Exploring Institutional Retention Support Initiatives for Retaining Women of Color STEM Faculty

Dr. Tonisha B. Lane, Virginia Tech

Dr. Lane's research agenda broadly examines diversity, equity, and inclusion in postsecondary education with the objective of advancing inclusive and transformative policies and practices. Her primary research strand investigates the experiences and outcomes of underrepresented groups in science, technology, engineering, and mathematics (STEM). Using qualitative methodologies, she has explored access and success for underserved students of color in STEM and STEM intervention programs. This line of research also seeks to understand the nuances and complexities of participation and persistence in these fields and develop new models for explaining such phenomena. Her secondary research strand focuses on the participation and achievement of Black students and professionals in higher education. She is the PI or co-PI on several grant-funded research projects including the national Black Doctoral Women Study (BDWS), the Women in Engineering Study (WIES), and Bulls-Engineering Youth Experience for Promoting Relationships, Identity Development, & Empowerment (Bulls-EYE PRIDE).

Dr. Johnny C. Woods Jr., Virginia Tech

Johnny C. Woods, Jr. is a Postdoctoral Associate in the School of Education at Virginia Tech, working on an NSF AGEP project that focuses on issues relating to the recruitment, retention, and promotion of Women of Color STEM faculty.

Natali Huggins, Virginia Tech

Natali Huggins is a Ph.D. in Higher Education from Virginia Tech. She holds a master's in public administration from the National Experimental University of Táchira in Venezuela. In addition, she has several years of experience in higher education administration and internal audit in Venezuela. Her international experience brings global and multicultural perspectives to her views as a researcher and practitioner. Natali's research interests include diversity equity and inclusion in graduate education, students' journey, motivation, and socialization. She is particularly interested in understanding and supporting international and Latinx graduate students' agency and persistence to navigate higher education in the United States.

Samuel Asare Darko
Faika Tahir Jan
Dr. Saundra Johnson Austin, Charis Consulting Group, LLC

Dr. Saundra Johnson Austin has dedicated her career to promoting diversity, equity, inclusion, and belonging of elementary, middle, and high school students in science, technology, engineering, and mathematics (STEM) education and careers. Her research is grounded in the effective implementation of STEM curricula in urban middle schools. She has published and presented on STEM education and organizational change. Dr. Johnson Austin earned a Bachelor of Science in Civil Engineering from The Pennsylvania State University, a Master's in Business Administration from the University of Notre Dame, and Doctor of Education in Organizational Change and Leadership from the University of Southern California.

At the University of South Florida (USF) she leads the project coordination for the National Science Foundation Florida Alliance for Graduate Education and the Professoriate (FL-AGEP), a $2.4M award to Florida A&M University (with a subaward to USF and Virginia Tech), Bethune-Cookman University, Florida International, and Florida Memorial University. Also, Dr. Johnson Austin is the project coordinator and Co-Principal Investigator for the USF Project Racism In School Exclusionary Suspensions (RISES), a $30k grant awarded to explore the suspensions of African American middle and high school students in Hillsborough and Pinellas County Florida.

Dr. Johnson Austin held positions as: math faculty at Academy Prep Center of Tampa; executive director of Curated PathwaysTM to Innovation; senior vice president for operations at the National Action Council for Minorities in Engineering, Inc.; president and CEO of St. Michael's High School; executive

vice president of the Community Partnership for Lifelong Learning; executive director of the National Consortium for Graduate Degrees for Minorities in Engineering and Science; and Minority Engineering Program director at The Pennsylvania State University. She began her career as a cost engineering at Bechtel Power Corporation. In 2007 she founded Charis Consulting Group, LLC.

Dr. Johnson Austin was recognized by numerous organizations for her work in promoting equity and access to STEM education. Her most notable award is the 2015 Outstanding Engineering Alumnus in Civil and Environmental Engineering from The Pennsylvania State University. In addition, she was awarded the 2004-2005 Selected Professions Fellowship by the American Association of University Women (AAUW). Dr. Johnson Austin was awarded in 2007 the Strengthening Our Communities Inaugural Community Educational Leadership Award at the 2nd Annual Celebrate Literacy Conference. In 1998, she was recognized with the National Society of Black Engineers' (NSBE) Inaugural Golden Torch Award for Minority Engineering Program Director of the Year and the Outstanding Contribution by a Minority Engineering Program Administrator Award by the National Association of Multicultural Engineering Program Advocates (NAMEPA).

She is a member of various STEM organizations including the United States White House endorsed initiative under the Obama Administration, Algebra by 7th Grade, and advisory committee member for the Smithsonian Science Education Center's 'Zero Barriers in STEM Education.' Dr. Johnson Austin is currently the President of the American Association of University Women Tampa, Inc., consultant to the board for the Caribbean Community Association of Tampa, and Treasurer for the Northeast STEM Starter Academy of Mount Vernon, NY.

Dr. Johnson Austin is a member of the editorial review board for the Caribbean Educational Research Journal (CERJ). She also served as a reviewer for the National Science Foundation's CS for All Pathways, HBCU-Up, INCLUDES Conference and INCLUDES Launch Pilot.

She enjoys doing yoga, spending time on the beach, and mentoring young girls and women in STEM studies and careers.

Dr. Lidia Kos, Florida International University

Dr. Lidia Kos is currently Professor of Biology, Associate Dean of the University Graduate School and Associate Vice President of the Office of Research and Economic Development at Florida International University (FIU). She received a BS in Biology from Universidade Federal do Rio de Janeiro, Brazil and a PhD in Neurobiology from UC Berkeley. She was a Fogarty Fellow at NIH where she did post-doctoral studies. Her research focuses on development and pathogenesis of pigment cells. She uses mouse molecular genetics to understand the molecular basis of neural crest differentiation and melanoma. She has extensive experience teaching undergraduate and graduate students in cell, developmental and molecular biology. She has mentored numerous undergraduate and graduate students as well as postdoctoral fellows in her laboratory. In the Graduate School she oversees over 9.000 students in masters, specialist and doctoral programs. She is responsible for all academic and administrative matters related to graduate education at FIU. She has served as the Executive Editor for the journal Pigment Cell and Melanoma Research and is currently in its editorial board. She has served as a member of grant review panels for NSF, NIH, and AHA and is currently on the NIGMS TWD review panel. She has been funded by NIGMS, NIAMS and AHA and is currently the PI of FL-AGEP and co-PI of an NIGMS T32 and NS BD training grants at FIU.

Exploring Institutional Retention Support Initiatives for Retaining Women of Color STEM Faculty

Introduction

Although women's representation has generally increased in some STEM fields in the professoriate [1], Women of Color (WOC) still face unique challenges due to unfavorable institutional climates [2], microaggressions based on race and gender [3], and hostile departmental climates [4]. As a result, WOC experiences chilly work environments [5], including isolation and tokenism [6]. While the literature on the challenges incurred by WOC STEM faculty is significant, these challenges are operationalized within the institutional context, wherein the problem of underrepresentation of WOC STEM faculty continues to persist [1], [7], [8]. As such, it is essential to deeply examine institutional structures and actions to upend WOC STEM faculty's unique challenges. Institutional transformation and support structures are critical to retaining WOC faculty [9]. WOC STEM faculty experience a sense of relevance to institutions when support initiatives recognize their unique identity [1]. Retention is an essential bridge between recruiting and promoting WOC STEM faculty within the institutional context. However, to date, little empirical research exists on the retention of WOC in STEM [8].

Specific to retaining WOC STEM faculty positions, most interventions and research are supported by award funding from various organizations. They often are directed to women without considering WOC's unique challenges. For example, ADVANCE is a fund that invests in faculty success by exploring and establishing institution-based support programs and strategies to enhance the climate and institutional context encountered by faculty women in engineering [10]. These initiatives may warrant a different structure at different institutions, such as minority-serving institutions (MSIs), in keeping with institutional missions and demographics. Specific to MSI, Allen et al. [11] proffered that institutional transformation must assist women faculty in STEM by providing support to develop writing and research skills, networking, and professional development to enhance their scholarly productivity and, consequently, their retention in STEM. Therefore, using Griffin's [12] institutional model for increasing faculty diversity as a guiding framework, we undertook this qualitative case study to examine institutional support structures for retaining WOC STEM faculty at MSIs.

Theoretical Framework: Institutional Model for Increasing Faculty Diversity

We used Kimberly A. Griffin's [12] Institutional Model for Increasing Faculty Diversity to analyze the emergent data in this study. The model is a multidimensional framework that identifies bottlenecks in faculty of color hiring and retention in the U.S. institutional contexts. Griffin's [12] model outlined four institution levels that need interventions: institutional context, faculty recruitment, transition, and retention. According to Griffin [12], faculty retention is a process that is both linear and interrelated. It can be achieved with a broad commitment and investment in the hiring, transition, and institutional context to achieve diversity and WOC faculty retention goals [12].

Further, Griffin [12] identifies three typologies for retaining faculty of color: *professional development*, *satisfaction* and *support,* and *advancement*. Professional development refers to the continuing opportunities for faculty of color for skill enhancement, training in mentoring,

workshops, conferences, and research opportunities. Satisfaction and support pertaining to creating a positive environment for faculty of color, ensuring access to resources, community building, and resolving any issues of bias or discrimination. Advancement corresponds to the need for institutions to provide opportunities for career advancement and leadership roles for faculty of color, providing clear pathways for promotion and tenure, creating leadership development programs, equal access to opportunities for research funding and collaborations required to advance their careers and perform better with a feeling of being valued, supported, and included in the institution. Griffin [12] contends that this model can help analyze institutional and departmental interventions for retaining faculty of color in academia. Therefore, in applying this framework in our study, we focused on three typologies for retaining faculty of color to explore how institutional practices and structures specifically support the retention of WOC faculty in STEM.

Literature Review

We used the primary tenets of the Institutional Model for Increasing Faculty Diversity [12] to frame our literature review. To this end, the scholarship on professional development shows that mentoring and counterspaces are essential to helping WOC faculty transition into their roles and providing them with refuge amid challenging institutional and departmental environments. WOC are satisfied with their faculty positions when they are provided adequate support and resources and family-oriented policies are present. They also seek out leadership roles to improve equity in the academy. Studies focusing on advancement show that support structures for successful careers vary based on race or ethnicity. Despite the increasing research on WOC, we need to learn more about the unique role MSIs may play in supporting WOC faculty retention. Thus, we conclude the literature review with a discussion on MSIs.

Professional Development

Professional development, broadly defined, encompasses activities that include mentoring [13]. The various types of professional development, whether formal, informal, or nonformal, enhance the skill levels of individuals, groups or programs, departments, divisions, and associations. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) describes formal, informal, and nonformal as active or intentional training, skills training or learning by doing, and training and orientation programs [14], respectively [15], [13]. Professional development improves job performance, expands professional networks, and builds mentor relationships.

In higher education, mentoring and professional development facilitate the transition and advancement, particularly for doctoral candidates, postdoctoral associates, and early career faculty WOC in STEM [16]. Women account for 21.7% of faculty positions in STEM fields [17]. Furthermore, WOC accounted for 3.6%, 2.5%, and 1.2% of all assistant, associate, and full professors, respectively [18]. Socio-cultural and institutional barriers to the STEM disciplines continue for women in higher education. West [19] studied Black women professionals in higher education. She determined that their skills, knowledge, and competencies were essential to their success in the workplace. Crutcher [20] recognized ongoing, intentional, and mutually enriching relationships with someone of different race, gender, ethnicity, religion, cultural background, socioeconomic background, sexual orientation, or nationality as cross-cultural mentoring. A study conducted by McGee et al. [21] well documented that academic persistence can lead to an intact psychological self. Disenfranchised individuals can be their whole selves when

counterspaces are presented as options [22]. Spaces of safety, survival, or refuge were understood to be counterspaces [22]. “These spaces may exist in physical structures or include the presence of participants in an organization that advance the needs of a certain racial or ethnic group” [23, p. 23].

Satisfaction and support

August and Waltman's [24] asserted that women faculty members' motivation and satisfaction were strongly influenced by how they felt about their professional life. Specifically, for women faculty, the degree of influence they had over their career advancement, research, and service responsibilities determines how satisfied they were as faculty members. Job dissatisfaction significantly affected faculty members' "desire to resign" and moderated other factors like salary sufficiency and level of authority [24]. Soto [25] argued that the promotion and tenure process could be complicated for WOC in STEM since they frequently experience biases and unfair treatment. Soto [25] further argued that to excel professionally, WOC in STEM must negotiate these difficulties to overcome systemic barriers through networking, actively looking for mentorship, and developing a solid research agenda [25]. Further, studies like Lisnic et al. [26] and Medina [27] generally agree that supporting and mentoring WOC faculty improved their chances of getting a promotion or tenure. However, WOC faculty reported poor levels of job satisfaction due to a lack of support from their senior colleagues, specifically men colleagues [26], [27].

Other studies point to resources and services, family-oriented policies, and opportunities to serve in leadership roles as critical to WOC faculty job satisfaction. For example, Nduagbo [28] discovered that accessibility to services and resources, influential mentors, family-centered cultural orientation, and family support had benefited Black women faculty job satisfaction. Insidious sexism, gender norms, underrepresentation, and racism were all detrimental factors in motivation and job satisfaction for this population. Black women faculty also grappled with issues related to promotion and tenure, building rapport with students, and the intersection of race and gender within faculty, staff, and administration [28]. Beyond assuming faculty responsibilities, Hannum et al. [29] found that WOC faculty were satisfied with the benefits of holding a leadership position and "making a difference." They also discovered that WOC faculty were less likely than their White women counterparts to be given leadership positions and were subject to more scrutiny and criticism. The experience of counter-veiling—having influence and a part in influencing policy—was a tremendous motivator for WOC faculty. Being able to speak out for individuals frequently left out of strategic discussions and choices was the specific advantage WOC acknowledged pursuing and claiming for themselves [29].

Advancement

Various studies have focused on WOC's challenges in academia. Some of those challenges included the hidden curriculum, power dynamics, excessive service, and teaching load, insufficient mentorship opportunities, lack of support, wage disparities, health and well-being detriment criticism, and stereotyping [30]-[33], [1], [34], [35]. Recently researchers have focused on understanding how WOC advances in academia despite the negative impact of those challenges. Martinez et al. [34] highlighted how WOC turned to self-care strategies to protect their mental health and wellness during the tenure process. In the case of wage disparity, McGee et al. [35] exposed how WOC decided not to negotiate their salaries, resulting in wage gaps.

They contended this approach enabled them to protect their well-being and not be a target of criticism in their institutions.

Regarding support for advancement, a qualitative study by McGee et al. [21] explored the persistence of WOC in engineering faculty positions and how institutional and non-institutional support allowed them to persist in their career. Receiving voluntary mentorship, academic guidance, teaching and publication advice -institutional support- and support for outside mentorship from doctoral peer groups, academic advisors, professional ethnic-based organizations, and faith-based support played a critical role in their career advancement. Moreover, [21] revealed how WOC might look for a distinctive source of support depending on their race and ethnicity. For example, Black women shared the role of spirituality and faith-based support in their career advancement. Looking for church support and God to help them navigate and understand academic challenges and frustration.

On the other hand, Latinas' connections with ethnic-based professional organizations allowed them to create a network of support outside their department. Lastly, Asian women appreciated having a network in their institution and connecting through teaching and research. In sum, this study demonstrated a diverse array of support that WOC enact when navigating their academic career.

WOC Faculty at MSIs

MSIs are one of the fastest-growing sectors within higher education [36]. They enroll a higher number of students than non-MSIs. They tend to have open admission policies, higher enrollment among low-income students, and more significant numbers of students of color. They also tend to have fewer resources than non-MSIs, but a more excellent representation of students of color who earn STEM degrees [37]. For STEM WOC faculty, this may translate into increased teaching and service loads in addition to demands to research productivity. Despite these circumstances, WOC STEM faculty report an interest in serving in these institutions because of their culturally affirming environments and the potential to impact students from similar backgrounds (e.g., race/ethnicity, gender, lower income) [11], [4], [38]. Further, our study considered these dynamics when investigating institutional structures that support WOC STEM faculty at MSIs.

Methods

The current study is part of a more extensive national study investigating recruitment, retention, and advancement efforts for WOC STEM faculty at research universities in the United States. Participants in the more comprehensive study include administrators, department chairs, and faculty. For the current study, we focused on the voices of WOC STEM faculty at three MSIs in the United States. We analyzed their semi-structured interview data to better understand their experiences with institutional structures that support WOC faculty retention. The research question that informed this study was: How do institutional structures contribute to the retention of WOC STEM faculty? What elements support their professional development, satisfaction and support, and advancement?

Study Context

The current study includes three institutions, a Hispanic Serving Institution (Campus A), a Historically Black University (Campus B), and another Minority-serving Institution (Campus C). Institutions defined as Other Minority-Serving Institutions do not fit the definition criteria of Asian, Native American, and Pacific Islander Institutions (ANAPISIs), HBCUs, HSIs, and Tribal Colleges and Universities. However, minority undergraduates include at least 50% of the total enrollment of undergraduate students [36]. Additionally, Campus A and B held Carnegie Classification as research universities with very high research activity (R1), and Campus C was classified as a research university with high research activity (R2).

Case Site Selection

We identified Campus A and B based on their NSF ADVANCE grant status within the last six years. The ADVANCE grant increases the representation and advancement of women in science and engineering careers in academia that contribute to developing a more diverse science and engineering workforce [10]. ADVANCE takes an intersectional approach to developing and institutionalizing initiatives that address systemic inequities that impede women and people of color from persisting and being promoted in these fields. We elected to target institutions with ADVANCE grants because of their intentional focus on organizational change, namely improving policy, practice, and culture in ways that support women's careers in academia. We also assumed that these institutions would perform better in terms of structural diversity (i.e., ample representation of WOC faculty). Campus C was selected through snowball sampling. Snowball sampling entails a researcher asking participants, who meet the criteria of a study, to identify other potential participants [39]. To this end, upon sharing the purpose and scope of this study with WOC in STEM in the field, these professionals invited participants who fit the study's criteria to sign up for an interview.

Participants

The participants in this study were 10 WOC faculty who were tenured or on the tenure track. Participants represented diverse racial and ethnic groups and different STEM disciplines. Table I provides further details of participants and is based on how participants self-identified.

Table 1

Participant Demographics

Pseudonym	Status/Position	Race/Ethnicity	Discipline/Field	Campus
Vanessa	Pre-tenure, Asst. Professor	Mexican	Engineering Education	A
Patricia	Tenured, School Asst. Director	Native American and White	Environmental Chemist/Marine Biologist	A
Christina	Tenured, School Director	Mexican	Political Scientist	A

Heather	Tenured, Special Advisor to School Director on Justice, Equity, Diversity, & Inclusion	Asian and White	Ecosystem Ecologist	A
Sabrina	Tenured, College Chief Diversity Officer	Latina	Social Psychologist	A
Crystal	Tenured, Full Professor	Black	Mathematics	B
Reina	Pre-tenure, Asst. Professor	Hispanic	Animal Sciences	B
Samantha	Pre-tenure, Asst. Professor	Black	Agricultural Science/Economics	B
Whitney	Pre-tenure, Asst. Professor	Black	Sociology	B
Faye	Pre-tenure, Asst. Professor	Puerto Rican	Math/Math Education	C

Note. Participants self-identified their race and ethnicity.

Data Collection

The data for this study were collected through semi-structured interviews via Zoom. The semi-structured interviews were guided by interview protocols focusing on the experiences of faculty careers, especially efforts to retain them at their institutions. Specifically, the interview prompts centered on eliciting concrete descriptions of participants' backgrounds, lived experiences, perceptions of departmental and institutional retention policies, practices, and procedures, and how these structures contributed to their retention. Each interview lasted between 45-60 minutes. Interviews were audio-recorded, transcribed verbatim through a third-party transcription service, and made ready for data analysis. All data collected were kept confidential and used for research purposes only.

Data Analysis

Data analysis was conducted in the Dedoose analysis software using the thematic analysis approach to identify salient themes emerging from the data [40]. Initially, interview transcripts were uploaded to Dedoose. After that, research team members employed line-by-line open coding [41] to develop a set of codes individually. Following identifying the initial codes, the research team reviewed the codes to determine a set of agreeable codes in developing the codebook for the reliability of the coding process. This aspect of our data analysis considered

sorting codes per our research question and the retention element of Griffin's [12] institutional model for increasing faculty diversity, focusing on issues related to professional development, advancement, satisfaction, and support in institutional and departmental retention policies, practices, and structures. We also centered this aspect on our analysis of how participants attached significance to the aforementioned elements in enabling them to remain at their institutions. Subsequently, the codebook was used to determine the major themes of our results based on Robson and McCartan's [40] analytical framework of deriving meaning from the data based on central concepts found in the data.

Limitations

While qualitative research is not intended to be generalizable due to its focus on gathering in-depth knowledge about a phenomenon using a "small, nonrandom, purposeful sample" [39, p. 254], the findings from this study may be transferable to WOC STEM faculty at other institutions. Some MSIs were formerly PWIs. Due to changes in undergraduate enrollment, they were reclassified. However, the faculty composition of these institutions is not dissimilar from PWIs [41], and the level of servingness to minoritized populations remains challenging.

Trustworthiness

We applied a set of measures to ensure the trustworthiness of our results [39]. Multiple researchers conducted interviews and contributed to the data analysis process. Concerning the latter, we analyzed the data individually and identified codes in the data. The individual codes were reviewed by all researchers. Next, we refined the codes by removing redundant terms and duplicates, developed the codebook, and identified the salient themes that culminated in the results of this study. We also maintained an audit trail detailing our "methods, procedures, and decision points in carrying out the study" [39, p. 259].

Results

We present the findings using the tenets of the framework: *professional development*, *satisfaction and support*, and *tenure and promotion*. Results revealed that the primary sources of professional development were faculty groups that centered race and/or gender, writing groups, and mentoring. We also found that NSF ADVANCE grant activities led by institutional ADVANCE teams were leading the efforts of most campuses to improve career satisfaction. Cluster hiring and mentoring that promoted work-life balance contributed to a sense of belonging and feelings of mattering. Lastly, advancement was being addressed through revising T&P guidelines, caring approaches to unveiling T&P expectations and advancing WOC as academic leaders.

Professional Development. Professional development opportunities varied substantially across the institutions in the study. Some institutions had mentoring programs, while others did not. Also, two of the three institutions developed writing groups, and workshops on grant writing were increasingly available. For example, Campus A had begun to implement more intentional professional development focused on the needs of women, based on data collected through the NSF ADVANCE grant. While many of the activities were geared toward women, some of them focused on WOC faculty. Heather described these efforts,

> I'll speak about my own experience. And other women share this, and perhaps women of color, that all these unspoken things were happening; how do you approach someone for a research collaboration? In a research collaboration, how do you not get subsumed, have the other voices speak, and start leading?... Our [research] division, which is thinking about grants, and incoming research dollars, and big collaborations, they're doing a lot more workshops, like really explicit; how do you write a proposal, how do you get a research collaboration? I just took a seminar just recently through-- it might have been through ADVANCE or might it have been through the [Women of Color Faculty Group], on assertiveness. How do you be an assertive person without being labeled that?

Like Heather, Sabrina highlighted how the WOC faculty group engaged in several practices instrumental in promoting this population and providing much-needed professional development. Sabrina shared,

> [Women of Color Faculty Group] is one that also highlights the different grants and products of women of color and puts out a publication every year. So you get to see what other people are doing, but it also has capacity-building workshops, like writing workshops. And so you can come in and join over a break, a writing circle if you will, and you support one another. So even if you're not in the same arena, you know you have a group you can talk to through issues with and get advice on. And it may not be unique to your discipline; knowing that other people care makes a difference.

Having specific groups and professional development for WOC STEM Faculty demonstrated that they were valued. It also allows the population to meet others like themselves across campus. Though the institutions in this study were MSIs, WOC faculty needed to be represented. Hence, these groups provided the necessary community and support to persist at the universities. Writing groups were established at two of the three institutions in the study. To this end, Ashley at Campus B discussed using a federal grant to set up the writing group. After its success, the institution decided to make it a permanent opportunity.

There were a variety of mentoring structures in the study. Campus B was unique in that faculty were assigned committees instead of assigning one mentor. Reina explained,

> **Interviewer:** Were you assigned a mentor upon starting your position?
>
> **Participant:** Yes, they assigned me-- it's kind of a committee. My main mentor is one professor. She's a full professor in the department, so she has a lot of experience in this university, and I usually meet with her at least once per semester. And we discuss if I have some questions regarding teaching or research or whatever, I can send her an email. The other faculty…I have good relationships with them. For example, one of them is Dr. [X], and we work together. We are collaborating on research projects together.
>
> **Interviewer:** How many people are on this committee?
>
> **Participant:** Three.

Similarly, Samantha shared how her mentor committee had been instrumental in her navigating the academy as well as managing a negative disciplinary climate within one of her professional organizations,

> So it's been really good… these ladies have taken me under their wings to say, "We are not overloading your plate. We're going to start you out with a work-life balance. This person can be difficult to work with women or vice versa," or, "Tread lightly with that relationship." And so that has been beneficial to me because I know what to look for. And I get a true perspective from people that have been through it because both of them have been there. They're both full professors. And then I'm the only junior faculty member on that half of our department. So I will say they devote a lot of time to mentoring me, both officially and unofficially. And I really appreciate that because we have to interface with the folks that run [professional association]. And I'm not sure if you heard about all the things that went on [professional association] last year at convention. But STEM, overall, is predominantly White and male, and you can have some issues. [Discipline] is White and male, and the issues are a lot more blatant. To hear from them strategies that they've used to deal with it or what they're doing to make a difference, it makes me a lot more confident because it can be very easy to feel minimized or out of place going into [disciplinary] spaces.

As Samantha noted, being the only pre-tenured faculty member in her department did provide a numerical advantage for having a committee of mentoring support. However, Samantha's mentors went above and beyond to ensure that she would be successful at her institution and in the profession. In the absence of mentoring programs and structures, information for navigating the academy seemed to come from a myriad of sources. This aspect left participants to decipher what information to apply or ignore largely up to their own discretion. In the case of Heather, she learned after a chance encounter with a senior colleague that she may not have been submitting "enough" journal manuscripts, though she had never received a rejection. She shared,

> There's a colleague who I just sat on a plane with, and I never really used to like him because he's a little abrupt. But he sat next to me on the plane and he was fantastic. And he was asking me about my own publishing, and I think at that time as a junior scientist, I said, "I've never had a paper rejected." And I was so proud of that. And he's like, "You know what that says to me, [Heather], is that you're not publishing enough." Which is true. So what I was doing is I was so slow, and my papers were perfect, and they all got accepted just like that. And he said-- he's was a sociologist, he's seen it with his male and female graduate students is that the women would take longer, they would do better work longer, slower, and the men would do faster, less careful work, but they would put in twice as many or whatever. And then maybe the rate, I think men would still come out on top in terms of more publications, even though they were less careful and less deliberate about that. And it just said a lot to me is that if you're not being rejected, you're not publishing enough, you're not trying hard.

Satisfaction and Support. At all campuses, NSF ADVANCE teams were helping to explore, identify, and implement policies and practices that would support women careers in general. However, some of these strategies focused on needs that considered the intersectional

identities of WOC faculty “explicitly”. Some of these efforts began as early as when WOC faculty were being recruited and hired. For example, Heather stated,

> Another thing that we're aiming to do is being really explicit and asking our candidates who they would like to meet across the university if there are any groups in their identity, whatever that-- [inaudible] however they self identify; are there groups across campus who they would like to meet with. And I know many of our Black candidates have been very welcoming of the fact that we explicitly say, "Hey, would you like to meet some other Black faculty members and see what it's like to live here as a Black mom or a Black person in [region], and just be really explicit about that. But of course, we ask and say, like, "Look, who would you-- here's the unit of science you could talk about the scientific community that you'd be embedded in [academic school]. But also would you like to meet with in the university?" So I think that going to those steps to say we recognize that you aren't just bringing your science, but you're bringing your whole self to this place, and we want to make sure that you feel satisfied and happy here, just being more explicit with that. These are all things that our ADVANCE team has been thinking about, writing about.

These approaches to seeing the humanity of candidates and making sure their professional, personal, and socioemotional needs were met resulted in faculty in this study choosing to accept offers and stay within their respective institutions. Proactive and supportive mentoring approaches were another way participants felt a sense of mattering. For example, Ashley noted how her mentoring of WOC faculty not only included attention to their career development, but how they would balance their personal goals with professional goals,

> And I've had several that still come to me, "I'm going to make this decision," or, "Should I--" Even now in ADVANCE, I'm working with a faculty member who became an interim dean. She's like, "You're my mentor now," before she became interim dean. So anytime she has a career decision, she'll come to me. She just went up to full.. I just told her how to strategize, when to go up for full, and then now to take this job. I was like, "Well, tell me how you're going to balance everything," and, "You're not married. There's some things that you want to do in terms of your outside life. How are you going to balance it all?" And then, "How are you going to take care of yourself and your extended family?" So being able to mentor her, because I had a really good mentor. So mentoring is important for me and has always been important for my career. So I think those are the two things, giving us, women of color, especially at HBCUs, more of a voice in the literature, more of the voice in social media.

In the previous quote, Ashley makes it a point to share that her capacity to mentor others stems from having access to good mentors. Of the departments and institutions in the study that did not have mentoring programs, they often mentioned the hardship of finding qualified mentors who could work with pre-tenure faculty, especially WOC faculty. For the tenured faculty in the study, many of them became mentors because they saw a need, particularly when there not others who could fill those roles. However, due to their own capacity, they were unable to mentor all WOC who may have presented an interest in being mentored. This created an issue

for retaining WOC faculty at some institutions, and many were trying to find ways to address this issue as they worked to develop mentoring structures.

Several early career faculty remarked about the benefits of cluster hiring. In addition to hiring large cohorts of faculty together, institutions who implemented cluster hiring, they also ensured there were events to enable the new hires to meet one another and that there were other culturally-relevant supports on the campus to sustain the faculty. Faye shared,

> [Campus C] did a very good job with mentoring, inviting me to several events for faculty of color. I made great connections with the director of [Latinx Office], and he introduced me to several others, Latinx community in the university. We came here as a big cohort, so there are two other Latinas that I know came the same year that I came here. But as far as I know, Campus C was trying to do this on purpose so that we had each other to navigate the system. We have Thanksgiving together. We have good connections. We support each other. We meet on Fridays for two hours for writing time. It was like an…accountability group, yes. That's something that we did for one or two semesters, two semesters, yes. During the pandemic, that helped a lot.

Faye concluded her statement by saying how these support structures were particularly important during the pandemic when isolation was exacerbated for everyone. It is also possible that institutions who did not have such structures in place saw a decline in their faculty research productivity.

Advancement. Efforts to improve advancement through the T&P process was addressed in several ways including revising T&P guidelines, providing clear information about the T&P process when WOC faculty were hired, and promoting WOC academic administrators who had experience as pre-tenure faculty and an interest in improving pathways to T&P.

Clear communication and resources helped pre-tenure faculty with more easily navigating the tenure and promotion process. Reina shared,

> When I started my position, I loved my [chair] because he's really clear with all the advice that he gives you and all the information. So I remember that when I started my position, within the first week, I had a meeting with him. He explained to me how to get my tenure, how to do the right things and follow the right path to get my tenure. And he also gave me these two books that talk about how to get tenure.

Other participants commented that part of the issue with the T&P process was the ambiguity. Any way to reduce that aspect proved to be helpful for new faculty. In addition to speaking with pre-tenure faculty directly, all the campuses were doing something to make T&P guidelines more equitable, Campus A participants talked extensively about revising tenure and promotion guidelines to be more inclusive of the work they were actually doing in the academy, not just setting guidelines based on a one-size-fits-all approach. Heather discussed how research and scholarship was being redefined at her institution, she explained,

> So what does it mean to do research? And so we brought it in and out, I think, to research a more creative work or scholarship generally, because does it need to be certain papers and the number and the age factor of those journals? Right? Does it need to be that

> narrow definition of scholarship? Can scholarship also mean changing the academy to be more inclusive so that other scientists who follow can just be scientists and not have to worry about changing the whole system? I mean, isn't that original, creative work that's highly important? So we tried to broaden the definition…"Okay, your traditional scholarship, if you're working on a COVID vaccine, go for it, do it. But we also are going to include as excellent as all sorts of other things that maybe traditionally we haven't."

Finally, on campus A, more attention directed toward the needs of WOC faculty was the result of hires of WOC in senior academic administrator roles. While at the time of the study, these individuals had been recently hired or promoted, there was optimism that this was the catalyst needed to improve conditions for this population. Sabrina commented,

> Most recently, we have found ourselves in the place, thanks to the president, where our three higher level vice presidents-- so that would be the provost, the vice president for research, and the vice president for [learning opportunities]. All three who have been appointed are women and two of them are women of color. So I think as our leadership begins to understand the importance of having representation at every level, more and more people are comfortable putting on the radar of discussion issues pertinent to women of color. And so women of color also say, "Okay, there are people like me here who have risen to these positions. So what are the options for me in terms of wanting to succeed here?" And so that compels them to seek out the networking opportunities, the fellowship, or the sisterhood, if you will. But also, I think as more and more units are understanding the relevance of inclusion as part of their climates, they're making sure that their young faculty succeed. And so perhaps they're providing more support on the academic side of things for research or teaching.

Moreover, not only does promoting WOC in administrative roles support their advancement, but it is also a key element in strengthening institutional and career satisfaction. As previous research shows, WOC faculty want to contribute to the success of others [29]. What better way to contribute to that success and improve conditions for WOC, which may also support all faculty, than serve in administrative roles. Unfortunately, as the research purports, WOC are less likely to get these positions compared to their counterparts [29].

Conclusion

The purpose of this study was to examine structures at MSIs that are designed to support the retention of WOC STEM faculty. The practices shared may be useful to any faculty member, which makes focusing on WOC useful to not only that group but to a litany of faculty who may benefit from exploring and implementing various promising practices for faculty retention and satisfaction. To this end, professional development tends to come in many forms and sometimes non-conventional ways, as evidenced by the current study. If it was more directed, specific, and culturally relevant it could be more effective in retaining WOC faculty. In the current study, some of this was happening through WOC faculty groups. These groups were successful because of the pragmatic support they provided – writing groups, grant writing workshops, assertiveness training – and a sense of community and camaraderie. As West [19] noted, spaces such as this can provide refuge amid the challenging and sometimes toxic academic environments. This is especially important in the STEM fields where WOC continue to be grossly underrepresented.

Satisfaction and support was being largely ushered into the campuses in this study due to NSF ADVANCE grant funding and a motivation to improve conditions for women faculty in the academy fostered by ADVANCE teams. Because job dissatisfaction can lead to resignation [24], it is in the best interest of institutions to begin taking seriously how WOC fare in the academy. WOC contribute a great deal to the teaching and service of the academy, they also bring a unique perspective to research and development which is critical to specific institutions and society. ADVANCE grants are an effective way to research and initiate efforts to support women careers, but once the funding is gone institutions have to do a better job of sustaining these programs. For example, Campus B found ways to sustain their writing group program beyond the funding because they knew it was critical to the success of their WOC faculty.

Lastly, the goal of providing professional development and supporting the satisfaction of faculty is to ensure they are well-positioned to earn tenure and promotion. Efforts being made at the institutions in our study including the promotion of WOC administrators, revising T&P guidelines to be more inclusive of diverse scholarship, and sharing of T&P expectations early and often are important strategies. Yet, there is still much to be done, and the extent to which these practices can be culturally relevant will be more instrumental to supporting the careers of WOC STEM faculty.

Implications

The results of this study have significant ramifications for higher education and the STEM field as a whole. The study offers insightful information on the possibilities and problems faced by WOC STEM faculty members and suggests the institutional support systems required for their retention. By examining institutional retention support initiatives in the case study institutions, this research can:

1. *Inform Policy and Practices:* This study contributes to establishing effective policies and practices to resolve specific challenges WOC faculty face in STEM in their day-to-day life, from promotion to retention and career advancement, by providing evidence-based insight to support and retain WOC faculty.
2. *Facilitate the retention of Talented, Diverse WOC Faculty in STEM:* This research supports the retention of skilled and diverse faculty members, which will progress diversity in STEM fields. Improving scientific understanding and technical development may result in more innovative and significant research.
3. *Promote Diversity and Inclusion:* This study promotes diversity and inclusion in STEM areas by underlining the significance of building welcoming and inclusive workplaces for WOC STEM faculty. This research can encourage academia to advance inclusivity, justice, and fair practices in academia and increase the representation of women of color in STEM areas.
4. *Increase Awareness:* The study could increase awareness by addressing issues of WOC faculty in STEM and the importance of their support and retention. This may inform policymakers of a broader conversation about practicing diversity and inclusion in STEM.

Recommendations for Improving Institutional Conditions for WOC STEM Faculty:

1. *Institutions intersectional strategies:* The study emphasizes the significance of institutional support programs for WOC faculty retention. Initiatives like establishing a support network through cluster hiring, transparent and equitable start-up packages, and individualized mentorship significantly affected WOC faculty retention. The institution should prioritize utilizing intersectional strategies to promote WOC STEM faculty. This entails considering the complex and different challenges people encounter and dealing with structural problems like implicit bias and discrimination. Practical resources and mentoring opportunities should be made available through intersectional approaches.
2. *Establishing Mentorship Structure:* The study found no unanimous mentoring model in any institution. It differs from department to department and varies across institutions. This study suggests creating a comprehensive mentoring structure for all WOC in academia. Institutions should establish mentorship programs that consider the work being done in academia by WOC STEM faculty. These mechanisms are needed to facilitate WOC academics in developing careers and to offer guidance on how to function in the academic world.
3. *ADVANCE Team Facilitation:* This study found ADVANCE programs that took an intersectional approach to addressing gender and race-related inequities to be more beneficial for WOC faculty in STEM than programming that focused on gender alone. Institutions should keep exploring and implementing policies and practices to assist women in STEM. These initiatives should be implemented specifically to foster individual needs complementing the intersectional identities of WOC in academia.
4. *Professional Development Opportunities:* This research found that institutions under study showed varied professional development programs. There were mentorship programs at specific institutions but only in some. Hence, it is necessary to provide extensive mentorship programs to all WOC faculty. Equity-based and comprehensive professional development initiatives, offering mentoring programs, writing groups and workshops on grant writing, training for teaching and refining pedagogical techniques, and professional development opportunities would benefit to retain WOC faculty in academia. Institutions should make sure that all WOC STEM faculty regardless of their department or college, have access to professional development opportunities.
5. *Revision to Tenure and Promotion Policies:* It is a high time for institutions to revise their tenure and promotion policies to better reflect the contributions made by the WOC faculty in STEM. This should include acknowledging the invested contributions of WOC faculties by establishing guidelines to reflect the recognition of WOC faculty achievement despite facing social and structural challenges.

Acknowledgment: This material is based upon work supported by the National Science Foundation AGEP Program under Grant No. 2055302. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

References

[1] S.-N. C. Liu, S. E. V. Brown, and I. E. Sabat, "Patching the 'leaky pipeline': Interventions for women of color faculty in STEM academia." *Archives of Scientific Psychology,* vol. 7, no. 1, pp. 32–39, Nov. 2019, doi: 10.1037/arc0000062.

[2] J. B. Main, E. O. McGee, M. F. Cox, L. Tan, & C. G. Berdanier, "Trends in the underrepresentation of women of color faculty in engineering (2005–2018)." *Journal of Diversity in Higher Education,* 2022.

[3] J. Y. Kim & A. Meister, "Microaggressions, interrupted: The experience and effects of gender microaggressions for women in STEM." *Journal of Business Ethics,* 1-19, 2022.

[4] M. Corneille, A. Lee, S. Allen, J. Cannady, and A. Guess, "Barriers to the advancement of women of color faculty in STEM: The need for promoting equity using an intersectional framework. *Equality, Diversity and Inclusion: An International Journal,* 2019.

[5] K. N. Miner, S. C. January, K. K. Dray, & A. R. Carter-Sowell, "Is it always this cold? Chilly interpersonal climates as a barrier to the well-being of early-career women faculty in STEM.," *Equality, Diversity and Inclusion: An International Journal*, vol. 38, no. 2, pp. 226-245, 2019.

[6] I. H. Settles, N. T. Buchanan, and K. Dotson, "Scrutinized but not recognized:(In) visibility and hypervisibility experiences of faculty of color.," *Journal of Vocational Behavior,* 113, pp. 62-74, 2019.

[7] G. Colby, and C. Fowler, *Data snapshot: IPEDS data on full-time women faculty and faculty of color,* American Association of University Professors, 2020.

[8] Ong, M., Wright, C. I., Espinosa, L. L., Orfield, G. "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, pp. 172-208, 2011.

[9] R. A. Reid., "Retaining women faculty: The problem of invisible labor. *PS: Political Science & Politics,* vol. 54, no. 3, pp. 504-506, 2021.

[10] M. Soledad., D. Basu., S. Bhaduri., & L. Virguez (2022, August), "WIP-Retention of women in engineering professoriate: A Systematic Review," *ASEE Annual Conference & Exposition*, 2022.

[11] S.V. Allen., A. Lee., M. Corneille.,R. N. Coger., M. I. Kanipes., S. Luster-Teasley, and A. DePass, "Recruiting, retaining, and advancing women in STEM at an HBCU: A model for institutional transformation," *The ADVANCE Journal,* vol 3, no 1, 2022.

[12] K. A. Griffin, "Institutional Barriers, Strategies, and Benefits to Increasing the Representation of Women and Men of Color in the Professoriate: Looking Beyond the Pipeline," in L. W. Perna (Ed.), *Higher Education: Handbook of Theory and Research,* vol. 35, pp. 277–349, 2020. https://doi.org/10.1007/978-3-030-31365-4_4

[13] R. A. Schwartz and W. A. Byan, "What Is Professional Development? *New Directions for Student Services,* vol 84, pp. 3-13, 1998. https://doi.org/10.1002/ss.8401

[14] H. S. Bhola, "Non-formal education in perspective," *Prospects*, vol 13, no 1, pp. 45-53, 1983.

[15] L. G. Lunsford, G. Crisp, G., E. R. Dolan, B. Wuetherick, "Mentoring in Higher Education, " in D. A. Clutterbuk, F. Kochan, L. G. Lunsford,N. Dominguez, and J. Haddock-Millar (Eds). The SAGE Book of Mentoring. SAGE, 2017.

[16] S. Thomas, S. Johnson Austin, B. Walker, T. Lane, A. Rowley, A. Watson et al., "Culturally relevant mentoring: A differentiator for institutional change. In El-Amin, A. (Ed.), *Implementing Diversity, Equity, Inclusion, and Belonging in Educational Management Practices,* pp. 290-309, IGI-Global*,* 2022. https://doi.org/10.4018/978-1-6684-4803-8

[17] Brown University (2021). Pathways to diversity and inclusion: An action plan for Brown University, *Diversity and Inclusion Action Plan (DIAP)*. https://diap.brown.edu/

[18] K. Mack, C. Rankins, and K. Woodson, "From graduate school to the STEM Workforce: An entropic approach to career identity development for STEM women of color. *New Directions for Higher Education*, 2013.

[19] N. M. West, "Withstanding our status as outsiders-within: Professional counterspaces for African American women student affairs administrators," *NASPA Journal About Women in Higher Education*, vol 10, no 3, pp. 281-300, 2017.

[20] B. N. Crutcher, "Cross-cultural mentoring: A pathway to making excellence Inclusive, *Liberal Education*, vol 100, no 2, 2014.

[21] E. O. McGee, J. B. Main, M. L. Miles, and M. F. Cox, "An intersectional approach to investigating persistence among women of color tenure-track engineering faculty," *Journal of Women and Minorities in Science and Engineering*, vol 27, no 1, 2021.

[22] M. Ong, J. M. Smith, and L. T. Ko, "Counterspaces for women of color in STEM higher education: Marginal and central spaces for persistence and success," *Journal of Research in Science Teaching*, vol 55, no 2, pp. 206-245, 2018.

[23] M. F. Howard-Hamilton, "Theoretical frameworks for African American women," *New Directions for Student Services*, vol 104, pp. 19-27, 2003.

[24] L. August and J. Waltman, "Culture, Climate, and Contribution: Career Satisfaction Among Female Faculty," *Research in Higher Education*, vol 45, no 2, pp. 177–192, 2004. https://doi.org/10.1023/B:RIHE.0000015694.14358.ed

[25] M. Soto, *Women of color faculty in STEM: Successfully navigating the promotion and tenure process,* Michigan State University, 2014.

[26] R. Lisnic, A. Zajicek, and B. Kerr, "Women Faculty in STEM Disciplines: Experiences with the Tenure Process and Departmental Practices," *Humanity & Society*, vol 46, no 1, pp. 52–77, 2022. https://doi.org/10.1177/0160597620978773

[27] L. A. Medina, "Women Faculty of Color, Higher Education, and Sociocultural Change," *Capstone Projects and Master's Theses*," *492,* 2019. https://digitalcommons.csumb.edu/caps_thes_all/492

[28] K. C. Nduagbo, "African-Born Black Women Faculty: Their Lived Experience, Challenges, and Perceived Barriers to Success and Progress in U. S. Higher Education," *Seton Hall University Dissertations and Theses (ETDs.*, 2482, 187, 2018).

[29] K. M. Hannum, S. Muhly, P. S. Shockley-Zalabak, and J. S. White, "Women Leaders within Higher Education in the United States: Supports, Barriers, and Experiences of Being a Senior Leader," *Advancing Women in Leadership*, vol 35, pp. 65–75, 2015. http://advancingwomen.com/awl/awl_wordpress/

[30] K. J. Alter, J. Clipperton, E. Schraudenbach, and L. Rozier, "Gender and Status in American Political Science: Who Determines Whether a Scholar Is Noteworthy?" *Perspectives on Politics*, vol 18, no 4, pp. 1048–1067, 2020.

[31] T. L. Carson, A. Aguilera, S. D. Brown, J. Peña, A. Butler, A. Dulin et al., "A Seat at the Table: Strategic Engagement in Service Activities for Early-Career Faculty from

Underrepresented Groups in the Academy," *Academic Medicine,* vol 94, no 8, pp. 1089–1093, 2019.
[32] S. D. Garrett, M. S. Williams, and A. M. Carr, "Finding Their Way: Exploring the Experiences of Tenured Black Women Faculty," *Journal of Diversity in Higher Education,* Advance online publication, 2022. http://dx.doi.org/10.1037/dhe0000213
[33] V. C. Jones, "Building bridges for women of color in the professoriate," in Women of color in higher education: Changing directions and new perspectives, Emerald Group Publishing Limited, 2011).
[34] M. A. Martinez, K. T., Glover, M. Ota, T. A. Long, and M. M. L. Ureta Viroga, "Sacrificing body and mind: Pretenure women faculty of color, their health, and Well-being," *Journal of Diversity in Higher Education,* 2023.
[35] E. O. McGee, D. T. White, J. B. Main, M. F., and L. Parker, "How women of colour engineering faculty respond to wage disparities," *Ethnic and Racial Studies*, 2023. doi=10.1080/01419870.2022.2159474
[36] X. Li, *Characteristics of Minority-Serving Institutions and Minority Undergraduates Enrolled in These Institutions (NCES 2008-156)*. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. 2007.
[37] A. Cunningham, E. Park, and J. Engle, "Minority-serving institutions: Doing more with Less, *Institute for Higher Education Policy,* 2014.
[38] A. M. Nunez and E. Murakami-Ramalho, "Advocacy in the hyphen: Perspectives from Latina junior faculty at a Hispanic-serving institution," in Women of color in higher Education: Turbulent past, promising future, Emerald Group Publishing Limited, 2011.
[39] S. B. Merriam & E. J. Tisdell, *Qualitative research: A guide to design and implementation*, 4th edition, Jossey-Bass, 2016.
[40] C. Robson and K. McCartan, *Real world research: A resource for users of social research methods in applied settings,* 4th ed., Wiley, 2016.
[41] J. Saldaña, *The coding manual for qualitative researchers, 4th ed,* SAGE, 2021.