Perceptions of Treatment for Underrepresented Minority Faculty in Engineering

Juan M Cruz
Dept. of Engineering Education
Virginia Tech
Blacksburg, Virginia, USA
juancruz@vt.edu

Indhira M Hasbun
Dept. of Engineering Education
Virginia Tech
Blacksburg, Virginia, USA

Stephanie G. Adams, PhD
Dept. of Engineering Education
Virginia Tech
Blacksburg, Virginia, USA

Joan M. Banks-Hunt
Dept. of Engineering Education
Virginia Tech
Blacksburg, Virginia, USA

Gilda A. Barabino
School of Engineering
CUNV City College
New York, New York, USA

***Abstract*- In this Work In Progress paper, we describe an NSF-funded research project designed to enhance the presence, socialization, retention and advancement of junior and mid-career university faculty from underrepresented minorities (URM) (i.e., African American, Native American, Pacific Islander and Hispanic Faculty) in engineering disciplines. The understanding behind this project is that to increase and sustain diversity in engineering, there is first and foremost, a fundamental need to increase diversity in faculty and enhance their career development; therefore, this project is developing and implementing a holistic array of career development initiatives for URM faculty. Although important conversations about race, inclusion and diversity are at the forefront of academic institutions around the country, preliminary results suggest that many of the circumstances that are potential barriers to URM faculty development still persist. Through this project, we are working to continue moving these conversations toward purposeful and deliberate actions and to research and analyze these perceived barriers to inform academic institutions, as well as interested constituents, of realities URM faculty face. This work-in-progress project is in the first year of the five years projected and it will continue to elaborate on a mixed method approach to answering the research questions while offering a yearly workshop that also integrates more than a decade of first-hand experience with the NSF Minority Development Workshop (MFDW).**

***Keywords*—** Diversity Concerns; Faculty development; Underrepresented Faculty

I. Introduction

Despite repeated calls for increased diversity in the engineering disciplines, women and certain ethnic and racial groups still remain profoundly underrepresented [2][3]. The numbers about this issue are overwhelming when referring to faculty members in engineering: the latest *Engineering by the Numbers* report released by the American Society for Engineering Education (ASEE) indicates that a mere 2.5%, 3.9% and 0.3% of engineering faculty are African American, Hispanics – including universities in Puerto Rico- and Native American, respectively [3]. These numbers, added to the fact that only 15.2% of engineering faculty members throughout the United States are females, makes the number of URM women faculty extremely low. Society today tend to believe that this lack of representation has several implications in engineering education like weakening mentoring processes for URM students, lesser attraction and retention of the increasing population of these minorities and deficiency of a diversified workforce [17].

If this lack of representation is not properly addressed it will likely be increasing. Given that is limited the gender and racial/ethnic diversity amongst engineering faculty, URM students are left with very few potential mentors they can identify with. Research has consistently shown the positive effects a faculty mentor plays in student's retention and persistence in STEM [6][12] and a lack of diversity amongst faculty restricts those URM students from the support of having a faculty role model who shares a common background. As such, it would follow that attrition rates of URM students – especially females- can be attributed, in part, to these disparities in the faculty body [8]. This phenomenon reinforces the need to break a never-ending cycle where URM students leave

This paper is submitted for review on Apr 25 2016. This work is supported by NSF EEC Grant No. 1444902 and No. 1444965

J. M. Cruz is a Ph.D student in the Engineering Education Department, Virginia Tech, Blacksburg, VA, 24060. (email: juancruz@vt.edu)

I. M. Hasbun is a Ph.D student in the Engineering Education Department, Virginia Tech, Blacksburg, VA, 24060. (email: imhasbun@vt.edu)

S. G. Adams is the Head of the Engineering Education Department at Virginia Tech, Blacksburg, VA, 24060. (email: sgadams@vt.edu)

Joan Banks-Hunt is a Ph.D student in the Engineering Education Department, Virginia Tech, Blacksburg, VA, 24060. (email: joaniebh@vt.edu)

G. A. Barabino is the Dean of the Engineering School, CUNY City College New York, NY. 100319101 (email: gbarabino@ccny.cuny.edu)

engineering, in turn thinning the pool of potential URM faculty that can serve as role models.

The above explains one of the reasons why important conversations about race, inclusion and diversity are at the forefront of academic institutions around the country. Our perspective to add value to these conversations is that to increase diversity in engineering there is, first and foremost, a fundamental need to increase diversity in faculty and enhance their career development. That is the fundamental reason why this ongoing project *Academic Career Enhancement for Underrepresented Faculty in Engineering* is both developing and implementing a holistic array of career development initiatives to enhance the presence, socialization, retention and advancement of junior and mid-career university URM faculty in engineering disciplines. To pursue this goal, this project is also researching individual experiences and systemic factors affecting the progression and advancement of these faculty members.

This work-in-progress project is in the first year of a five years project and will continue to elaborate on a mixed method approach to attain the research objectives while offering a yearly workshop that also integrates more than a decade of first-hand experience with the NSF Minority Faculty Development Workshop (MFDW) [11]

II. PURPOSE

The specific purpose of this paper is to present the preliminary results and emerging hypothesis of this ongoing project; our study suggest that despite the growing conversations and discussions about increasing diversity, many of the circumstances that are potential barriers to the URM faculty professional development still persist; professors of this community are still perceiving unconscious biases, stereotyping and discrimination towards them. These results also suggest that those barriers are not outwardly expressed, but rather arise implicitly and lead to perceptions of different and/or unfair treatment by colleagues and peers.

Furthermore, we argue that to enhance the success and advancement of URM faculty it is necessary to research and analyze these perceived barriers not only to inform academic institutions, and interested constituents, of realities URM faculty face but to project the development and implementation of tools for URM engineering faculty to face these challenges.

As previously noted, this ongoing research has the broader goal of contributing to the literature because the research examines elucidating factors that impact the experiences of underrepresented groups over time. Although we agree that the literature is broad in understanding diversity and the inclusion of minorities, we are expecting that the results of our research will provide deeper insights than those gleaned in previous studies. Often narrowly focused on obstacles to career progression and lacking inclusion of intragroup differences, earlier studies constrain the scope of research variables. With a broader scope, our research examines a) these omitted variables, b) individual and systematic factors that facilitate or hinder career progression, c) identification of intragroup experiential differences, and d) the impacts of past professional development experiences upon both opportunities and challenges facing URM faculty presently. The research team will use research findings and insights in annual MFDW design enhancements and implementation improvements

III. FRAMEWORK

The literature on professional development and trajectories of underrepresented minorities in science and engineering is marked by a paucity of studies that attend keenly to intragroup differences; that is, studies conducted to elucidate career advancement has the tendency to omit the benefits of disaggregating data based on gender, race/ethnicity, and other differentiating characteristics [7]. The latter is corroborated within the engineering education context where limited studies recognized intersectionality [13], a concept that Abbe and others have defined as “how socially constructed identities are experienced simultaneously, not hierarchically” [1]

To date, engineering has come a long way to include women and racial and ethnic minorities to a certain extent (as compared to previous years) but yet still fails to ignore how these multiple identities intersect [14]. Similarly, Abbe [1] has found that many researchers argue that the intersecting experiences of gender identity and racial/ethnic identity are deeply intertwined and cannot be looked at as mutually exclusive or as if the sum of the two makes the whole. Such unbalance in research has negative consequences, as claimed by Leggon [7] who argues that failure to disaggregate race/ethnicity data by gender, and gender data by race/ethnicity masks important intragroup distinctions and has negative implications for policies, practices, programs and institutions.

Additionally, our view is that to foster success in URM faculty’s career progression, faculty development approaches must have a holistic perspective; a point of view which understands that professors are situated within an adaptive and dynamic system that takes into consideration professional development opportunities, organizational policies, practices and culture, as well as, individual choices and decisions. To accomplish the purpose of our project, we have borrowed the holistic approach from Magrane et al [9]. Their *Systems of Career Influences Model* (SCIM) for faculty development in academic medicine provides a systems-based model specifically designed to identify research questions to probe and explore factors influencing persistent inequities in faculty career development and to evaluate the role of professional development activities. We are also influenced by the work of Mahoney et al [10] that examined career experiences of minority faculty in academic medicine through their own lenses.

IV. METHODS

Recognizing that over time there are multiple and interrelated influences on a faculty member's career path -as illustrated in the SCIM- and that women and minority faculty have varied experiences, we crafted three overarching research questions to identify variables influencing career progression nuanced by individual backgrounds and professional experiences, these questions are:

- What individual and systemic factors are facilitating and/or hindering the progression and advancement of URM faculty members?
- What are the salient intragroup differences in the experiences of URM faculty?
- How do URM faculty members' past professional development experiences impact their present-day responses to professional challenges and opportunities?

To answer these questions, we have planned to conduct a mixed-method analysis [5] of the factors influencing the career trajectories of underrepresented faculty members. Data will be collected within the context of the annual symposium. Quantitative data will be collected by surveys administered prior to the start of the symposium, whereas qualitative data will be collected following a phenomenological approach [4] with focus group sessions and follow-up interviews.

Data presented in this paper was collected within the 3-day workshop held in Arlington, VA, September 2015. In this meeting, 40 participants (respondents to our survey were 12 females, 18 males; 20 African-Americans and 10 Hispanic/Latinos) of seven different nationalities engaged in activities and workshops where a number of issues were addressed including: i) becoming a tenured professor, ii) advancing beyond tenure, and iii) funding and publishing opportunities. Some sessions were held in parallel as a means of presenting content-specific agendas to both young (21 of 30 respondents were assistant professors) and mid-career level participants (e.g. getting tenured vs getting full professorship). Moreover, gender and racial/ethnic affinity groups -also held in parallel- were incorporated in the agenda as means of discussing issues germane to each group. Gender affinity groups (males and females) were held the first day and race/ethnicity affinity groups (African American and Hispanic) were held the second day. In spite of efforts to recruit Native Americans, only one individual from this ethnic background signed up for the symposium. However, the individual of Native American decent later withdrew attendance. To analyze survey data collected, our research team utilized *IBM SPSS* software for analyzing descriptive statistics.

Self-reported data from URM Engineering Faculty suggest that many of the circumstances that are potential barriers to their professional development still persist: in the initial survey, 23 out of the 30 professors established that they were treated differently because of their race or ethnicity (see table 1)

TABLE I. NUMBER OF FACULTY MEMBERS THAT PERCEIVED BEING TREATED DIFFERENTLY BECAUSE OF THEIR RACE OR ETHNICITY

Gender	**Race/Ethnicity**		
	Hispanic	***African-American***	***Total***
Male	5	8	13[a]
Female	3	7	10[a]
Total	8[b]	15[b]	23

[a] 13 of 18 Male and 10 of 12 female faculty.
[b] 8 of 10 Hispanic and 15 of 20 African-American faculty
[c]

On the other hand, 10 out of the 30 professors recognized that they were treated differently because of their gender (see table 2)

TABLE II. NUMBER OF FACULTY MEMBERS THAT PERCEIVED BEING TREATED DIFFERENTLY BECAUSE OF THEIR GENDER

Gender	**Race/Ethnicity**		
	Hispanic	***African-American***	***Total***
Male	1	0	1[b]
Female	7	2	9[b]
Total	8[a]	2[a]	23

[a] 1 of 18 Male and 9 of 12 female faculty.
b. 8 of 10 Hispanic and 2 of 20 African-American faculty

Although the perception of unfairness is less strong than the perception of differences in treatment, some results are salient and show dissimilarities between the minorities: 8 out of the 30 professors showed that they were treated unfairly in terms of funding opportunities (see table 3); likewise, 8 out of the 30 faculty members expressed that they were treated unfairly in terms of departmental service (see table 4). Similar patterns occurred when participants were asked about other perceptions, 9 established unfair treatment in their teaching assignments and 9 in their performance reviews (see tables 5 and table 6 respectively). All these results imply that 13 of 30 participants -almost half of our sample- perceived unfairness in their treatment.

TABLE III. NUMBER OF FACULTY MEMBERS THAT PERCEIVED BEING TREATED UNFAIRLY IN TERMS OF FUNDING OPPORTUNITIES

Gender	**Race/Ethnicity**		
	Hispanic	***African-American***	***Total***
Male	3	1	4[a]
Female	2	2	4[a]
Total	5[b]	3[b]	8

[a] 4 of 18 Male and 4 of 12 female faculty.
[b] 5 of 10 Hispanic and 3 of 20 African-American faculty

TABLE IV. NUMBER OF FACULTY MEMBERS THAT PERCEIVED BEING TREATED UNFAIRLY IN TERMS OF DEPARTMENTAL SERVICE

Gender	Race/Ethnicity		
	Hispanic	*African-American*	*Total*
Male	0	3	3[a]
Female	1	4	5[a]
Total	1[b]	7[b]	8

a. 3 of 18 Male and 5 of 12 female faculty.
b. 1 of 10 Hispanic and 7 of 20 African-American faculty

TABLE V. NUMBER OF FACULTY MEMBERS THAT PERCEIVED BEING TREATED UNFAIRLY IN TERMS OF TEACHING ASSIGNMENTS

Gender	Race/Ethnicity		
	Hispanic	*African-American*	*Total*
Male	1	5	6[a]
Female	1	2	3[a]
Total	2[b]	7[b]	9

a. 6 of 18 Male and 3 of 12 female faculty.
b. 2 of 10 Hispanic and 7 of 20 African-American faculty

TABLE VI. NUMBER OF FACULTY MEMBERS THAT PERCEIVED BEING TREATED UNFAIRLY IN TERMS OF PERFORMANCE REVIEWS

Gender	Race/Ethnicity		
	Hispanic	*African-American*	*Total*
Male	3	3	6[a]
Female	1	2	3[a]
Total	4[b]	5[b]	9

a. 6 of 18 Male and 3 of 12 female faculty.
b. 4 of 10 Hispanic and 5 of 20 African-American faculty

V. DISCUSSION

Although we recognized that the total number of participants is low compared to the population of URM faculty, and therefore, there is not enough data to examine fairly statistical generalizability; it is noteworthy that more than two-thirds of the participants are still experiencing unconscious biases, stereotyping or discrimination towards them manifested as different and/or unfair treatment by colleagues and peers. Discussions within the affinity group sessions also suggest that those barriers are not outwardly expressed, but rather arise implicitly and that there were reasons to believe that these barriers were directly related to individuals' gender, race or ethnicity. Although inequities can occur in non-minority faculty, is salient the fact that these inequities occur in the first sample of URM faculty.

VI. FUTURE WORK

We are employing open-coding strategies to analyze the qualitative data. Open-coding is a process in which data gets broken down into discrete parts or "concepts" and are assigned properties and dimensions [15]. We are going through the transcript of the affinity groups sessions and identifying sentences in which participants described experiences or instances relevant to the answer of Research questions. This process of discovering "significant statements" is what the phenomenological researcher Moustakas [16] calls "horizontalization". Next, we will proceed to classify those statements into broad categories or clusters based on similarities between statements, [15][16]

The final steps in our analysis will include axial coding and member checking. Axial coding is the process through which categories and sub-categories are related [15], however, the categories we have identified so far are limited and we ultimately recognized the need to collect more data in order to develop sub-categories and establish definitive relationships amongst them. Member checking will be a fundamental piece of the study given that we are aiming at providing a description based on the participants' lived experiences. Analyzed data will be discussed with participants and their feedback obtained on whether or not they feel like the results are accurately depicting their collective opinions [4][15]

Finally, before the execution of the second workshop, we are going to revise the surveys and affinity group protocols to gain deeper insights in our research.

ACKNOWLEDGMENT

This ongoing project is supported by the National Science Foundation EEC Grant No. 1444902 and No. 1444965. The P.Is of this collaborative grant are Dr. Gilda Barabino, CCNY's Dean of Engineering and Dr. Stephanie Adams, Virginia Tech's Head of the Engineering Education department. Any opinions, findings, and conclusions or recommendations expressed in this material are these of the authors and do not necessarily reflect the views of the National Science Foundation.

REFERENCES

[1] E. S. Abes, S. R. Jones, and M. K. McEwen, "Reconceptualizing the model of multiple dimensions of identity: The role of meaning-making capacity in the construction of multiple identities," *Journal of College Student Development*, vol. 48, no. 1, pp. 1–22, 2007.

[2] "ASEE: Action on diversity," in *Year of action on diversity*, 2014. [Online]. Available: http://diversity.asee.org/. Accessed: Apr. 17, 2016.

[3] B. L. Yoder, "Engineering by the numbers," 2012. [Online]. Available: https://www.asee.org/papers-and-publications/publications/14_11-47.pdf. Accessed: Apr. 17, 2016.

[4] J. W. Creswell, Qualitative inquiry and research design: Choosing among five approaches: Sage, 2012.

[5] R. B. Johnson, A. J. Onwuegbuzie, and L. A. Turner, "Toward a definition of mixed methods research," *Journal of Mixed Methods Research*, vol. 1, no. 2, pp. 112–133, Apr. 2007.

[6] Y. K. Kim and L. J. Sax, "Are the effects of Student–Faculty interaction dependent on academic major? An examination using multilevel modeling," *Research in Higher Education*, vol. 52, no. 6, pp. 589–615, Jan. 2011.

[7] C. B. Leggon, "Diversifying science and engineering faculties: Intersections of race, ethnicity, and gender," *American Behavioral Scientist*, vol. 53, no. 7, pp. 1013–1028, Feb. 2010

[8] G. Lichtenstein, H. L. Chen, K. A. Smith, & T. A. Maldonado, (2014). "Retention and Persistence of Women and Minorities Along the Engineering Pathway in the United States" in *Cambridge Handbook of Engineering Education Research*, Cambridge, 2014, (pp. 311-334)

[9] D. Magrane *et al.*, "Systems of career influences: A conceptual model for evaluating the professional development of women in academic

medicine," *Journal of Women's Health*, vol. 21, no. 12, pp. 1244–1251, Dec. 2012.

[10] M. R. Mahoney, E. Wilson, K. L. Odom, L. Flowers, and S. R. Adler, "Minority faculty voices on diversity in academic medicine: Perspectives from One school," *Academic Medicine*, vol. 83, no. 8, pp. 781–786, Aug. 2008.

[11] "National institute for faculty equity," National Institute for Faculty Equity, 2015. [Online]. Available: http://serc.carleton.edu/facultyequity/index.html. Accessed: Apr. 17, 2016.

[12] M. Ong, C. Wright, L. Espinosa, and G. Orfield, "Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics," *Harvard Educational Review*, vol. 81, no. 2, pp. 172–209, Jun. 2011.

[13] M. C. Paretti and L. D. McNair, "Analyzing the intersections of institutional and discourse identities in engineering work at the local level," *Engineering Studies*, vol. 4, no. 1, pp. 55–78, Apr. 2012.

[14] D. Riley, A. E. Slaton, and A.L. Pawley, "Social Justice and Inclusion: Women and Minorities" in *Cambridge Handbook of Engineering Education Research*, Cambridge, 2014, pp. 335-355.

[15] J. M. Corbin and A. Strauss, *Basics of qualitative research: Techniques and procedures for developing grounded theory*. United States: Sage Publications, 2014.

[16] C. E. Moustakas, *Phenomenological research methods*, 6th ed. Thousand Oaks, CA: SAGE Publications, 1994

[17] D. E. Chubin, G. S. May, and E. L. Babco, "Diversifying the engineering workforce," *Journal of Engineering Education,* vol. 94, pp. 73-86, 200