A Symbiotic Solution for Facilitating Faculty Transitions in Engineering Academia

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Abstract
Two challenges to the logical shift in the nation’s engineering faculty demographics may actually become merged as a symbiotic pair of solutions. Underrepresented minorities (URMs) in STEM recently accounted for 6.3% of engineering faculty (National Action Council for Minorities in Engineering, 2014), despite approaching nearly a third of the nation’s population (2010 Census). A central reason for the disproportionate representation is the continued need for effective mentorship and advocacy for these historically marginalized groups into and through the professoriate. Another sensitivity in the requisite shift in engineering faculty composition pertains to the effective transition of senior faculty who are of retirement age yet have the skillsets and desire to continue to be “active”. These two perceived “bottlenecks” in the engineering professoriate are simultaneously addressed by strategically matching retired (with emphasis upon “emeriti”) faculty as advocates-mentors for appropriately matched URM faculty. Synergistically, a transformative outcome could be more engineering faculty positions opening to an increasingly diversified pool of talent, wherein a generation of retired/retiring faculty advocate for their empowered successors.

A pilot program, Increasing Minority Presence within Academia through Continuous Training (IMPACT), was accordingly implemented wherein seven emeriti faculty from a large engineering college were matched with ten URM engineering faculty and one URM post-doctoral associate (i.e., some emeriti faculty had multiple one-on-one assignments). The younger faculty stakeholders were from different engineering colleges, and each had near-term aspirations regarding their progression through academia. Protocols used for recruiting-matching and proactive intervention were key implementation measures. Both sets of participants have generally had positive outcomes from, and sentiments toward, this initiative; yet there have been some “lessons learned” (e.g., establishing a minimal frequency of contact between emeriti and engineering faculty to which both are more rigorously held accountable).

Introduction
A new mentoring and advocacy-networking paradigm is proposed which brings together two stakeholder groups: 1) underrepresented minorities (URMs: herein emphasizing Blacks, Latinos, Native Americans) who are aspiring (i.e., progressing) engineering faculty and 2) accomplished engineering faculty who have gone through entire full time careers in academia and hold emeriti roles. Increasing Minority Presence within Academia through Continuous Training (IMPACT) seeks to create a synergistic pairing of these two sets of stakeholders based primarily, but not exclusively, on technical expertise. URM faculty have an opportunity to engage in activities designed to further their socialization process into the engineering academic profession and gain access to the vast insights, greater discretionary time, and, as appropriate, extensive contacts that the emeriti faculty have garnered over the courses of their careers. The project has the potential to impact the engineering faculty ecosystem by demonstrating a new method to support and engage diverse faculty by including an often-overlooked resource—senior retired faculty.

Significant attention has been placed upon production of more URM science, technology, engineering and math (STEM) Ph.Ds. and their subsequent entry into the academy through
programs such as the NSF Alliances for Graduate Education and the Professoriate (AGEP); yet more attention needs to be placed upon systematic and sustainable means of aiding their **retention, tenure and promotion through the academy**. There is growing disproportionality in the number of URMs that are engineering faculty. As described in the National Science Foundation (NSF) Solicitation PD 14-7680, URMs comprised 8.6% of assistant professors, 8.7% of associate professors, and 5.8% of full professors; yet, according to the 2010 Census they comprised 31.7% of the American population.

Members of underrepresented groups may often be at a disadvantage for success in academia, because they lack access to informal resources and may be subjected to subtle biases (Jackson, 2004; Thomas & Hollenshead, 2001; Turner, Myers, & Creswell, 1999; Valian, 1998). Mentoring and advocacy are ways that women and URMs gain knowledge about important career information that many “majority” men are able to acquire through informal networks (Hyers, Syphan, Cochran, & Brown, 2012; Ibarra, 1997; Stanley, 2006; Thomas, 2001; Thomas & Hollenshead, 2001; Tillman, 2001). Mentorship and advocacy opportunities may still be lacking from senior (**full time, practicing**) professors for various reasons such as their continued workloads. A National Academies report (Johnson & Lucero, 2003) cites an article by Nyquist (2002), wherein a key recommendation was to help “… universities to enhance faculty reward structures to encourage senior colleagues to mentor novice professors.” The connotation is that that there was limited engagement of junior faculty by these stakeholders; nonetheless, the support of predecessors as engaged role models remains pivotal to URM junior faculty success.

Lack of informal socialization can impact women and URMs in multiple ways (e.g., evaluation, distribution of resources, and mentoring opportunities) (Jackson, 2004; Thomas & Hollenshead, 2001; Turner, Myers, & Creswell, 1999; Valian, 1998). Four systemic challenges to promotion and tenure were referenced in a National Academies report (Johnson & Lucero, 2003), and two of those (i.e., “chilly climate” and “turnover”) were directly associated with insufficient guidance and advocacy for the “young” (i.e., with respect to time in career) junior faculty.

An immediate benefit of the current pilot is for URM engineering faculty participants to engage in activities designed to further their socialization process into their respective disciplines within the academy via the insights, networking and advocacy by well-regarded predecessors. An incentive for emeriti faculty is the opportunity to continue to engage in the discipline by providing technical and professional expertise and to contribute to a more diversified next generation of engineering faculty. The pilot is yielding valuable information needed to expand the effort into a viable full-scale mentoring and advocacy-network that includes more stakeholders that elect to participate. Concurrent with the pilot, multi-phased phenomenological mixed method research is being conducted to gain an in-depth understanding of the ways in which the URM faculty and emeriti faculty experience the opportunities afforded by the project. The research is aimed specifically at the hypothesized effectiveness of using emeriti “majority” faculty (i.e., primarily white, male) as strategic mentors-advocates for URM faculty.

This paradigm and pilot network is intended to be a **novel complement** to prevailing approaches to supporting the retention, tenure and promotion of URM engineering faculty. The support model includes professional networking and advocacy by individuals who are uniquely situated to provide these resources—retirees. The new paradigm encompasses three domains of mentoring: (1) career development (emeriti faculty provide assistance in the retention, tenure,
and promotion of URM faculty); (2) sponsorship (emeriti faculty create opportunities for networking, exposure, and visibility with potential research collaborators, teaching scholars, and grant program officers by promoting their disciplinary expertise); and (3) coaching (emeriti faculty share their wisdom about the discipline and provide professional and personal advice in successfully navigating academic careers) (Kram, 1985a; Kram, 1985b; Zellers, Howard, & Barcic, 2008). These domains are critical to faculty in STEM fields as they establish their professional identities and progress in their careers (Cawyer, Simonds, & Davis, 2002; Lechuga, 2014). All of the activities will aid in URM faculty professional socialization and serve to widen networking opportunities through emeriti faculty making direct referrals and recommendations from personal, professional contacts, as well as their own experiences. The advocacy-networking paradigm encompasses specific tangible outcomes associated with participation. For example, retirees will make resolute efforts, as appropriate, to introduce URM faculty to potential research collaborators, project officers, and others who may be in a position to recognize the talent and expertise of the URM faculty participants.

Furthermore, there are indications that retired faculty can significantly supplement needed support for junior and mid-career faculty in a mutually beneficial manner. Retired faculty may appreciate the opportunity to support young scholars in their disciplines as a means of remaining active contributors to their respective fields and in engineering academia. Studies have shown that a key reason for reluctance to retirement is the concern with disconnecting from scholarly engagement (Conley, 2007; Ehrenberg, 2001; Finkelstein, Conley, & Schuster, 2016; Leslie & Conley, 2006). This concern is exacerbated within engineering, because it represents a field where continued engagement in scholarship has often been contingent upon resource-intensive measures such as maintaining significantly sized lab resources and student groups. Finally, retired faculty represent an under-tapped resource, since they have completed full careers and thus have some unique “longitudinal” perspectives as well as the discretionary time to convey these perspectives. The two stakeholder groups (i.e., URM and retired engineering faculty) thus have respective professional objectives served by advocacy that can transform the engineering faculty ecosystem.

This paper provides a detailed description of the implementation approach of the pilot effort, as well as emerging results, with successes and “lessons learned” (e.g., imposed frequency-of-contact requirements) that will help hone the initiative in future expanded renditions.

Project Implementation
IMPACT aims to engage renowned, retired engineering professors as a novel set of dedicated advocates for URM engineering faculty. The primary objectives are to aid the URM faculty through relationships with a new asset of senior supporters from their interest areas and to conduct initial research that will assess the effectiveness of the approach.

Matching participants and orientation-intervention: A group of emeriti faculty from a large engineering college has been enlisted as the initial cohort of senior experts. The emeriti engineering faculty are accomplished individuals across four engineering disciplines, have

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1 Advocacy is herein defined to include career counseling, as does effective mentoring, but it also involves assistance with professional networking and relaying opportunities that strategically benefit the URM engineering faculty.
sustained professional activities as emeriti, and are well-regarded by peers; **they thus can serve as advocates for the URM scholars endeavoring to network and establish a growing presence among professional peers.** The URM faculty were primarily recruited via a recently developed database of minority STEM faculty (i.e., the Academic and Research Leadership Network) as well as more “grass roots” efforts. Pairings were broached by the project leads primarily based upon sub-disciplinary commonalities of expertise (e.g., tribology, engineering structures, polymer engineering) to further assure mutual relevance. Ultimately seven emeriti faculty and eleven URM engineering faculty became participants.

An orientation was done which comprised an initial face-to-face meeting to establish expectations and allow participants an opportunity to develop some level of familiarity with each other and the members of the project team. It included a main session followed by breakout sessions. The primary purposes of the gathering were to remind and further acclimate the URM and emeriti faculty to the project’s goals, initially equip both sets of stakeholders to be good stewards of this mentoring networking-advocacy opportunity, and afford grouped participants an opportunity to engage each other in person and beyond any initial telecommunications. Finally, a milestone was an opportunity for all of the participants to reaffirm their initial commitment to the project scope and to their respective initial matches.

Despite the compelling commonality of scholarly interests by which the pairings were formed, there were natural “gaps” to be considered. There was no commonality of ethnicity between the emeriti (i.e., white males) and URM faculty (more than half of which are women). Additionally, there was a significant age gap given the stages of career between those partnered. Such natural gaps are the actuality of conditions in engineering academia should the paradigm of emeriti faculty advocates be embraced and scaled beyond this seed project. There was incentive to proactively intervene with enabling insights for both participant groups. The orientation thus included experts conveying to both stakeholder groups (i.e., emeriti and URM engineering faculty) what advocacy/effective mentoring is (e.g., establishing expectations of both sides of the mentoring relationship such as goals and frequency of contact; being good stewards of each other’s time) and sharing insights on how advocacy can be advanced in this context.

Beyond the general session there were breakout sessions. These were focused meetings between each emeritus faculty member and assigned URM faculty nominally for one hour. The primary purpose of the breakout sessions was to allow URM faculty members to articulate their situational context and unique circumstances. For example, a tenured, associate URM faculty would not necessarily want the same “coaching” attention as would a recent hire, but might rather emphasize facilitating “sponsorship” to leaders in the field as the URM faculty member moves toward full professorship. Given that same example, the participating emeritus faculty member could then be able to express the pre-requisite for his assistance with such networking (i.e., the emeritus faculty member may want to set some ground rules for this level of advocacy). The opportunity for candid discussion, inclusive of the in-person meeting dynamic, enabled the pairings to properly manage and target each other’s expectations.

Three requests of the breakout sessions were for the pairings to summarize amongst themselves what they would appreciate from the engagement, initially scope the URM faculty member’s plan of professional advancement, and agree upon a nominal frequency and mode of contact.
This was an attempted alignment with the three advocacy domains (i.e., career development, sponsorship, and coaching) (Kram, 1985a; Kram, 1985b; Zellers et al., 2008).

**Active advocacy:** Subject to mutually agreeable matchings being confirmed at the orientation, the active phase was launched. The groups were charged to communicate at least monthly (verbal dialogue, e-mail, etc.) with the URM scholars giving updates and receiving advisement and advocacy aligned with their professional progression plans. Areas of attention were primarily to include the following.

1. **Professional progression:** This entailed emeriti faculty conveying insights across an assortment of professional responsibilities such as teaching and scholarship, effective networking/engagement within the engineering societies, building a funded research program, and understanding the nature of academic leadership positions. As detailed, the emeriti engineering faculty were not only able to conceptually speak on these topics, but experientially as well. The specific group of emeriti faculty enlisted collectively have had prestigious careers that include teaching awards, volumes of high impact publications, highest honors within their respective professional societies, expansive research funding and instances of senior departmental leadership. Their renown could also aid extended networking needs of the URM engineering faculty.

   Effective networking has critical ramifications during the formative stages of a young scholar (i.e., graduate student, post-doctoral associate, junior faculty) or even progression as a mid-career faculty member. One’s recognition among peers in her or his discipline and sub-discipline can affect the provision to serve in scholarly activities (e.g., societal conference roles), being informed about domain-specific opportunities and, very poignantly, have a general presence within her or his technical community that facilitates strong external reviews during promotion and tenure processes. As referenced in the National Academies report (Johnson & Lucero, 2003), URM perceptions of a “chilly climate” can impose an additional barrier to this needed networking. Advocacy, however, can be the necessary means of connection.

   In addition to good scholarship (e.g., publications impact) and service, a critical difference for one’s recognition by, and collegiality with, others “in the field” can be the advocacy that a well-regarded predecessor provides. The matched faculty thus have a charge to further connect the URM faculty with “people and programs” that are appropriate and relevant. As an example, a URM faculty member may have a noteworthy publication that beckons the attention of a strategic expert in the field. If the retired faculty member perceives such and has a collegial relationship with the strategic third party, a recommendation may greatly facilitate that opportunity. As a tangible support, each emeritus-URM pairing received access to discretionary travel funds for them to periodically meet, inclusive of professional societal meetings and conferences wherein strategic connections can be made, or at least be coordinated in the usage of funds for strategic travel. This extended networking then compounds the benefit of the initial URM scholar-emeritus network, as shown in Fig. 1.
2. **Career/work life balance:** As appropriate, optional perceptions may also be given regarding stages of career work-life balance given the possibility of URM faculty having growing families and evolving personal demands. Entities such as the National Science Foundation and Alfred P. Sloan Foundation have given increased attention to this area of need in academia. As a number of faculty retirees consider their pre- and post-tenure years, they can reflect both professionally and personally; and thus can often offer experiential wisdom regarding the navigation of these two areas of life. **This provision is optional and subject to the mutual interests of both faculty.**

3. **Miscellaneous other “lessons learned”:** Additional insights may also be conveyed that would help the URM scholars achieve a fulfilling career in the engineering professoriate given more recent nuances (e.g., recently increased attention upon innovation and technology transfer in engineering academia, one of the enlisted emeriti faculty has notable expertise in “forecasting innovation pathways” for emerging technologies).

In addition to periodic telecommunications, there is again a provision for the matched groups to travel to meet in person such as at strategic professional conferences or technical meetings. All faculty members are thus given opportunities to engage in activities that are formal and informal involving both vertical (information flowing from advocate to URM scholar) and horizontal (exchange of ideas and collaboration) opportunities throughout the years.

**Concurrent Research Project Methodology**

A concurrent research project was designed to develop an in-depth understanding of the ways in which the IMPACT participants experienced the proposed mentoring and advocacy-network paradigm. A multi-phased phenomenological mixed method research design was used to explore the influence of the three domains of advocacy (career development, sponsorship, and coaching)—each phase of data collection served to inform the next data collection phase (Creswell, 2014). This paper shares the results to date on the first two data collection phases, the first qualitative interview and the first quantitative survey.
Qualitative Methods
A phenomenological qualitative research design was utilized to explore the influence of the three domains of the mentoring and advocacy-networking model (career development, sponsorship, and coaching). In this first phase, a phenomenological study approach was utilized to gain an in-depth understanding of the nature, meaning, and ways in which the IMPACT participants anticipated the value of the mentoring and advocacy-network paradigm (Hycner, 1999; Moustakas, 1994; Van Manen, 1990). Additionally, initial thoughts were gathered relative to the participants’ motivations and expectations for being a part of the project and concerns about potential cultural and generational gaps between the URM and emeriti faculty.

Participants
The participating respondents included six emeriti professors and 11 early- through mid-career URM engineering faculty in various engineering disciplines, such as aerospace, biomedical, chemical, industrial systems, and mechanical. The mentees were both female and male, with over half at the Associate Professor rank and the others at the Assistant Professor rank. All were employed at higher education institutions across the United States (Research 1, Historically Black Colleges and University, Ivy League, Comprehensive Research, and Baccalaureate). All emeriti professors serving as mentors were White, male, and retired from one Research 1 College of Engineering.

Data Collection
Upon obtaining Institutional Review Board approval, participants were provided with consent forms detailing the purpose of the study and the interview processes and procedures. The study employed maximum variation and purposeful/criterion-based sampling as both mentors and mentees of the IMPACT project were invited to participate in order to capture the holistic mentoring relationship experience (Patton, 2014). The interviews averaged 45 minutes in length, were digitally recorded, and were conducted through a one-on-one interview process to ensure data accuracy (Creswell, 2013). A semi-structured interview protocol was used that described the process of the interview and the areas to be explored. Adherence to the interview protocol ensured that questions were asked in a specific order and were carefully worded, and probing questions were embedded to provide opportunities to seek clarification and meaning (Creswell, 2013).

Data Analysis
Data analysis strategies established by Silverman (1993) and Stake (1995) were selected to examine the interview data. Silverman’s technique follows an inductive approach of data analysis in order to search for themes and patterns related to the research questions—this method is referred to as thematic content analysis. Using this technique, data were coded in a comprehensive process to identify cross-references between the data and the evolving themes while memoing (journaling), which allowed for flexibility when approaching research patterns in inductive ways (Frith & Gleeson 2004; Hayes, 1997; Silverman, 1993; Watt, 2007). For the organization of the thematic codes found in Silverman’s technique, Stake’s four-step deductive process was followed to report the themes. This process included direct interpretation, categorical aggregation, pattern recognition, and naturalistic generalizations (Creswell, 2013; Stake, 1995). Thus, both inductive and deductive analyses were employed throughout the data collection and analysis process, with coding in cycles, frequent reflection, and code revision.
Quantitative Methods
A cross-sectional survey design was utilized to provide a quantitative description of the efficacy of the IMPACT program from the participants’ perspectives (Fowler, 2009). The survey allowed for a descriptive examination of opinions on the mentoring and advocacy-network paradigm, with special attention upon how the quantity of contact mediates the quality of the relationships and the mentoring activities.

Survey Instrument
An online 35-item survey was developed for this study to gather opinions on the quality of the mentoring relationship; the mentoring received; the career development, sponsorship, and coaching activities engaged in; as well as the quantity of contact (Fowler, 2009; Sue & Ritter, 2012). The survey was based upon the first interview round in which participants were asked to share the mentoring and advocacy-networking paradigm activities planned in their mentoring matches. The survey was closed-ended with a mix of factual, categorical response options (Yes/No) and opinion, continuous response options (Likert-scales). The survey included an item on rating the quality of the individual relationship on a Likert-Scale of Below Average to Excellent. Additionally, the survey included four domains and corresponding individual statements on a Likert-scale of Strongly Disagree to Strongly Agree: (1) the mentoring relationship, (2) career development activities, (3) sponsorship activities, and (4) coaching activities.

Data Collection
Upon obtaining Institutional Review Board approval, all IMPACT participants were invited to complete the survey. The study employed maximum variation and purposeful/criterion-based sampling as both mentors and mentees of the IMPACT project were invited to participate in order to capture the holistic mentoring relationship experience (Patton, 2014). The survey completion window was open for one month. The purpose of the survey and the instructions were provided at the beginning of the survey, which required approximately 15 minutes to complete.

Participants
Ten of the 11 early- through mid-career URM engineering faculty completed the survey, as well as six of the seven emeriti faculty. The quantity of contact was gathered categorically and is displayed in Tables 1 and 2. Seven mentees reported contact with their mentors less than once per month, while three indicated at least once per month. All mentors reported contact less than once per month. The majority of communication occurred by email, followed by phone. Participants shared that most contact occurred spontaneously but found that planned communication was more useful. Last, the majority of mentees and mentors reported that the frequency met their expectations.

Data Analysis
A descriptive analysis of the survey data was completed to report the results. IBM SPSS Software was used for data screening, descriptive reporting, and disaggregated exploration. Data screening efforts demonstrated the data to be normally distributed and the outlier responses of
“not applicable” were removed from the analysis. Inferential analyses were not possible at this stage due to the small sample size.

Qualitative and Quantitative Trustworthiness
Multiple verification strategies ensured the findings of the two phases of data collection were credible, transferable, dependable, and confirmable (Anfara, Brown, & Mangione, 2002). In order to address credibility, cross-case synthesis was utilized throughout the analysis of each interview to examine whether the themes were cases of similar or different perspectives of URM and emeriti faculty participants (Hayes, 1997). Additionally, triangulation was achieved by merging the qualitative findings and quantitative results (Patton, 2014). To ensure transferability, thick, rich descriptions were utilized (Geertz, 1978), and participant saturation of the mentors and mentees were found to be indicative of the larger engineering professoriate (Patton, 2014). Dependability was addressed by evaluating how the themes represented the whole of the text through the data analysis technique employed (Silverman, 1993). Confirmability was ensured by validating themes in the early and late stages of data analysis (Miles, Huberman, & Saldaña, 2013).

Results-to-Date

Qualitative Interview Findings
The findings demonstrate the initial efficacy of the mentoring and advocacy-networking paradigm in supporting the career mentorship of URM engineering faculty by emeriti faculty. Two themes are highlighted, amongst others, to assess the value placed on URM faculty progression and emeriti faculty engagement.

Theme 1: Mentees view the IMPACT project as a means for career progression, and mentors see this as an opportunity to “give back” to a new generation of engineering faculty

The participants in the IMPACT mentorship program offered similar reasons for joining the National Science Foundation (NSF) study. All 11 mentees believed the program would aid in career progression through introductions to subject matter experts, connections to editors at high-profile research journals, and advice on the way in which to navigate tenure and promotion processes. Of particular interest, one mentee stated, “We should feel free to express and ask questions about a promotion process or career advancement that maybe I wouldn't feel comfortable asking people at my university or people that I don't know so well.” In this particular case, the mentee felt that the assignment of a mentor outside of her university provided an opportunity to inquire about promotion processes without encountering any university “politics”. Another mentee noted this:

I transitioned from an assistant professor to an associate professor, just recently, and knew that the goal … was to stay motivated, still highly productive, but desiring to broaden my horizons. You have a little bit more freedom so I felt like I needed someone who was more senior, more advanced, and someone who’d been through academe, one who could really provide some insight into what their experience was, and what others' experiences were . . . my motivation was to learn from others who have been down the administrative track, which I might be interested in.
When questioned as to the reasons the mentees thought the mentors agreed to participate, the mentees’ opinions aligned with the mentors’ responses. Both groups posited that the mentors’ reasons were due to a desire to give back to the engineering profession and to advance the careers of others.

Six emeriti professors provided a response of “giving back” when asked about their reasons for participating in the IMPACT study. One mentor stated,

It sounded like something I could possibly contribute to. One of the things that, as an older faculty member I have is a lot of experience, and I think that passing that on seems to be something I can certainly do fairly easily and that might actually help somebody. One mentor noted that his ultimate goal was to help in any way possible to advance his mentee’s international status as an expert in her field. Another mentor said, “What motivated me was the conviction that we just have to do a better job of diversifying our faculty and universities.” The mentor believed that every experienced professor in the engineering field is responsible for assisting in the diversification of the field.

Theme 2: In the mentoring relationship, the mentees desired sponsorship, whereas the mentors felt they could provide the most benefit through coaching

Of the mentees, 9 of the 11 felt mentor sponsorship would provide the greatest benefit to their careers. Specifically, the needed assistance in sponsorship was related to learning about journal submission processes, recommendations for conference presentations, and offering connections with federal grant officers. One mentee stressed this:

For me specifically, I would say I'm at a state in my career where the one big negative or hole in my CV or bio sketch is the lack of federal funding. If my mentor could give me tips on craftsmanship . . . that would be the greatest benefit.

Another mentee discussed the importance of sponsorship with faculty who already have federal grant funding. He believed that “Increasing my [grant] awareness and putting me in contact with some people who could better use my expertise, I think that would be a benefit to my career.”

Through hindsight upon their careers, the mentors felt the most significant aid each could provide involved coaching. One mentor believed he could assist in advice and stated, “Well, I would assume that some advice based on my own experience and my observation of other young faculty members will help.” Another mentor added this:

I think general advice, I've found in previous experience with other faculty that I've gotten close to, is sometimes just making a comment that's pretty clear to me, but wouldn't have been real clear to me when I was their age. That kind of comment can be very helpful to a young person . . . that kind of connection can be really, really useful. While the mentors were most interested in the coaching aspect of the mentoring relationship, the mentors did feel they could help in sponsorship. For example, one mentor said, “I’ve already connected one of my mentees to two faculty members that have an interest in her area of expertise . . . they are more experienced in the area so I’m expecting that to be a helpful research connection.”
Quantitative Survey Results
The following findings are re-iterations of the results reported in the National Science Foundation projects poster session for this conference’s procedures, as the results are relevant to both submissions.

Quality of their Mentoring Relationship
Mentees generally rated the quality of their mentoring relationship between average and good. However, when the mentee data was disaggregated by amount of contact, mentees with contact less than once per month reported the quality of their relationship as slightly less than average; those with communication at least once per month reported the relationship to be nearly excellent. Table 3 illustrates mentee responses on the quality of the mentoring relationship overall and by the amount of contact with mentors.

Mentoring Domain
In most cases, mentees agreed that their mentor was approachable, was an active listener, answered questions in a timely manner, provided constructive feedback, and had sufficient time to support the mentoring relationship. Yet, on average mentees disagreed that their expectations for the IMPACT program had been met, that they were in regular contact with their mentor, that their mentor benefited from the relationship, or that they utilized their mentor’s expertise. Those who were in contact with their mentors at least once per month shared more notably positive opinions on each measure of the mentoring relationship than those in contact less than once per month. Table 4 shows mentee opinions on the mentoring relationship domain overall and by the amount of contact with mentors.

Career Development, Sponsorship, and Coaching Activities
Mentees reported the most engagement in coaching activities, followed by career development and sponsorship. In the coaching domain, mentees agreed that their mentors shared information on their career successes and pitfalls, as well as provided new insights on an academic career and advice on academic career norms. In the career development domain, mentees agreed that their mentors provided advice relative to university committee work, as well as formal and informal expectations on promotion. In the sponsorship domain, mentees noted agreement that their mentors grew their professional networks. Yet, mentees disagreed that their mentors provided mentorship and support across most areas of the career development, sponsorship, and coaching domains. The trend in higher ratings of mentees in communication at least once per month continued across the domains. Table 5 provides mentoring and advocacy-networking activity responses by mentees overall and by the amount of contact with mentors.

Discussion
In the first phase of this study, the phenomenological interviews were useful in documenting the reasons the URM and emeriti faculty agreed to participate in the IMPACT project and for participants to share concerns relative to potential gaps between the mentoring matches. All mentees believed the program would aid in their career progression. Mentees were most interested in the sponsorship aspect, with specific interest in networking with potential research collaborators, editors at high profile journals, and federal grant officers. Thus, the mentoring paradigm domains of career development, sponsorship, and coaching appear to be critical areas
of mentorship desired by the URM faculty as they continue to establish their professional identities and progress in their careers (Cawyer et al., 2002; Johnson, 2015; Lechuga, 2014; Zellers et al., 2008). Mentors indicated they participated in the program to “give back” to the engineering field and to aid in the diversification of the engineering professoriate. Mentors were most interested in the coaching aspect of the program and felt their experience and insight could be of great benefit to the mentees. Neither mentees nor mentors believed cultural, gender, or generational gaps would hamper the mentoring relationship, as their shared academic interests would provide a natural bridge for any gaps.

As the project ensued, survey results demonstrated that IMPACT participants who had regular, planned contact rated the quality of the mentoring relationship and the mentoring received stronger than those who did not. An expansion upon this point and the preceding results, including tabular data, is provided in the complementary poster and executive summary, “A Mentoring Paradigm for URM and Emeriti Engineering Faculty: Does Quantity of Contact Determine the Quality of the Relationship for Mentees?” This citation was co-submitted to the present conference yet under the National Science Foundation’s Grantee’s poster track.

Promising components of the IMPACT project from the mentees point of view was mentors being rated high in approachability, active listening, answering questions in a timely manner, providing constructive feedback, and having time in which to mentor. Additionally, survey results noted that participants engaged in coaching activities at a higher rate than career development and sponsorship. The most often cited activities included advice on university service, information on expectations on promotion, and discussions on career accomplishments. While mentees found this information instructive, their foremost desire was to grow their professional network so they could cultivate research collaborators and gain access to federal grant officers and high-profile journal editors. These results coincide with much of the mentoring literature establishing that URM faculty socialization and successful tenure and promotion processes are bolstered by senior faculty mentorship (Berk, Berg, Mortimer, Walton-Moss, & Yeo, 2005; Johnson-Bailey & Cervero, 2003; Mullen & Hutinger, 2008; Stanley & Lincoln, 2005; Turner, 2003).

**Conclusion**

As a part of the present paper’s emphasis upon the implementation of IMPACT, it is clear that all mentoring matches would benefit from established guidelines of regular contact in order to facilitate success of the mentoring and advocacy-networking paradigm. If this were to occur, mentees could maximize the assistance they seek toward promotion and mentors could maximize their desire for continued engagement in the field. Such consistency of contact was initially tasked to the project participants at the orientation to permit sustainable self-governance; however, an added intervention may be to prescribe some minimal frequency requirement as a condition of involvement within the initiative.

This alternative mentoring and advocacy-networking paradigm holds promise in aiding in URM faculty career progression and emeriti faculty engagement. Through a phenomenological and survey approach, the findings support the need for URM faculty to have access to mentorship and socialization experiences in the tenure and promotion process. Additionally, the emeriti faculty commitment to diversifying the engineering professoriate through offering career
development, sponsorship, and coaching to their mentees supports URM retention in academia and also strengthens their role in the engineering discipline.

Acknowledgements
The authors wish to thank the National Science Foundation for its present support of the research depicted in the preceding paper (NSF Awards #1542728, #1542524).

Tables
Table 1

**Mentee Responses for Quantity of Contact by Percentage**

<table>
<thead>
<tr>
<th>Contact Questions</th>
<th>Never</th>
<th>Less than Once per Month</th>
<th>Once per Month</th>
<th>More than Once per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often are you in contact with your mentor?</td>
<td>-----</td>
<td>70%</td>
<td>20%</td>
<td>10%</td>
</tr>
<tr>
<td>Types of Communication</td>
<td>Phone</td>
<td>Email</td>
<td>Virtual</td>
<td>In Person</td>
</tr>
<tr>
<td>In what ways do you communicate?</td>
<td>25%</td>
<td>63%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>Frequency of Communication</td>
<td>Planned</td>
<td>Spontaneous</td>
<td>Both</td>
<td></td>
</tr>
<tr>
<td>How do your contacts occur?</td>
<td>30%</td>
<td>50%</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>Which is most useful?</td>
<td>60%</td>
<td>40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expectations of Communication</td>
<td>No</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does this frequency meet your expectation?</td>
<td>20%</td>
<td>80%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2

**Mentor Responses for Quantity of Contact by Percentage**

<table>
<thead>
<tr>
<th>Contact Questions</th>
<th>Never</th>
<th>Less than Once per Month</th>
<th>Once per Month</th>
<th>More than Once per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often are you in contact with your mentee?</td>
<td>-----</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Types of Communication</td>
<td>Phone</td>
<td>Email</td>
<td>Virtual</td>
<td>In Person</td>
</tr>
<tr>
<td>In what ways do you communicate?</td>
<td>33%</td>
<td>42%</td>
<td>8%</td>
<td>17%</td>
</tr>
<tr>
<td>Frequency of Communication</td>
<td>Planned</td>
<td>Spontaneous</td>
<td>Both</td>
<td></td>
</tr>
<tr>
<td>How do your contacts occur?</td>
<td>20%</td>
<td>40%</td>
<td>40%</td>
<td></td>
</tr>
</tbody>
</table>
Which is most useful? | 60% | 40%
---|---|---
Expectations of Communication | No | Yes
Does this frequency meet your expectation? | 40% | 60%

Table 3
*Mentee Responses for Quality of Mentoring Relationship by Contact with Mentor*

<table>
<thead>
<tr>
<th>Quality Questions</th>
<th>Overall</th>
<th>In Contact Less than Once per Month</th>
<th>In Contact at Least Once per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>How would you rate the quality of your mentoring relationship?</td>
<td>2.40</td>
<td>1.86</td>
<td>3.67</td>
</tr>
</tbody>
</table>

Note: The results are reported as an average on a scale of 1 to 4 (1 = below average; 2 = average; 3 = good; 4 = excellent).

Table 4
*Mentee Opinions on the Mentoring Relationship Overall and by Contact with Mentor*

<table>
<thead>
<tr>
<th>Questions</th>
<th>Overall</th>
<th>In Contact Less than Once per Month</th>
<th>In Contact at Least Once per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mentoring Domain</strong></td>
<td><strong>2.97</strong></td>
<td><strong>2.70</strong></td>
<td><strong>3.46</strong></td>
</tr>
<tr>
<td>My expectations for the IMPACT mentoring program have been met</td>
<td>2.78</td>
<td>2.50</td>
<td>3.33</td>
</tr>
<tr>
<td>I am in regular contact with my IMPACT mentor</td>
<td>2.56</td>
<td>2.17</td>
<td>3.33</td>
</tr>
<tr>
<td>I believe my mentor has benefited from our relationship</td>
<td>2.00</td>
<td>1.83</td>
<td>2.33</td>
</tr>
<tr>
<td>I have utilized my mentor’s expertise</td>
<td>2.89</td>
<td>2.83</td>
<td>3.00</td>
</tr>
<tr>
<td>My mentor is approachable</td>
<td>3.50</td>
<td>3.29</td>
<td>4.00</td>
</tr>
<tr>
<td>My mentor is an active listener in our conversations</td>
<td>3.29</td>
<td>2.75</td>
<td>4.00</td>
</tr>
<tr>
<td>My mentor answers my questions in a timely manner</td>
<td>3.13</td>
<td>3.00</td>
<td>3.67</td>
</tr>
</tbody>
</table>
My mentor provides me with constructive feedback 3.43 3.25 3.67

My mentor has enough time to support our mentoring relationship 3.17 2.67 3.67

Note: The results are reported as an average on a scale of 1 to 4 (1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree).

Table 5
*Mentee Mentoring and Advocacy-Networking Activity Responses Overall and by Contact with Mentor*

<table>
<thead>
<tr>
<th>Questions</th>
<th>Overall</th>
<th>In Contact Less than Once per Month</th>
<th>In Contact at Least Once per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Career Development Domain</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My mentor provides advice about advising students</td>
<td>2.42</td>
<td>2.29</td>
<td>2.81</td>
</tr>
<tr>
<td>My mentor provides advice about university committee work</td>
<td>1.83</td>
<td>2.00</td>
<td>1.50</td>
</tr>
<tr>
<td>My mentor provides me with teaching strategies/resources</td>
<td>3.29</td>
<td>3.00</td>
<td>3.67</td>
</tr>
<tr>
<td>My mentor has helped me develop stronger grant submissions</td>
<td>2.20</td>
<td>2.33</td>
<td>2.00</td>
</tr>
<tr>
<td>My mentor and I are collaborating on research</td>
<td>1.57</td>
<td>1.40</td>
<td>2.00</td>
</tr>
<tr>
<td>My mentor provides advice about publication outlets</td>
<td>2.22</td>
<td>2.00</td>
<td>2.67</td>
</tr>
<tr>
<td>My mentor provides me with information about formal expectations for promotion</td>
<td>3.00</td>
<td>2.60</td>
<td>3.67</td>
</tr>
<tr>
<td>My mentor provides me with information about informal expectations for promotion</td>
<td>2.75</td>
<td>2.20</td>
<td>3.67</td>
</tr>
<tr>
<td><strong>Sponsorship Domain</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.13</td>
<td>1.99</td>
<td>2.22</td>
</tr>
<tr>
<td>Statement</td>
<td>1.88</td>
<td>1.80</td>
<td>2.00</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>My mentor has recommended me for awards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My mentor has recommended me for invited talks</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>My mentor and I have attended a conference/seminar together</td>
<td>1.88</td>
<td>1.80</td>
<td>2.00</td>
</tr>
<tr>
<td>My mentor has grown my professional network</td>
<td>2.88</td>
<td>2.33</td>
<td>3.00</td>
</tr>
<tr>
<td>My mentor has served as an intermediary with journal editors</td>
<td>1.88</td>
<td>1.80</td>
<td>2.00</td>
</tr>
<tr>
<td>My mentor has introduced me to potential research collaborators</td>
<td>2.25</td>
<td>2.20</td>
<td>2.33</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coaching Domain</th>
<th>2.66</th>
<th>2.31</th>
<th>3.24</th>
</tr>
</thead>
<tbody>
<tr>
<td>I exchange professional confidences with my mentor</td>
<td>2.75</td>
<td>2.40</td>
<td>3.33</td>
</tr>
<tr>
<td>My mentor provides advice about academic social norms</td>
<td>2.75</td>
<td>2.40</td>
<td>3.33</td>
</tr>
<tr>
<td>My mentor has told me about his career successes</td>
<td>3.00</td>
<td>2.80</td>
<td>3.33</td>
</tr>
<tr>
<td>My mentor has told me about his career pitfalls</td>
<td>2.63</td>
<td>2.20</td>
<td>3.33</td>
</tr>
<tr>
<td>My mentor has provided me new insights to an academic career</td>
<td>2.75</td>
<td>2.40</td>
<td>3.33</td>
</tr>
<tr>
<td>My mentor has provided advice on strategies to balance my workload for promotion</td>
<td>2.25</td>
<td>2.00</td>
<td>2.67</td>
</tr>
<tr>
<td>My mentor has provided advice on administrative pathways</td>
<td>2.50</td>
<td>2.00</td>
<td>3.33</td>
</tr>
</tbody>
</table>

Note: The results are reported as an average on a scale of 1 to 4 (1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree).
REFERENCES


