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Barriers to the Advancement of Women of Color Faculty in STEM: The Need for Promoting Equity Using an Intersectional Framework

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Barriers to the advancement of women of color faculty in STEM

The need for promoting equity using an intersectional framework

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Abstract

Purpose – The purpose of this paper is to highlight critical issues facing women of color (WOC) faculty and to synthesize the research literature in order to offer recommendations for action to address inequities using an intersectionality framework.

Design/methodology/approach – The authors conducted a qualitative meta-analysis. Relevant articles were obtained through a search of the EBSCO and Google Scholar databases entering in combinations of specific keywords. In order to be included in this review, the manuscripts had to be published between the years 2001 and 2017; in a peer-reviewed journal; and available through the university library system.

Findings – The majority of manuscripts in the meta-analysis revealed high teaching and service loads, ambiguous standards for tenure and lack of culturally responsive mentorship are challenges experienced by WOC faculty. Moreover, there is limited research that examines STEM WOC faculty experiences at minority-serving institutions and in leadership roles. Further research is needed to examine the long-term efficacy of mentoring strategies and institutional transformation efforts for WOC. These numerous challenges cumulatively undermine institutions' abilities to implement institutional transformation that impacts WOC in higher education.

Originality/value – The recommendations provided are based on the results of the meta-analysis and are intended to promote systemic change for STEM WOC faculty in institutions through intersectional and transformational approaches.

Keywords Teaching, Tenure, STEM, Service, Mentorship, Women of color faculty

Paper type Literature review

Essential to the advancement of women of color (WOC) faculty in science, technology, engineering and mathematics (STEM) disciplines is an institutional culture that promotes equity by empowering organizational structures to facilitate the attainment of leadership positions. Currently, Black/African American, Latina and Native women are grossly underrepresented in the academy and, most drastically, in full professor ranks. According to National Science Foundation data on science, health and engineering doctorates, Black/African American, Latina, and Native women accounted for less than 1 percent of full professors, less than 2.5 percent of associate professors and less than 3 percent of assistant professors (National Science Foundation, 2015). The daunting magnitude of underrepresentation of WOC in the STEM professoriate underscores serious equity concerns that have the potential to negatively impact institutional equity, undergraduate and graduate STEM education and society at large (Monroe *et al.*, 2008). Specifically, the potential consequences of this underrepresentation are that fewer WOC faculty are involved in developing and implementing institutional policies that promote equity (Ong *et al.*, 2011); fewer aspirational and support models exist for students of color (Espinosa, 2011; Morse, 1995; Ong *et al.*, 2011; Rosser, 2004); and fewer WOC researchers are in place to use their unique perspectives for conducting research on problems plaguing communities of color (e.g. health disparities, biases in STEM pedagogies) (Malcom and Malcom, 2011; Morse and Pratt (1995); Ong *et al.*, 2011). Therefore, the purpose of this paper is

to highlight critical issues facing WOC STEM faculty through qualitative meta-analysis that synthesizes existing literature and to propose recommendations for action using an intersectionality framework. The recommendations are based on an intersectional lens because it accounts for the roles of power and privilege and allows for the evaluation of the impact of race and gender simultaneously (Collins, 2002; Thomas et al., 2008).

Background and rationale

In recent years, there has been an increase in the literature on WOC faculty in the academy. Research has documented that WOC experience racism and sexism (Harley, 2008; Patitu and Hinton, 2003; Thomas and Hollenshead, 2001; Turner, 2003; Turner et al., 2008; Villalpando and Delgado Bernal, 2002) in the workplace. In one study African American women reported incidents that involved race, gender and sexual orientation when asked to describe their experiences as administrators (Patitu and Hinton, 2003). WOC have also reported feeling less integrated into the academic culture (Turner, 2003), having fewer opportunities for collaborative research (Harley, 2008) and being disproportionately burdened with university service (Monroe et al., 2008).

While there has been a greater research emphasis on WOC faculty in general, there is a lack of understanding the experiences of WOC faculty in STEM. The aim of this work is to synthesize and analyze the existing research literature on STEM WOC faculty to make actionable recommendations. Because prior research has documented that WOC faculty experience race and gender-based bias, the analysis is centered within an intersectional theoretical framework. This framework was chosen to account for the simultaneous impact of race and gender on an individual's experience. We focused on three major areas that are associated with career advancement in academia: teaching and service, tenure and promotion and mentorship.

Methods

Qualitative meta-analysis was selected as the methodological approach because most of the published research studies used a qualitative research approach. Therefore, a qualitative meta-analysis, also known as meta-synthesis, was used to provide greater insight into the lived experiences of WOC faculty (Park and Gretzel, 2007). A meta-analysis is used to synthesize the outcomes of various studies related to the same topic or outcome measure (Hunter et al., 1982). Typically, meta-analysis is conducted as a quantitative procedure geared toward the comparison of effect sizes across research studies. The benefit of a qualitative meta-analysis is an integration of research findings that is more interpretative and rather than aggregative. It is also important to note the challenges associated with this approach, which include adequacy of qualifying studies and inclusion criteria; availability and accessibility of qualified studies; publication bias; quality vs quantity of primary studies; studies containing both quantitative and qualitative data; studies based on identical samples; locating relevant findings; and the ability to ensure that independent coding and data analysis were conducted by multiple qualified researchers (Xu, 2008). However, other scholars have stated that criteria of quality should not be used to determine inclusion or exclusion of primary studies into a qualitative meta-analysis study and no strict rule exists as to what specific number is considered adequate (Sandelowski and Barroso, 2006).

Criteria for inclusion: the authors conducted a search of the EBSCO and Google Scholar databases by entering combinations of the following keywords: WOC faculty, STEM, tenure, mentorship, teaching, service and advancement. We supplemented the initial list with hand searches based on reference lists. Google Scholar was used to account for the variety of discipline-specific journals in which this type of research may be published. In order to be included in this review, the manuscripts had to be published between the years 2001 and 2017; located in a peer-reviewed journal and available through the university

library system. We did not solicit unpublished manuscripts and did not include books or book chapters. The graduate research assistants created a table of major findings from each study. The researchers developed domains (e.g. teaching and service, tenure and promotion, mentoring) from the most frequently mentioned areas of focus. Findings that were discussed across multiple studies were considered themes.

Results

Table I presents the meta-analysis of research articles describing the experiences of WOC in the academy. Our sample of research articles focused on issues pertaining to teaching and service, tenure and promotion and mentoring and mentoring models. A total of 42 scholarly articles on the experiences of WOC in the academy were found and reviewed. Of the reviewed articles, 12 articles describe challenges related to teaching and service; 11 articles discuss challenges related to tenure and promotion; and 19 articles focused on mentoring. Historically Black colleges and universities (HBCUs) were the focus of one article; predominantly White universities were the focus of three articles. The remaining articles did not clearly specify an academic setting. Additionally, 30 articles were qualitative, 4 were interviews/focus groups, 4 were literature reviews, 3 were quantitative and 1 was mixed qualitative/quantitative. Due to the limited research on STEM WOC faculty, literature reviews were included to ensure an exhaustive examination of existing work in this area.

This search revealed a dearth of research that focuses explicitly on WOC faculty. Black/African American women were the most frequently studied WOC group. Most studies examined faculty experiences broadly and did not limit their sample to STEM faculty. Researchers may have opted for this approach to decrease the likelihood of compromising anonymity of participants given the relatively small number of WOC faculty in STEM fields.

Theoretical frameworks

Theoretical frameworks used within the sample of studies included Intersectionality theory, Critical Race Theory, Critical Race Feminism and Black Feminist Thought (See Table I). Intersectionality theory asserts that people are disadvantaged by multiple sources of oppression. As such, race, class, gender identity, sexual orientation, religion and other identity markers do not exist independently of each other, and inform the others with the probable creation of complex combinations of oppression (Crenshaw, 1991). Intersectionality addresses the various ways in which racism and sexism and other forms of oppression impact the lives of WOC (Crenshaw, 1991). Specifically, within the domain of education, scholars have used intersectionality theory to address the underrepresentation of WOC among tenure track faculty and in leadership positions and the overrepresentation of WOC faculty among non-tenure track (NTT) faculty in STEM disciplines. Scholars have outlined major areas of emphasis for intersectionality research on WOC faculty within the academy; specifically, they include emphasis on understanding interconnecting systems of oppression (e.g. sexism, racism, classism, heterosexism), inclusion of both individual and collective struggles for equity by placing marginalized groups and people of color at the center and the promotion of social justice by linking research and practice to eliminate disparities in the academy (Hunt et al., 2012).

Critical Race Theory (CRT) provides a framework for identifying how racism – enacted through policies, practices and interpersonal interactions – contributes to inequities within the education system (Collins, 2002; DeCuir-Gunby, 2007; Ladson-Billings and Tate, 1995). CRT articulates that racism intersects with other forms of oppression, but race is central in this intersection. CRT challenges claims of objectivity, color-blindness and meritocracy in favor of a race-conscious approach that acknowledges the pervasiveness of racism and

Teaching and service

Authors	Year	Title	Type of Study (Qual/Quant)	Methods (interview, focus group, regression)	Type of institution	No. of participants	Theoretical approach
Baez	2000	Race-related service and faculty of color: conceptualizing critical agency in academe. Higher Education	Qualitative	Interview	PWI	16	Race relation
Evans and Cokley	2008	African American women and the academy: using career mentoring to increase research productivity. Training and education in Professional Psychology	Qualitative	Review of Literature	N/A	N/A	N/A
Gregory	2001	Black faculty women in the academy: History, status and future					
Hall *et al.*	2012	Black women talk about workplace stress and how they cope	Qualitative	Focus group, structured interview	Not labeled	41	Grounded theory
Harley	2008	Maids of academe: African American women faculty at predominately white institutions		Review of Literature	PWI	N/A	N/A
Misra *et al.*	2011	The ivory ceiling of service work. Academe	Qualitative	Survey/Focus group	PWI	350	
Pyke	2011	Service and gender inequity among faculty. PS: Political Science and Politics				N/A	N/A
Thomas and Hollenshead	2001	Service and gender inequity among faculty. PS: Political Science & Politics	Literature review	Review of literature	Not labeled		
Turner	2002	Women of color in academe: Living with multiple marginality. The Journal of Higher Education	Qualitative	Interview			

Table I.
Articles reviewed

Table I.

Authors	Year	Title	Type of Study (Qual/Quant)	Methods (interview, focus group, regression)	Type of institution	No. of participants	Theoretical approach
Turner and González	2011	Faculty women of color: The critical nexus of race and gender	Qualitative	Focus groups (12 groups/90 mins each)	PWI	51	Critical race theory, critical race feminism
White	2005	Pipeline to pathways: new directions for improving the status of women on campus. ADVANCE Library Collection	Qualitative	Review of Literature	Not labeled	N/A	N/A
Yoder	1991	Rethinking tokenism: looking beyond numbers	Qualt/Article reviews Kanter's work	Interview	Fortune 500 corporation	20	Concept of Tokenism by Kanter, Blalock's theory of intrusiveness mentioned in abstract
Tenure and promotion							
Armenti	2004	Women faculty seeking tenure and parenthood: lessons from previous generations					
Brown and Lurland	1990	Academic tenure and academic freedom. Law and Contemporary Problems	Qualt/Article reviews work	Review of Literature	PWI	N/A	
Carroll	2017	A faculty Woman of Color and micro-invalidations at a White research institution: A case of intersectionality and institutional betrayal	Qualitative	Narrative discusssion	PWI	N/A	Critical race theory/ Institutional Betrayl Theory
Dade et al.	2015	Assessing the impact of racism on black faculty in white academe: A collective case study of african american female faculty	Qualitative	"Self Interview" Each participant wrote their own narrative based on 5 guiding questions highlighted in the article, then collectively they analyzed the data	PWI	4	Critical race theory, critical theory, critical multicultural theory, Black feminist thought

Authors	Year	Title	Type of Study (Qual/Quant)	Methods (interview, focus group, regression)	Type of institution	No. of participants	Theoretical approach
Evans	2007	Women of color in American higher education. Thought and Action					
Griffin et al.	2013	Marginalizing merit? Gender differences in black faculty D/discourses on tenure, advancement, and professional success	Qualitative	Semi structured interview	PWI	28	Critical race theory
Jones et al.	2015	African American female professors' strategies for successful attainment of tenure and promotion at predominately White institutions: It can happen. Education, Citizenship and Social Justice	Qualitative	Descriptive Phenomlogical Study	PWI		Relational Culture Theory
Roos and Gatta	2009	Gender (in) equity in the academy: Subtle mechanisms and the production of inequality. Research in Social Stratification and Mobility	Qual/Quan	Descriptive Stats			
Rosser	2005	Measuring the change in faculty perceptions over time: An examination of their worklife and satisfaction	Quantitative[a]				Two Group Structural Model
Turner and González	2011	Faculty women of color: The critical nexus of race and gender	Qualitative	Focus groups (12 groups/90 mins each)	PWI	51	Critical race theory, Critical race feminism
Wingfield	2007	The modern mammy and the angry Black man: African American professionals' experiences with gendered racism in the workplace	Qualitative	Interviews		23	

Table I.

Mentorship

Authors	Year	Title	Type of Study (Qual/Quant)	Methods (interview, focus group, regression)	Type of institution	No. of participants	Theoretical approach
Allen and Butler	2014	African American women faculty: toward a model of coethnic mentorship in the academe	Qualitative	Review of Literature			
Campbell et al.	2013	Partnered research experiences for junior faculty at minority-serving institutions enhance professional success	Quantitative[a]	Mixed Effects Regression Model	PWI	32	
Chandler	1996	Mentoring and women in academia: reevaluating the traditional model	Qualitative	Review of Literature	N/A	N/A	
Crawford	2015	Tailor-made: meeting the unique needs of women of color STEM-SBS faculty through mentoring	Qualitative	PWI	N/A	N/A	
de Dios et al.	2013	The development of a diversity mentoring program for faculty and trainees: A program at the Brown Clinical Psychology Training Consortium	Qualitative	Review of Literature	N/A	N/A	
Evans and Cokley	2008	African American women and the academy: Using career mentoring to increase research productivity	Qualt/Article reviews various other work	Review of Literature	N/A	N/A	N/A
Green and King	2001	Sisters mentoring sisters: Africentric leadership development for Black women in the academy	Qualitative	Focus groups & mentoring group	PWI	10	N/A
Hall et al.	2012	Black women talk about workplace stress and how they cope	Qualitative	Focus group, structured interview	Not labeled	41	Grounded theory

(continued)

Table I.

Authors	Year	Title	Type of Study (Qual/Quant)	Methods (interview, focus group, regression)	Type of institution	No. of participants	Theoretical approach
Hill et al.	2016	Rationale and design of the women and inclusion in academic medicine study	Qualitative	Interiews	PWI	21	Grounded theory
Jackson	2002	Attracting and retaining African American faculty at HBCUs	Qualitative		HBCU		
Jones	2013	Black female faculty success and early-career professional development	Qualitative	Focus group interview	PWI/HBCU public and private	7	N/A
Montgomery et al.	2014	Guiding the way: mentoring graduate students and junior faculty for sustainable academic careers	Qualitative	Review of Literature			
Núñez et al.	2015	Weaving authenticity and legitimacy: Latina faculty peer-mentoring					
Ong et al.	2011a	Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics					
Ponjuan et al.	2011a	Career stage differences in pre-tenure track faculty perceptions of professional and personal relationships with colleagues	Quantitative[a]	Confirmatory factor analysis, regression models, factor scale,	Not labeled, information from 80 postsecondary institutions was used	6,882	"Bauer's newcomer adjustment/ socialization model" an updated model based with roots in Van Maanen and Schein's theory of organizational socialization

Table I.

Authors	Year	Title	Type of Study (Qual/Quant)	Methods (interview, focus group, regression)	Type of institution	No. of participants	Theoretical approach	
Reyes	2011	Unique challenges for women of color in STEM transferring from community colleges to universities						
Whittaker and Montgomery	2014	Cultivating institutional transformation and sustainable STEM diversity in higher education through integrative faculty development	Journal Article format, like a literature review	Review of Literature	N/A	N/A	N/A	[b]This is a great article, it warrants a second look
Yun et al.	2016	Mutual mentoring for early-career and underrepresented faculty: model, research, and practice						
Zambrana et al.	2015	"Don't Leave Us Behind" The Importance of Mentoring for Underrepresented Minority Faculty						

Table I.

other forms of oppression across various systems (e.g. education, legal, health) (Bell, 1993; Ladson-Billings and Tate, 1995).

Critical race feminism theory emphasizes the ways in which WOC's identities and systems of oppression impact their well-being (Wing, 1997). Critical race feminism is a feminist perspective of critical race theory which focuses on the issues of power, oppression and conflict centralized in feminist theory. It also leans on many of the tenets and elements of critical race theory (Berry, 2010).

Black Feminist Thought argues that Black women occupy a unique standpoint on their own oppression composed of two interlocking components: Black women's political and economic status provides them with a distinctive set of experiences that offers a different view of material reality than that available to other groups; and these experiences stimulate a distinctive Black feminist consciousness concerning that material reality (Collins, 2002). Intersectionality theory contends that numerous systems and structures operate together to impact an individual's experience of power, privilege and oppression (Crenshaw, 1991).

Each of the preceding perspectives maintains that the voices and lived experiences of marginalized groups are valid and essential to the analysis of race, gender, racism and sexism. Consistent across theories is an emphasis on centering women's voices and lived experiences to provide a voice to marginalized groups through the use of narratives that offer a vehicle for telling their lived experiences (Donnor *et al.*, 2016; Hiraldo, 2010; Iverson, 2007). Consistent with this emphasis, most studies used qualitative methodologies. The journal articles focused thematically on teaching and service, tenure and promotion and mentoring and mentoring models. Below is a more in-depth discussion of these themes.

Teaching and service
Challenges facing WOC faculty. Considerable research documented that WOC faculty provide a disproportionate amount of teaching and service (Dade *et al.*, 2015; Griffin *et al.*, 2013; Misra *et al.*, 2011; Thomas and Hollenshead, 2001). STEM women spent time more mentoring and performing service in comparison to STEM men (Misra *et al.*, 2011). WOC are more likely to be relegated to the role of NTT teaching faculty that often have high course loads and less access to resources such as laboratory space and space to meet with students (Harper *et al.*, 2001).

Harley (2008) described WOC, specifically African American women, as the "maids of academe" (p. 19) because of the considerable labor often exerted toward teaching and service. Harley (2008) examined how racist stereotypes are embedded into the work roles of African American women faculty at a predominantly White institution (PWI) and found the amount of time spent in service roles was considerably higher than their White faculty counterparts. Dade *et al.* (2015) examined four narratives of African American female faculty employed at a large predominantly White research one institution. Within these narratives, WOC reported that high service loads often occurred as a result of being sought out by administrators to serve on committees and by students who feel similarly marginalized by the institution. Additionally, WOC reported feeling an obligation to serve to honor the legacy of those who provided mentorship throughout previous generations.

Potential impact on WOC faculty. Disproportionate amounts of time spent teaching, mentoring and service place WOC at a disadvantage for promotion and tenure because research productivity is more highly valued and associated with prestige in STEM disciplines. Because WOC are frequently asked to serve as representatives of women and people of color in various capacities for the university while being unrecognized for this labor, WOC may experience high levels of stress from serving in this capacity in addition to maintaining research agendas and high quality teaching (Griffin *et al.*, 2013; Harley, 2008).

The stress from balancing multiple roles, family responsibilities, and coping with micro and macro-aggressions can have negative health effects (Hall *et al.*, 2012; Harley, 2008). The overrepresentation of women and WOC in NTT positions creates considerable challenges. NTT positions tend to have the lowest salaries and the least decision-making power over university policies relative to other faculty positions (Harper *et al.*, 2001).

Tenure and promotion

Challenges facing WOC faculty. With respect to tenure and promotion, there are several challenges facing WOC faculty including bias in criteria for establishing promotion and tenure (Dade *et al.*, 2015); subjectivity and biases within the evaluation process (Jones *et al.*, 2015); and the deleterious impact of various types of subtle inequities (Jones *et al.*, 2015; Rosser, 2005; Turner and González, 2011; Wingfield, 2007).

One of the ways that bias can be embedded in the promotion and tenure process is the mechanism through which work is valued during the tenure process (Griffin *et al.*, 2013). Tenure processes frequently emphasize evaluating numbers of publications or grants rather than transformational factors such as impact on society and contribution to community. Under this system, faculty who engage in scholarship that requires lengthier processes such as community-engaged research may experience tacit penalties for this work (Evans, 2007). Most institutions have tenure standards that emphasize impactful contributions in research, teaching and service. However, the process by which tenure and promotion committees weigh each of these categories and define impact varies across institutions and may devalue the ways that transformational factors benefit the institution overall.

Subjectivity and biases within the evaluation process may also impact the experiences of WOC faculty. Griffin *et al.* (2013) examined narratives of 28 Black/African American professors employed by predominantly White research universities. These researchers found that Black/African American women perceived both race and gender as influential in their evaluations for academic advancement. This subjectivity can manifest through hidden or ambiguous standards for tenure (Griffin *et al.*, 2013; Jones, 2013). For example, Griffin and colleagues' (2013) qualitative study examined four narratives of African American female faculty employed at a research-focused predominantly White university. One tenured participant described her realization of the importance of the institutional agenda over the actual assessment of work factors. WOC faculty may experience challenges accessing the institutional agenda and unwritten rules of tenure at their particular institutions if isolation and marginalization prevents them from gaining access to influential spheres at their institution (Dade *et al.*, 2015). Tokenism is a superficial effort at inclusion in order to avoid conflict wherein one individual represents a racial and/or gender category. Tokenism is associated with heightened visibility, isolation from work-related networking and social engagements, and retention in gender-stereotyped roles (Sanchez-Hucles and Davis, 2010; Turner, 2002). WOC faculty members in STEM fields are frequently "extreme tokens" who may experience fewer opportunities to tap into institutional memory of governing decisions, the presence of new resources and hidden rules of tenure (Turner and González, 2011; Turner *et al.*, 2008).

Consistent across the research on WOC faculty is the documentation of subtle mechanisms of inequity that produce micro-advantages to male faculty (most dramatically US born, White male faculty) and "micro-disadvantages" to women (most dramatically to WOC) (Roos and Gatta, 2009). The stress involved in developing a competitive promotion or tenure packet may be exacerbated by subtle mechanisms of inequity that stem from both racism and sexism from students, faculty, and administrators (Dade *et al.*, 2015; Pittman, 2010; Turner and González, 2011). For example, Pittman (2010) examined interactions

between WOC faculty and White male students at a large predominantly White research institution. Pittman (2010) found that micro-aggressions from students in the classroom included failure to acknowledge the authority typically associated with the title of faculty, failure to address WOC faculty appropriately, questioning teaching competency, minimizing scholarship of race and gender and intimidating interactions. Inequities from administrators and faculty included completing year-end evaluations that did not match the evaluations received throughout the year (Dade *et al.*, 2015). Moreover, WOC often experienced a climate whereby perpetrators of inequities did not experience consequences for their actions (Dade *et al.*, 2015).

Potential impact on WOC faculty. Because the challenges that WOC experience impact stress and access to institutional resources, the cumulative impact of these challenges has the potential to impact promotion and tenure. Turner and González (2011) conducted 12 focus groups with WOC faculty ($n = 51$) at a predominantly White public research-intensive universities to examine how WOC faculty experience inequities. Turner *et al.* (2011) examined the unique intertwined nature of discriminatory practices targeting individuals based on their gender and race collectively. Themes included feelings of isolation, feelings of resistance to their presence, marginalization, tokenism and uneven knowledge of available resources for funding purposes. Other themes included difficulty balancing work and family, ambiguous and arbitrary tenure selection processes and lack of connectedness. The impact of these factors may be mitigated, however, if critical institutional supports are in place. Jones *et al.* (2015) examined factors that increased the likelihood for attainment of tenure at predominantly White universities. Structured mentoring programs, professional networking and leadership support were identified as ways that WOC who attained tenure were supported systemically to overcome these barriers.

Mentorship
Challenges facing WOC faculty. Much of the work on addressing challenges experienced by WOC has focused on providing additional support and mentorship for WOC (Ong *et al.*, 2011; Reyes, 2011). However, the most widely implemented mentoring models employed – the traditional one-on-one, group or network and peer-mentoring – have been shown to meet the needs of WOC faculty insufficiently (Crawford, 2015). Thus, effective mentoring models for WOC faculty must be designed to fit the institutional culture of WOC and not become a barrier to success. For WOC faculty, one barrier to a productive and successful mentoring relationship occurs when a more traditional research agenda is valued while nonconventional research topics that incorporate cultural or community needs of WOC are devalued (Chandler, 1996; Whittaker *et al.*, 2015). Other barriers include a mentor displaying apathy toward a woman of color faculty engaging in the community as well as exhibiting a reluctance to discuss the unwritten rules of engagement especially in predominately White structures and spaces (Zambrana *et al.*, 2015). Furthermore, traditional mentoring programs in STEM disciplines fail to capture the intersection of gender and race/ethnicity. Hence, the lack of research focused on WOC faculty-to-faculty mentoring models forces one to make inferences from studies on other populations and contexts (Hill *et al.*, 2016).

Mentoring and support programs for WOC faculty have the potential to minimize these barriers by decreasing isolation and alienation (Green and King, 2001; Jones, 2013), increasing access to mentors (Hall *et al.*, 2012; Jones, 2013) and increasing opportunities for collaboration (Evans and Cokley, 2008; Ponjuan *et al.*, 2011). Zambrana *et al.* (2015) argued that ideal mentoring programs must include mentors who possess a deep respect for the mentees potential and scholarly endeavors; demonstrate an understanding of how marginalization and barriers influences WOC faculty; appreciate scholarship that focuses

on community engagement or a social problem-focused research agenda; and provide access to key scholarly networks or opportunity structures which build social capital and make mentees privy to the unwritten rules of the institutional culture and the larger discipline.

Mentoring models developed specifically for WOC faculty have been implemented at various institutions yet have varying designs (de Dios *et al.*, 2013; Green and King, 2001; Jones, 2013; Yun *et al.*, 2016). The majority of models targeting WOC have centered on developing a sense of community that embraces their multiple identities. For example, the Sisters Mentoring Sisters (SISTERS) project centered around creating a "village" or community in which participants acted as mentors or received mentoring from their "sister colleagues" for career advancement and leadership development (Green and King, 2001). Similarly, the Mutual Mentoring model was a network-based support model where faculty were incentivized, through grants, to build "their network" comprised of multiple mentors in their respective area(s) of expertise (Yun *et al.*, 2016). This model afforded women and underrepresented faculty an opportunity to develop relationships with faculty in various career stages and disciplines, allowing them to experience the collegiality that is the hallmark of an academic community.

Potential impact on WOC faculty. The aforementioned mentorship strategies and models may have implementation challenges because many academic institutions have very few WOC faculty at the level of full professor that could provide mentorship for advancing through all ranks in the academy (Evans and Cokley, 2008; Whittaker and Montgomery, 2014). In addition, strategies that rely on WOC solely mentoring their peers also place an additional burden of time commitment for individuals who are likely to be overburdened with high mentorship and high service loads.

Discussion

The issues experienced by WOC faculty are multifaceted, complex and have a long history of being embedded into university systems and society. Simply increasing the number of WOC faculty in STEM fields is not likely to be an adequate solution to address the multifaceted challenges that WOC in STEM experience. Furthermore, "intrusiveness" may occur in response to a surge in numbers in areas previously dominated by men or White people (Yoder, 1991). Intrusiveness refers to when individuals in the majority group feel threatened and employ discriminatory behaviors such as blocked mobility and lower wages in response to a surge in numbers of people from marginalized groups. Historically, intrusiveness has occurred for women and people of color across various disciplines (Blalock, 1967; Brown and Fuguitt, 1972; Frisbie and Neidert, 1977).

Therefore, recommendations to promote systemic change for WOC faculty in institutions must embrace intersectionality and transformational approaches. Choo and Ferree (2010) distinguished three styles of understanding intersectionality in practice: group-centered, process-centered and system-centered. Group-centered intersectionality stresses the importance of placing multiply marginalized groups and their perspectives at the center of the practice and research. Process-centered intersectionality emphasizes strategies that address the relational nature of power. System-centered intersectionality focuses on transforming entire systems. The following recommendations are suggestions for ways that universities can begin to address these challenges using a system-centered intersectional approach that calls for institutions to transform rather than placing the burden of transformation on the individuals most harmed by the issue. The recommendations center the experiences of WOC as a group that is multiply marginalized and consider the ways that racism and sexism may affect WOC's ability to have access to relationships with individuals in power.

Recommendations for institutional transformation through equity

Teaching and service

Our review of the literature on teaching and service found that WOC experience a high burden of service, teaching, and mentorship. Therefore, we recommend the creation of minimums and maximums for service efforts for any individual faculty member. These standards could be created at the university level to address disproportionate service demands placed on WOC faculty. This approach may also address the issue of certain individuals engaging in minimal service responsibilities.

Another recommendation to address this issue is to increase the transparency and value placed on service and mentorship. Some WOC report that service efforts (e.g. mentoring underrepresented students of color, community engagement) are a valuable part of their contribution to communities of color (Baez, 2000). Many times, this type of service benefits institutions by advancing the institutional mission and increasing enrollment and retention. Moreover, WOC faculty play a critical role in providing role models as well as culturally-responsive education and mentorship for WOC students. However, these service and mentorships efforts may receive minimal visibility and recognition. Many institutions excel at publicizing the innovative research that faculty produce via university websites. University websites can also be used to highlight faculty service and mentorship with the goal of acknowledging the contribution and workload involved.

One additional recommendation is to revise tenure standards to more highly value the contribution of this work. Historically, tenure was developed as way to promote academic freedom and to minimize university professors' fear of retribution as a result of their ideologies (Brown and Kurland, 1990). This system was developed during a time when the professoriate was comprised largely of White men who had partners that provided much of the labor of caring for children and taking care of the household (Armenti, 2004).

Moreover, academia has favored disciplines with strong potential to enhance their economic standing through extramural funding (Evans, 2007). Many of the tenure requirements mirror this enduring preference for laboratory and bench research and are less tailored for individuals in STEM education, service and community engagement, areas that have higher representation of WOC faculty (Griffin *et al.*, 2013).

In previous attempts to address and rectify sexism and racism, some universities, particularly PWIs have adopted policies to ensure that diversity is represented on service committees. Other strategies have encouraged WOC to say no to burdensome service requests (Gregory, 2001). Process-centered intersectionality suggests that this ignores the power dynamic involved in making and responding to requests. Further, Pyke (2011) advocate for a shift from "Just say no" to "Just don't ask." This approach calls for individuals in power to analyze the types of service requests they make, particularly of multiply marginalized groups such as WOC faculty. This approach requires individuals in power to reflect on the following types of questions before making a request: Could the request be related to stereotypes about WOC in service and secretarial roles or perception of limited power to say no? Does the request benefit the faculty member in terms of opportunities for advancement?

Tenure and promotion

Our review of the research literature on challenges WOC experience within the tenure process include subjectivity and biases within the evaluation process and criteria, unwritten and unspoken rules impacting the process, and the deleterious impact of subtle mechanisms of inequity. Therefore, in order to promote equity in the tenure and promotion process based on systems-centered intersectionality, we recommend that the process necessary to dismantling inequities must include transparency, accountability, training and policy change as well as oversight of equitable implementation.

Institutional transparency consists of ensuring that the expectations and evaluations for promotion and tenure process are transparent, consistent and equally accessible to everyone. Strategies to attain the goals of transparency include establishing centralized mechanisms for disseminating information, resources and institutional agendas. This centralized mechanism can include a process for making available successful dossiers from previous years.

A strategy to implement accountability can include training human resources personnel to observe promotion and tenure committees. Many institutions rely on individuals that serve on promotion and tenure committees to ensure the process is equitable and to intervene when inequities occur. Process-centered intersectionality suggests that this approach ignores the challenges/penalties that an individual may experience speaking up about bias, particularly when engaging with a person in a position of greater power. Trained human resources personnel can observe the process to ensure that the committees' processes are similar across all faculty. Checklists to evaluate tenure can increase the likelihood that unwritten and unspoken rules of tenure do not affect the decision-making process.

Ongoing training of administrators and faculty on conducting equitable evaluations and hiring processes, creating inclusive environments and preventing micro-aggressions are critical to systemic transformation. Frequently, WOC faculty and other multiply marginalized groups experience the burden of responding to biases and inequities. Equity trainings such as implicit bias training have demonstrated some effectiveness with respect to decreasing bias in hiring practices (Roos and Gatta, 2009). Research on implicit bias training indicates that this training is most effective when trainees have "buy in" into the approaches and implement them in an ongoing fashion. Therefore, this strategy is promising based on the research; however, it requires considerable buy-in and advocacy support from administrators. Integrating these trainings into activities valued by the institution such as faculty professional development is critical to demonstrating that an equitable, inclusive environment is highly valued at the institution and the responsibility of everyone.

Another strategy to facilitate a tenure and promotion process that WOC may experience as supportive and equitable is policy changes. Institutional policy changes that allow people to stop the tenure clock for the birth of a child can be beneficial but may need to be expanded to include the experiences of WOC. WOC faculty may have caregiving responsibilities that extend beyond birth children to aging parents and extended family. We advocate that the option to stop the tenure clock should be expanded to include formal or informal adoption of a child and caregiving of an aging parent or spouse. Additionally, the policy should be open to both mothers and fathers to encourage gender equity in caregiving and decrease the likelihood that women are penalized for utilizing this policy.

Mentorship
Our literature review revealed that mentorship programs have been developed to support WOC faculty with research productivity, grantsmanship and knowledge of the tenure process. While some mentorship programs demonstrate efficacy at achieving these goals, the impact of these approaches is limited by their ineffectiveness in changing systems. The success or failure of any of these approaches can be dependent on the ways they are implemented and administrators' motivation for effective implementation. Therefore, we recommend granting agencies create incentives to institutions for working toward systemic equity and mentorship of WOC. The Institute for Women Policy Research in a report entitled "Accelerating Change for Women Faculty of Color in STEM: Policy, Action, and Collaboration" provides some guidance on ways to incentivize universities to increase their equity efforts. One of these recommendations include developing metrics that monitor and

make public an institution's diversity efforts (Berry *et al.*, 2014; Hess *et al.*, 2013). To improve funding opportunities, the panel recommended the development of novel funding opportunities focused on increasing visibility and prestige of WOC, the development of targeted research and academic support programs for WOC and enhancement of transparency in the gender and racial/ethnic backgrounds of federal grant applicants and recipients (Berry *et al.*, 2014; Hess *et al.*, 2013).

One challenge that some universities have faced in developing effective mentoring for WOC faculty is a lack of faculty with the skills and motivation to mentor WOC faculty. We advocate for incentives aimed at offering and increasing opportunities for WOC faculty and students that provide strategies and resources for cross-cultural mentorship (Evans and Cokley, 2008). Given that WOC faculty are frequently overlooked for awards and advancement opportunities, mentorship of WOC faculty should include mentors advocating for WOC faculty to receive opportunities for awards and advancement that are consistent with their goals (Table II).

We support these recommendations and believe that they could be extended by establishing committees that conduct an equity analysis of new and existing policies. Certain policies that appear race and gender neutral on the surface can have unintended negative consequences for underrepresented faculty. An equity committee could work closely with upper administration to review new and existing policy for its impact on underrepresented faculty.

Limitations and directions for future research

The aforementioned recommendations are intended to provide a starting point for advancing equity for WOC in academia. However, the existing research does have some limitations. The research is limited by lack of variation of institution type, a dearth of

Challenges	Recommendations for change
High burden of service, teaching and mentorship	Colleges/universities create minimums and maximums for service efforts for any individual faculty member Colleges/universities increase the transparency and value placed on service and mentorship Colleges/universities highlight contributions of faculty service and mentorship via university websites Colleges/universities train administrators to consider benefits to faculty member before making service requests Colleges/universities revise tenure standards to more highly value the contribution of teaching, mentorship and service
Bias in tenure standards against research with longer processes such as community-engaged research	Colleges/universities include assessment of transformational factors such as impact on society and contribution to community under publications requirement for promotion and tenure
Subjectivity and biases in evaluation process	Colleges/universities train human resources personnel to observe the process and intervene when processes are inconsistent
Disconnect between tenure track faculty interpretation of standards and implementation of standards	Colleges/universities create checklists to evaluate tenure to decrease the likelihood that unwritten and unspoken rules of tenure affect the decision-making process Colleges/universities develop centralized a mechanism for disseminating information, resources that includes successful dossiers from previous years
Subtle mechanisms of inequity	Colleges/universities train administrators and faculty on conducting equitable evaluations and hiring processes, creating inclusive environments and preventing micro-aggressions
Lack of effective mentorship opportunities designed for women of color faculty	Granting agencies create incentives to institutions for working toward systemic equity and mentorship of color

studies on HBCU and limited research on WOC STEM faculty. It is critical to address these gaps by expanding research that focuses on WOC at HBCUs and STEM WOC faculty. WOC faculty make up a greater percentage of the tenured and tenure track faculty at historically Black colleges and universities in comparison to predominantly White universities (Mack and Rankin, 2011). Moreover, WOC faculty in STEM fields are more likely than WOC faculty in non-STEM fields to be the only person of their gender and race in their department (Turner and González, 2011; Turner *et al.*, 2008).

The research is also limited by a reliance of small sample sizes. Qualitative studies tend to have smaller samples. However, this can present some challenges with generalizability to other populations (Morrow, 2005; Polkinghorne, 2005). Mixed methods approaches that incorporate both qualitative and quantitative analyses may be useful to capitalize on the strengths of both approaches. Moreover, few studies have used the institution as the unit of analysis to determine if and how systemic transformation efforts are effective. Few studies have utilized an asset-based approach whereby a focus on the assets of WOC faculty are highlighted. Asset-based research considers questions such as:

RQ1. What are the strategies of WOC faculty who have successfully navigated barriers in the academy?

RQ2. What approaches have institutions with fewer equity challenges used to achieve greater institutional equity?

Additional research is needed to examine the mechanisms by which race and gender stereotypes embed themselves into expectations of WOC faculty. Additional research is needed to determine the ways that these processes of marginalization may operate together to impact tenure and promotion. To address these concerns, researchers could consider using quantitative research to examine how factors identified in qualitative research findings (e.g. isolation, tokenism) operate as mediators and moderators of productivity or tenure and promotion outcomes.

In conclusion, the meta-analysis revealed a variety of barriers related to WOC's experiences in the academy. Therefore, a "both-and" approach to institutional transformation is necessary wherein specific strategies are implemented to transform institutions as well as prevent WOC faculty from experiencing well-documented challenges. This approach can promote equity when implemented by individuals who have awareness of equity-related issues at the institution and within broader society.

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Further reading

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