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Understanding Female STEM Faculty Experiences of Subtle Gender Bias from Microaggressions Perspective

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ABSTRACT

Research has repeatedly discussed the lack of women in many Science, Technology, Engineering, and Mathematics (STEM) fields. It has been suggested that the "chilly climate" - feeling unwelcomed or discriminated- pushes women away from STEM fields. This leads to many women leave STEM fields at multiple stages, thus creating the "leaking pipeline" phenomenon. The experiences of women who remained and are established in STEM fields are under examined. This study used *microaggressions theory* to understand STEM women's experiences in academia. This study examined the degree to which women faculty in STEM disciplines experience subtle gender bias and whether such experiences differed based on their ranking, position track, age, and race/ethnicity.

Participants were 57 women who were instructional, clinical, and/or research faculty in a broad range of STEM disciplines from a Midwestern land grant university. Subtle gender bias was measured by two instruments, which consisted of 29 items and asked the extent to which participants agreed with statements regarding gender-based microaggression events on a 7-point scale. The instruments included three aspects/factors of gendered microaggressions: (1) *Sexual Objectification*, (2) *Silenced and Marginalized*, and (3) *Assumptions of Inferiority*. Participants were asked to identify their position title, position track, age, and ethnicity.

The scores on three aspects/factors of gendered microaggressions were calculated by averaging across items that loaded on each factor with the range of 1~7, with higher scores indicating higher frequency of the experience being asked. On *Sexual Objectification*, 25% of the participants who responded agreed they either experienced stereotypes of women or were objectified on their physical appearance. On *Silenced and Marginalized*, 40% of those who responded agreed they were either ignored in a professional setting or had been challenged regarding their authority. Similarly, on *Assumptions of Inferiority*, 25% of the participants who responded agreed they experienced being told women's work would be inferior to men's work or being told she was too assertive or sassy. Furthermore, our preliminary results suggested that women faculty differed in gendered microaggressions experiences based on their ranking, position track, age, and ethnicity.

This study provided a greater understanding of how women faculty perceive and encounter gender-based microaggressions in various STEM fields. The results contribute to gender equity issues for the STEM disciplines where women are under-represented and under-valued.

Introduction

Research has repeatedly discussed the lack of women in many Science, Technology,

Engineering, and Mathematics (STEM) fields.[1-3] It has been suggested that the "chilly climate" - feeling unwelcomed or discriminated- pushes women away from STEM fields.[4] This leads to many women leave STEM fields at multiple stages, thus creating the "leaking pipeline" phenomenon.[5] The experiences of women who remained and are established in STEM fields are under examined. This study used *microaggressions theory* [6] to understand STEM women's experiences in academia. According to microaggressions theory, under-represented groups, such as women in most male-dominant STEM disciplines, are likely to experience subtle bias and discrimination based on their identities. This study examined the degree to which women faculty in STEM disciplines experience subtle gender bias and whether such experiences differed based on their ranking, position track, age, and race/ethnicity.

Microaggressions Theory

Microaggressions are nuanced forms of insulting, disrespectful communications that occur during everyday exchanges. They target individuals from a different identity groups (e.g., race, gender, religion, sexual orientation, person with disability).[6, 7] They are often subtle and can take on both verbal and nonverbal formats. Most of the research literature on microaggressions theory has focused on racial/ethnic microaggressions.[6-8] The prevalence of racial microaggressions and/or subtle racial discrimination has been documented in educational settings,[9, 10] workplace,[11] and clinical settings.[6]

Gendered microaggressions have been used to explain subtle sexism and sex-based discrimination on women.[12, 13] Gendered microaggressions are manifested in various forms, such as making gender stereotypical assumptions, sexually objectifying women, or being gender blind.[13, 14] Several studies have shown that gendered microaggressions cause detrimental consequences to women's psychological and behavioral health, and their careers.[12, 15, 16] This study focused on women faculty, an often under-represented group in many male-dominant STEM disciplines. We examined whether, and to what degree, women faculty in STEM experienced gender-based subtle bias and discrimination.

Methods

Instruments

Several research measurements have been established to gauge individuals' perceptions of racial and/or gender microaggressions.[6, 7, 17] This study used two instruments: Gendered Racial Microaggressions Scale, and the Racial and Ethnic Microaggressions Scale. The Gendered Racial Microaggressions Scale (GRMS) was developed to evaluate the experiences and perceptions of African American women and examined the intersection of gendered and racial

microaggressions.[17,18] The 25-item instrument yielded four independent factors: (1) sexual objectification, (2) silenced and marginalized, (3) strong Black woman, and (4) angry Black woman. In the present study, we examined women of all ethnic groups. Thus, for the purpose of this study, we used only the first two factors: (1) sexual objectification, including 8 items, and (2) silenced and marginalized, including 13 items. *Sexual Objectification* refers to someone objectifying women on their physical features or making a sexually inappropriate comment.[18] *Silenced and Marginalized* involves ignoring women's opinions or challenging women's authorities in a workplace.[18] The reliability coefficient Cronbach's alpha value was .87 and 88 for these two scales respectively.[18]

The second instrument, Racial and Ethnic Microaggressions Scale (REMS), was developed to measure the microaggressions that people of color experience in their everyday lives.[7] The 45-item instrument yielded 6 independent factors: (1) assumptions of inferiority, (2) second-class citizen and assumptions of criminality, (3) microinvalidations, (4) exoticization/assumptions of similarity, (5) environmental microaggressions, and (6) workplace and school microaggressions. The descriptions of all factors can be found elsewhere.[7] Among the six factors, only the first and the sixth factors apply to the experiences of women. Additionally, since the items in the sixth factor overlap with the second factor, *Silenced and Marginalized* in the GRMS measure, we only included the first factor, *Assumptions of Inferiority* from REMS, with 8 items. The reliability coefficient Cronbach's alpha value was .93 for this factor.[7]

Taken together, the three independent factors mentioned above consisted of 29 items and asked the extent to which participants agreed with statements regarding gender-based microaggression events on a 7-point scale (1=Strongly disagree to 7=Strongly agree). The three aspects/factors of gendered microaggressions were (1) *Sexual Objectification* from GRMS (8 items), (2) *Silenced and Marginalized* from GRMS (13 items), and (3) *Assumptions of Inferiority* from REMS (8 items). Participants were asked to identify their position title, position track, age, and ethnicity. See Figure 1-4 for participant demographic information.

Participants

Participants were 57 women who were instructional, clinical, and/or research faculty in a broad range of science, technology, engineering, and mathematics (STEM) disciplines from a Midwestern land grant university. Both tenure-track (including tenured) and non tenure-track faculty were included. The STEM disciplines chosen were so defined by the National Science Foundation.[19] These disciplines included: aerospace studies, agriculture, architecture, aviation technology, biochemistry and molecular biophysics, biology, chemistry, economics, engineering, geography, geology, kinesiology, mathematics, physics, statistics, and veterinary medicine.

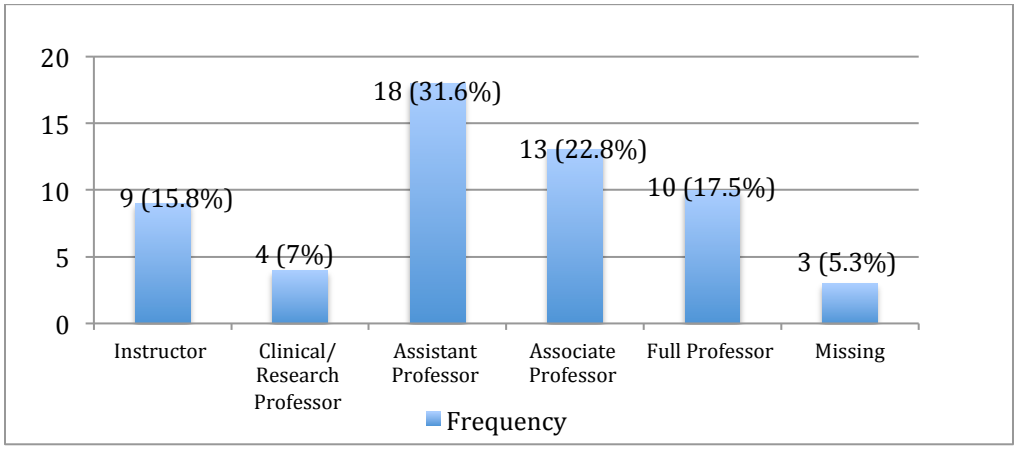

Figure 1. Number of faculty respondents by position title.

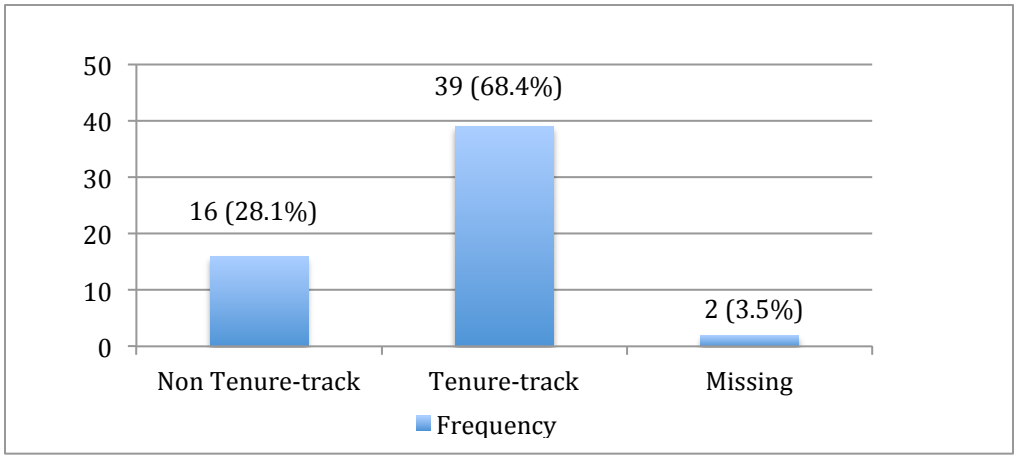

Figure 2. Number of faculty respondents by position track.

With Institutional Review Board approval, we acquired email addresses of potential participants from the university's planning and analysis office. An Internet survey procedure first articulated by Dillman was utilized.[20] First, participants received an e-mail survey invitation directly from the researchers. Participants were recruited by an introductory e-mail correspondence that invited their participation. It was followed days later by the electronic survey email, a follow-up e-mail and a final debriefing correspondence.

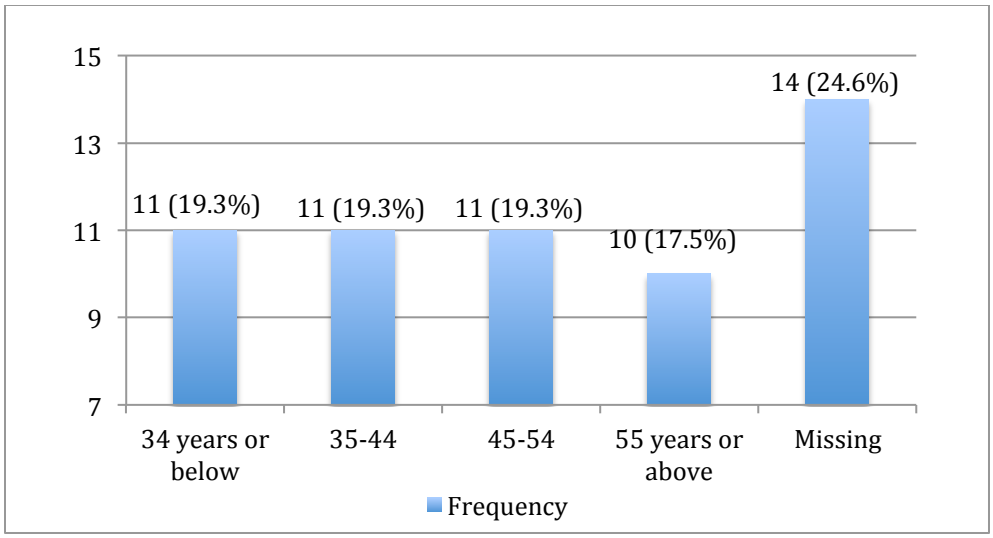

Figure 3. Number of faculty respondents by age group.

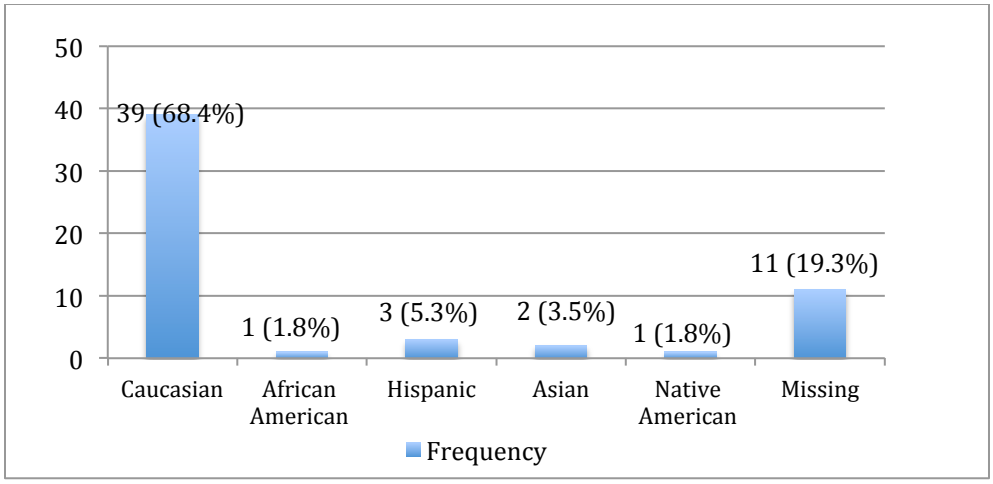

Figure 4. Number of faculty respondents by ethnicity.

Results

The scores on three aspects/factors of gendered microaggressions were calculated by averaging across items that loaded on each factor with the range of 1~7, with higher scores indicating higher frequency of the experience being asked. Nine participants had missing data and thus were excluded from the data analyses. On *Sexual Objectification*, the responses ranged from 1~6.75 (*Mean* = 2.83). Twenty-five percent of the participants who responded (Figure 5) agreed they either experienced stereotypes of women or were objectified on their physical appearance (scored 4.01 or higher). On *Silenced and Marginalized*, the responses ranged from 1~6.92 (*Mean* = 3.41). Forty percent of those who responded (Figure 6) agreed they were either ignored in a professional setting or had been challenged regarding their authority (scored 4.01 or higher). Similarly, the responses ranged from 1.13~5.88 (*Mean* = 3.27) on *Assumptions of Inferiority*.

Twenty-five percent of the participants who responded (Figure 7) agreed they experienced being told women's work would be inferior to men's work or being told she was too assertive or sassy (scored 4.01 or higher).

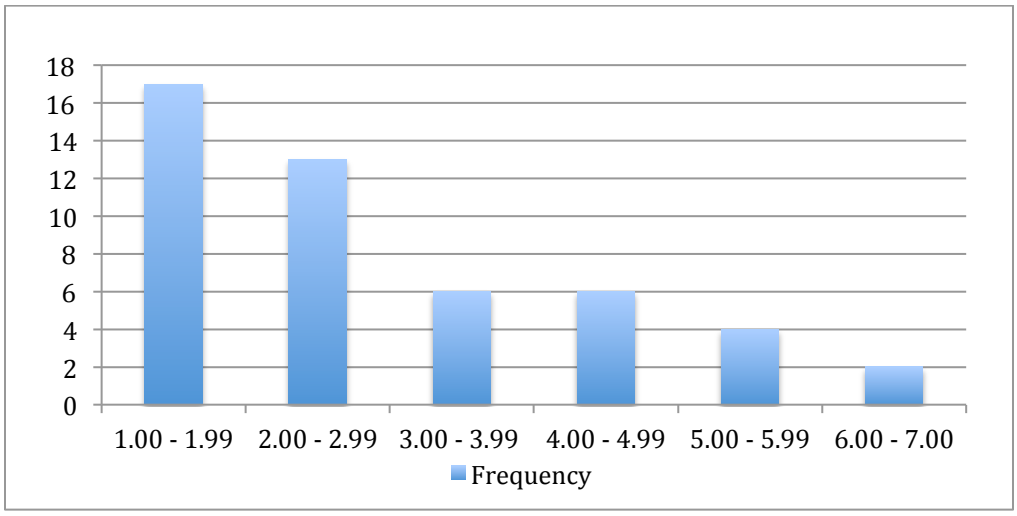

Figure 5. Number of faculty respondents in different score ranges on Sexual Objectification Factor.

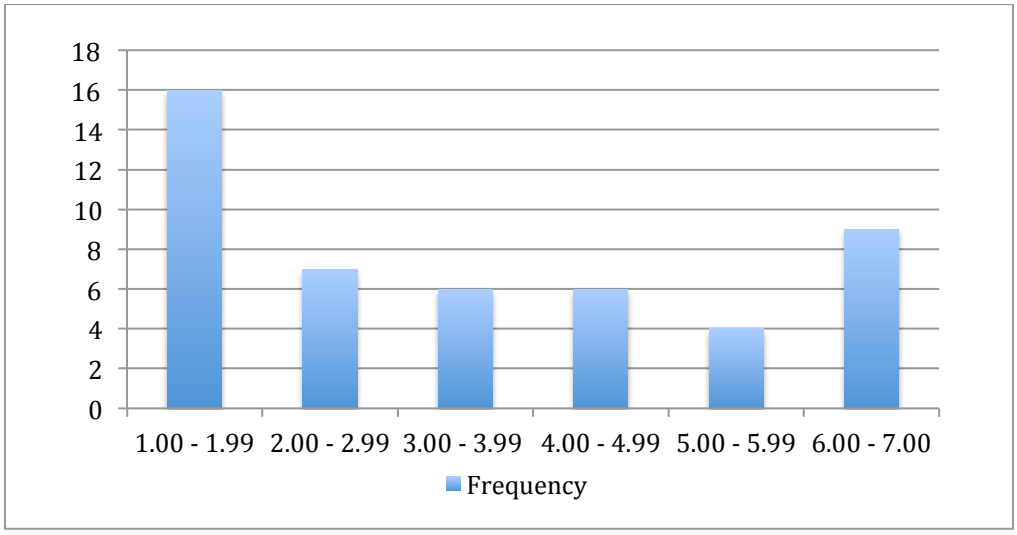

Figure 6. Number of faculty respondents in different score ranges on Silenced and Marginalized Factor.

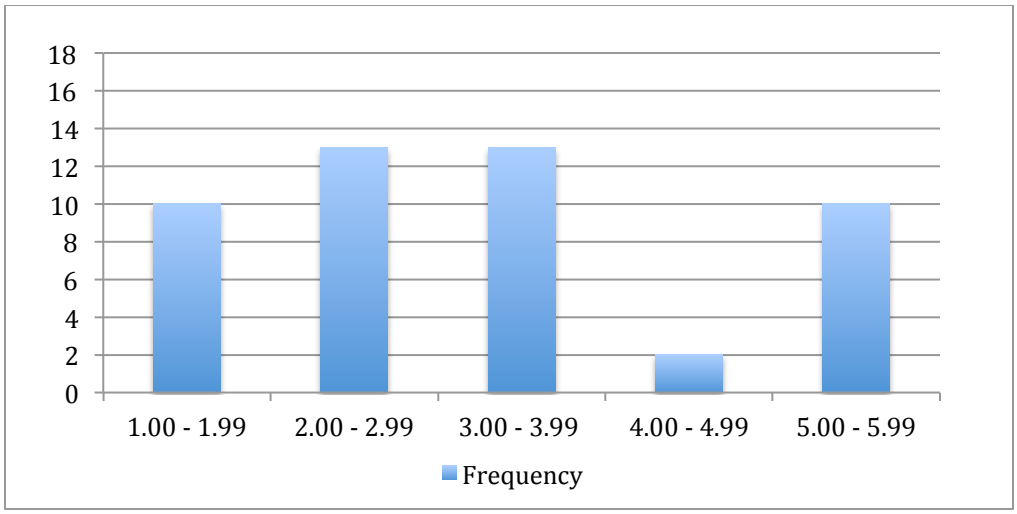

Figure 7. Number of faculty respondents in different score ranges on Assumptions of Inferiority Factor.

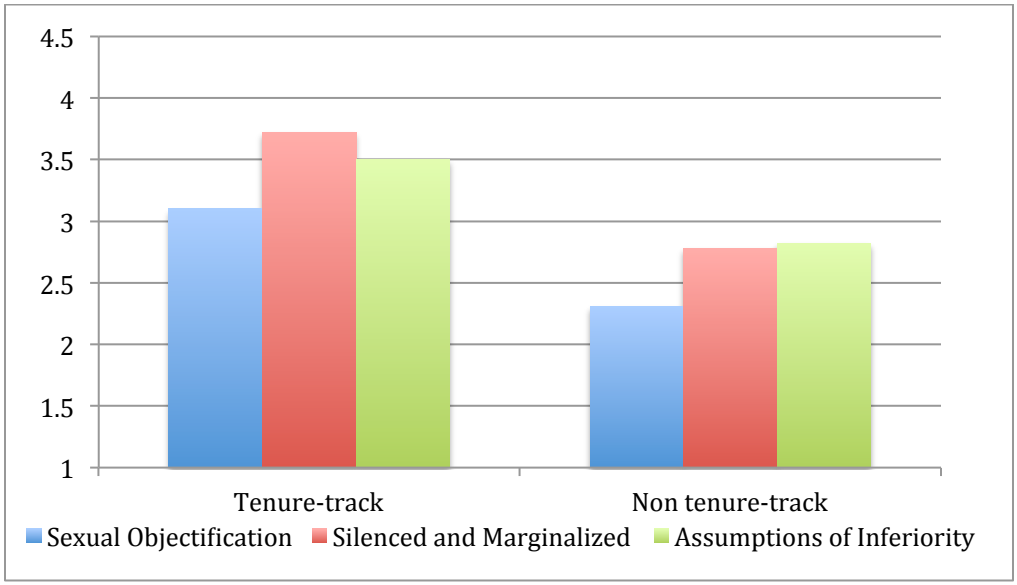

Figure 8. Average scores on three factors by position track.

We further compared whether respondents differed in various forms of gendered microaggressions based on their ranking, position track, age, and ethnicity. Since we had few respondents in certain groups, the sample size was insufficient for inferential statistical comparisons. Nevertheless, we compared faculty participants' responses descriptively. Tenure-track respondents experienced more gendered microaggressions of all forms than non tenure-track respondents (Figure 8). Full professors experienced the most gendered microaggressions, followed by assistant professors, whereas instructors experienced the least (Figure 9). The oldest age groups overall experienced more gendered microaggressions than other age groups (Figure 10). There is not much difference in gendered microaggressions by

ethnicity except one Native American respondent being much higher than the others (Figure 11).

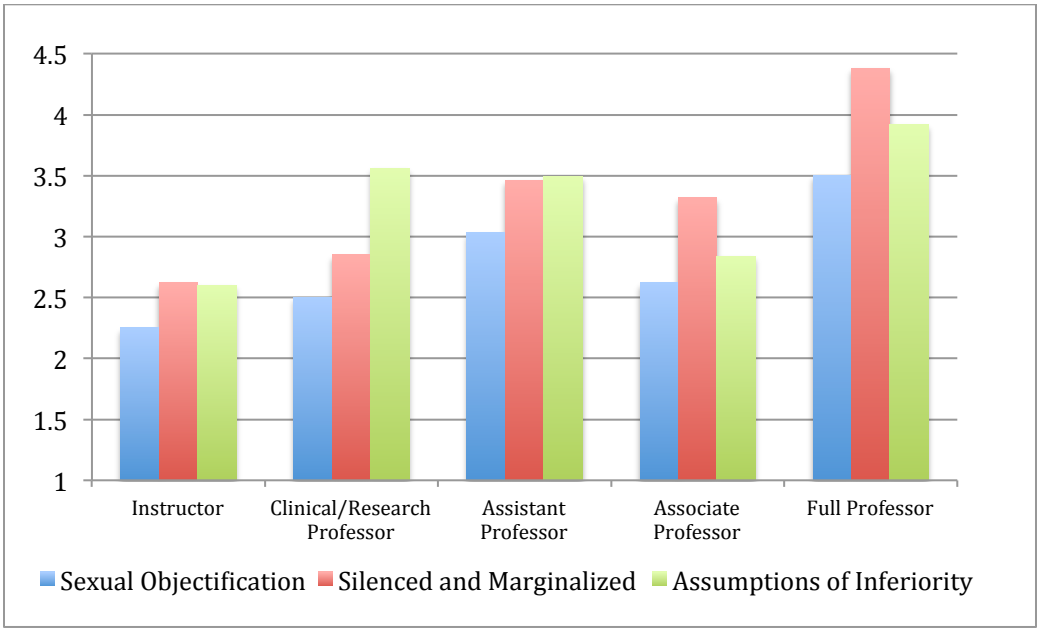

Figure 9. Average scores on three factors by position title.

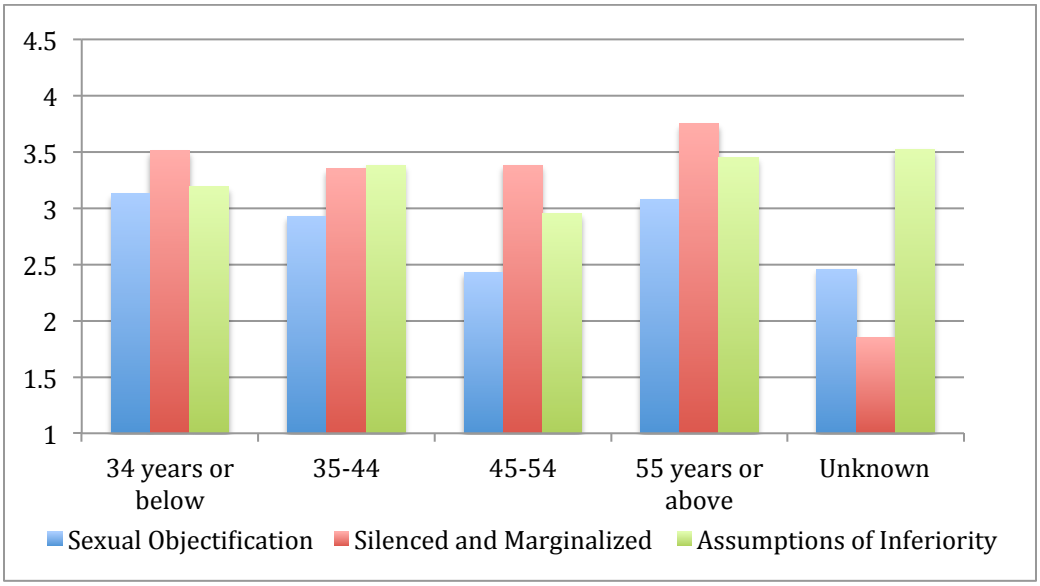

Figure 10. Average scores on three factors by position track.

Since the above mentioned group comparisons were descriptive in nature, many other factors were not accounted for in the comparisons. For example, the differences between tenure-track and non tenure-track faculty could be influenced by the nature (e.g., lab only or lecture only) and the environmental dynamics (e.g., classroom, lab, etc.) of the positions. The differences between

full professors (which is likely to overlap with the oldest age group) and other position titles could be due to the length that full professors have been in the field or due to their heightened awareness of the issue. In addition, our study combined all STEM fields together whereas the departmental environment could vary drastically among different STEM disciplines. Therefore, we are not concluding that these factors are defining factors in examining gendered microaggressions. Instead, we believe further research is very much needed to gain a nuanced understanding of the phenomenon of gendered microaggressions.

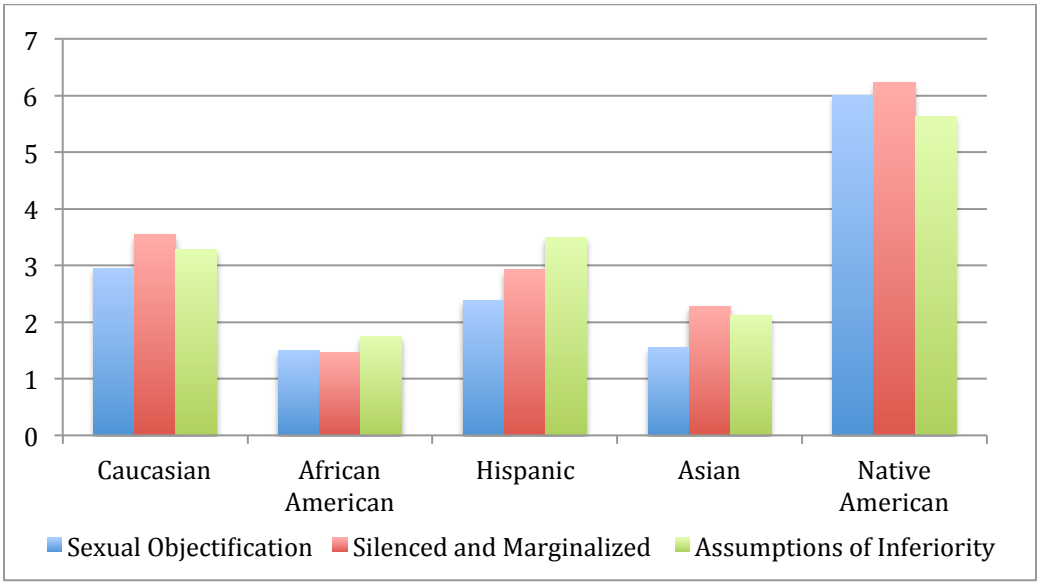

Figure 11. Average scores on three factors by position track.

Noteworthy, our sample was predominantly Caucasian, which was expected. The research site is a Midwestern land grant university. 81.3% of all faculty members are Caucasian, followed by 5.5% Asian, 3.3% Hispanic, 3% African American, 0.5% Native American, 4.5% Non-Resident Alien, and 1.9% other. Our faculty sample from STEM disciplines was consistent with the racial and ethnic composition of the university faculty overall.

Discussion and Conclusion

This study used microaggressions theory to examine the experiences of women who have stayed and are established in STEM fields, where women are often under-represented and under-valued. It provided a greater understanding of how women faculty perceive and encounter gender-based microaggressions in various STEM fields. The results contribute to gender equity issues for the STEM disciplines where women are under-represented and under-valued.

Literature has illustrated the harmful and detrimental impact of gendered microaggressions on individuals is occurring on college campuses. This study suggested that various forms of gendered microaggressions occur in STEM fields. Therefore, we call on researchers and policy makers to manage systemic biases within departmental and organizational settings that sustain gendered microaggressions. Ultimately, the goal is to inform the STEM professionals and provide concrete steps to create a respectful, inclusive, and empowering professional environment for everyone.

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