “Allies before Implementation”, building our team alliance and blending core aspects of the Peer Summits with the symposium concept. This will be critical as we execute the second symposium for URM women pre-engineering WOC faculty in 2019.

The intentionality on this project is demonstrated through the robust ethnographic study that is being conducted by members of the LATTICE team on the interaction of gender, race and discipline in the creation of a socioemotional culture and coherent group identity of the organizing team (Parker and Hackett 2012). Based in the core aspects of being allies and cross-cultural partnerships, members of the team are exploring how their own perspectives on these topics inform their development of a partnership focused on the growth and success of women engineering faculty. The aspects of solidarity and collective identity are referred to as “coherence” within the group. The term “coherent group” refers scientists who collaborate across disciplines to buck the status quo and break new ground in both theory and practice. An extensive ethnographic study of our perspectives is being conducted through a series of: (i) intensive individual and group interviews, and (ii) participant observation of both online and in-person team meetings (Spradley 1979; Spradley 1980).

The bi-weekly online LATTICE team meetings form the basis for the development of a unified, shared and collective perspective on how the various aspects of social, political, scientific and cultural identities impact our interdisciplinary collaborations. Over the course of three years (of a five year project), the sometimes intense conversations around the core issues that empower women engineering faculty have generated a unique blend of interactions steeped in trust, friendship and shared professional goals. Because we have “put in the work” we expect a LATTICE intervention that has at its core a strong set of allies that have mutual respect for cultural differences in regards to both social identities and fields of study.
Regional summits of PURPOSE

Based on our experience with the summits and the continuing growth of large scale multi-investigator research efforts, there is a continuing need to promote interdisciplinary research partnerships while engaging a diverse group of researchers from a range of institutions. It is also critical to connect research teams. A recommended framework to engage multiple stakeholders is to develop regional summits at different institutions. The original series of summits relied upon a major grant from the National Science Foundation to convene a large group of women faculty in collaboration with two institutions. Based on time, travel and funding constraints that exist in the academic realm, the authors are recommending an approach that will: (i) engage multiple Colleges of Engineering, and (ii) limit the time associated with travel for participants.

Using the model developed by the Summits described in this paper, an institution could duplicate on a much smaller scale the community of women faculty that were present at the summits. The number of participants could range from five to 25 women or more depending on the level of engagement of the departments across a particular college of engineering. The regional summits of PURPOSE have four main components: (1) Traditional scholarly research seminars (e.g. departmental weekly seminars) as part of the regular seminar cycle. This would be coordinated with individuals departments to occur during the time of the visit; (2) Meetings with faculty to explore potential research collaborations, development of center-level initiatives and “exchange” of research personnel in the form of students and post doctoral associates; (3) Collaborative networking between the visiting scholars that will incorporate elements of the summits to create long term community, and; (4) On-site coaching and mentoring for URM and women students (undergraduate and graduate) on the host campus. Table 3 shows the elements in a basic schedule that colleges could start with for the regional summits.
Table 3: Regional summits of PURPOSE, sample baseline schedule

<table>
<thead>
<tr>
<th>Day One</th>
<th>Day Two</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Breakfast meeting with women faculty</td>
<td>Session 2: for Visiting Faculty participants</td>
</tr>
<tr>
<td>On campus meeting with College of Engineering administrator or University Research Program office on mechanisms of research collaborations</td>
<td>Lunch with undergraduate/graduate students</td>
</tr>
<tr>
<td>Departmental Faculty Meetings</td>
<td>Afternoon meetings with Campus faculty</td>
</tr>
<tr>
<td>Departmental Seminar ( may be at a different time based on regularly scheduled seminars)</td>
<td>Session 3: for Visiting Faculty</td>
</tr>
<tr>
<td>Session 1: Dinner for Visiting Faculty</td>
<td>Dinner</td>
</tr>
</tbody>
</table>

What’s next?

The next steps in leading transformational change will require an authentic partnership between WOC engineering faculty, academic engineering leadership and the engineering faculty at large. In the white paper entitled, “Inside the Double Bind: A Synthesis of Empirical Research on Women of Color in Science, Technology, Engineering and Mathematics,” a team led by Mia Ong wrote that, “The particularistic norms of the scientific community can lead to the exclusion of women of color from the workplace milieu, often very important to career success. Institutions should be more aware of organizational dynamics and the qualitative “feel” of formal and
informal professional networks and how they are linked to the career trajectories of women of color in STEM” (p. 176).

One example of a commitment to change is the recent pledge taken by more than 100 engineering deans across the country. Organized by the American Society for Engineering Education (ASEE), the “Diversity Letter” was submitted to provide express commitment to providing women and other underrepresented demographic groups with increased opportunities to pursue meaningful engineering careers. (Source: http://www1.udel.edu/udaily/2016/aug/engineering-diversity-080415.html - Accessed 1/21/18). Among other actions the deans committed to developing “proactive strategies to increase the representation of women and underrepresented minorities in their faculty.”

As we celebrate the ten year anniversary of the first summit at NC State, it would be interesting to formally explore the long term impact of the summits on the participants. One thing is for sure, there is still more work to be done to achieve parity, equity and inclusion for WOC engineering faculty. As the next generation of WOC faculty move up the ranks, it will be critical to engage them in the ongoing identification of core actions relative to all of the literature that has at times excluded them from an active dialog. Collaborations with thoughtful, engaged and committed institutional leadership will complete the partnerships required to implement real and sustained change. A long-term impact study of the summit participants will catalyze these engagements with institutional leadership.

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