Influence of Workplace Microaggressions on Engineering Female Faculty Motivation to do Research

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Abstract: Negative and often unconscious beliefs about marginalised groups, including women and people of colour, sometimes manifest in discriminatory and degrading slights called microaggressions. Since most often microaggressions are in the form of subtle actions, unobtrusive comments, or humorous gestures, they are frequently overlooked as innocent and harmless, specifically to bystanders. However, their adverse effects on those on the receiving end are anything but innocuous, even if perpetrators are utterly unaware of their harmful comments or behaviours. Minorities and marginalized individuals often find microaggressions more harmful than blatant racism and discrimination. Six hundred and eleven STEM (Science, Technology, Engineering, Math) faculty from ten USA universities completed an online survey in the spring of 2021, of which 39% self-identified as Underrepresented Minority, URM, faculty. This study revealed that on average, URM women were 50% more susceptible to gender microaggressions, which correlated negatively with autonomy (having choice) and competence (being capable and effective), and positively with amotivation (lack of motivation). Case in point, 38% of them believed their opinions were overlooked in a group discussion because of their gender. Women with intersecting identities, such as women of colour, experienced both forms of gender and racial/ethnic microaggressions. They have experienced being ignored at work, being treated differently, and their opinion being overlooked based on their gender and/or their race/ethnicity. While detecting bias and microaggression and acknowledging their occurrence is crucial, taking deliberate and precise actions to disrupt and prevent them from re-occurring is even more pivotal. By realising the prevalence of discrimination and microaggressions towards underrepresented minority female faculty, and sharing insights into the complex and overarching race, ethnic, and gender relations among other social constructs, this study deepens our understanding of the challenges and barriers that this group has to grapple with. By adopting and creating effective institutional policies and professional training in support of diversity, inclusion, and cultural competency we can improve the experiences of URM faculty and positively impact their motivation and productivity.

Keywords: Gender microaggressions, Gender discrimination, Motivation, Underrepresented minority, URM faculty, Female faculty

1. Theoretical Framework and Objectives

According to the US National Center for Science and Engineering Statistics (NCSES, 2020), underrepresented minority (URM) STEM faculty are identified as those whose representation in STEM fields are smaller than in the USA population; typically, gender, race, and ethnicity are the most studied demographics. The term microaggression was first used in 1970 by Chester Pierce, a Harvard University psychiatrist, to describe his observation of the subtle insults and daily indignities inflicted on African Americans by non-blacks, which he emphasized were more offensive than blatant racism. Since most often microaggressions are in the form of subtle actions, unobtrusive comments, or humorous gestures, they are frequently overlooked as innocent and harmless, specifically to bystanders (Haynes-Baratz et al, 2021; Lilienfeld, 2017; Torino et al, 2018). The adverse effects of microaggressions on those on the receiving end are anything but innocuous, even if perpetrators are utterly unaware of their harmful comments or behaviors. Because of microaggressions' ambiguous and imperceptible nature, minorities and marginalized individuals often find microaggressions are more harmful than blatant racism and discrimination (Pierce, 1970; Smith, 2020; Sue et al, 2007, 2008).

Microaggressions verify that racial and gender discrimination are not maladies of the past and they still exist in the modern higher education (Johnson and Joseph-Salisbury, 2018). External factors and social conditions, such as microaggressions in educational settings, negatively impacted URM faculty's perceptions of their competence, sense of relatedness and belonging, and excluded them from formal and informal networking opportunities, causing failure in the institutional retainment of URM faculty, especially in STEM fields (Mountz, 2016; Payton et al, 2018; Ryan and Niemiec, 2009; Williams 2020). Assumptions of inferiority emanated from microaggression were also negatively correlated with job satisfaction (Carr, 2017) and research productivity (Zambrana et al, 2021). Female and African Americans faculty are the most susceptible targets for workplace microaggression and some of their harmful impacts such as stress and psychological ruin (Lui, 2019; O'Meara et al, 2000; Pierce, 1995; Stolzenberg et al, 2019, 2020; Young et al, 2015; Zambrana et al, 2021). The combination

of high-demand careers in research universities and structural racism incessantly contributed to compounded stress, depression, poor health, and even early death (Pierce, 1995).

This study utilized self-determination theory (SDT; Deci and Ryan, 1985; Deci et al, 1997) as a framework to understand faculty motivation for research (Stupnisky et al, 2019, 2022). SDT recognizes autonomy (choice), competence (self-efficacy), and relatedness (connectedness) as three basic individual psychological needs and defines the degrees to which these are satisfied as determining the type and level of motivation for particular tasks. Motivation itself has been categorized into various forms: autonomous motivation (enjoyable [intrinsic] and/or valuable [identified]), controlled motivation (to gain rewards or avoid punishment [external] and/or to prevent guilt or anxiety [introjected], and amotivation (lack of motivation), the worst psychological state for productivity.

The current study first examined the percentage of STEM URM faculty and various subgroups who experienced gender and/or racial/ethnic microaggressions. We then investigated the relationship between STEM URM faculty members' perceived gender and racial microaggressions with their motivation to conduct research and productivity. Another population of significant interest within URM are those with intersecting marginalized identities, such as women who identify with a race other than white. Intersectionality is a framework to describe the interweaving and overlapping of social identities (Crenshaw, 1989). This population endures compounded negative effects and consequences of gender as well as racial and/or ethnic discrimination and daily microaggressions (Essed, 1990; Stergiopoulos and Rosenburg, 2020). This study further examined if reports of microaggressions were higher for URM with intersecting identities. Additionally, we tested if these microaggressions related to the motivation and perceive of success for this population.

2. Methods and Materials

2.1 Participants and Procedure

In February of 2021, 611 STEM faculty members from 10 USA Doctoral Universities (R2 Higher Research Activity Carnegie Classification) completed an online survey. Participant demographic and position details are in Table 1. Faculty reported contract time percentages as research 40.10% (*SD*=21.73), teaching 36.26% (*SD*=20.25), service 12.54% (*SD*=10.13), and other/administration 7.85% (*SD*=16.30).

Table 1: Full Sample Participant Characteristics

		Count	Percent
Primary Disciplinary Area	Life sciences	150	24.6
	Social sciences	92	15.1
	Engineering	85	13.9
	Psychology	48	7.9
	CISE	36	5.9
	Geoscience	34	5.7
	Mathematical sciences	32	5.2
	Physics and astronomy	32	5.2
	Chemistry	30	4.9
	STEM education learning research	27	4.4
	Materials research	7	1.1
	No response	38	6.2
Academic Rank	Assistant Professor	185	30.3
	Associate Professor	156	25.5
	Full Professor	208	34.0
	Instructor/teaching professor	15	2.5
	Research scientist/analyst	5	0.9

		Count	Percent
	Other	42	6.9
Tenure Status	On tenure track but not tenured	174	28.5
	Tenured	353	57.8
	Not on tenure track	77	12.6
	Other	7	1.1
Gender Identity	Man	347	56.8
	Woman	254	41.6
	I prefer not to respond	10	1.6
Racial Identification	White	484	79.2
	Asian	73	12
	Multiracial	17	2.8
	Other	15	2.5
	Black or African American	12	2.0
	American Indian or Alaska Native	3	0.5
	No response	7	1.2
Ethnicity	Not of Hispanic, Latinx, or Spanish origin	560	91.7
	Yes, another Hispanic, Latinx, or Spanish origin	23	3.8
	Yes, Mexican, Mexican American, Chicano	22	3.6
	No response	6	1.0
International	No	442	72.3
	Yes	165	27.0
	No response	4	0.7
Underrepresented minority (self-identified)	No	373	61.1
	Yes	236	38.6
	No response	2	0.3

2.2 Measures

2.2.1 Microaggressions

Two separate scales were used, one for gender microaggressions and one for race and ethnicity (Table 2), both involving five items on a five-point scale (1 = *Never*, 5 = *Very often*). To measure gender microaggression, we adapted five items from Yang and Carroll (2018). It included statements such as: “My opinion was overlooked in a group discussion because of my gender”. The racial and ethnic microaggressions scale (REMS) was adapted from Nadal (2011), with the heading question as: “How many times this academic year have you experienced

the following interactions?", followed by specific questions such as: "An employer or co-worker was unfriendly or unwelcoming toward me because of my race".

Table 2: Full Sample Scale Reliabilities and Descriptive Statistics

Measure	α	# items	*M*	*SD*	Actual range	Skew	Kurtosis
Basic Needs							
Autonomy	.83	4	4.05	0.65	1.25-5	-0.78	1.06
Competence	.84	4	4.19	0.58	1.75-5	-0.74	1.24
Relatedness	.87	4	3.86	0.73	1-5	-0.81	1.02
Motivation							
Intrinsic	.86	3	4.49	0.59	2-5	-1.23	1.90
Identified	.69	3	4.37	0.61	2-5	-1.13	1.40
Autonomous	.86	6	4.43	0.56	2-5	-1.19	1.85
Introjected	.86	3	3.45	1.06	1-5	-0.46	-0.72
External	.56	3	3.40	0.81	1-5	-0.24	-0.30
Amotivation	.83	3	1.81	0.80	1-5	1.02	0.59
Research Success							
Activity	.85	3	3.32	0.85	1-5	-0.19	-0.44
Publications	.89	3	3.05	0.98	1-5	0.05	-0.56
Grants	.90	3	3.18	0.79	1-5	-009	-0.10
Overall	.92	12	3.16	0.94	1-5	-0.32	-0.57
Microaggression							
Gendered Microaggressions	.96	5	1.58	0.92	1-5	1.78	2.68
Racial & Ethnic Microaggressions	.93	5	1.31	0.64	1-5	2.67	7.88

Note. Autonomous motivation is the amalgamation of intrinsic and identified motivation.

2.2.2 SDT psychological needs

Twelve items adapted from Stupnisky et al (2017) measured faculty members' perceived level of need satisfaction regarding their research. Following the question, "Regarding your RESEARCH, to what extent do you agree with the following?" were four items equally distributed among three subscales (1 = *Strongly disagree*, 5 = *Strongly agree*): autonomy ("I have a sense of freedom to make my own choices."), competence ("I have confidence in my ability to do things well."), and relatedness ("I am supported by the people whom I care about [students, colleagues, etc.].").

2.2.3 Motivation

Motivation was measured using twelve items adapted from Stupnisky et al (2019; 1 = *Strongly disagree*, 5 = *Strongly agree*). Regarding the question, "To what extent are the following reasons for why you engage in RESEARCH?", faculty members responded to three items distributed across five subscales: intrinsic ("It is enjoyable to engage in research."), identified ("My research is important to me."), introjected ("I would feel guilty not engaging in research."), external motivation ("Because I am paid to produce research."), and amotivation ("Honestly, I don't know why I do research."). Exploratory factor analysis revealed the intrinsic and identified subscales be combined to form the autonomous motivation subscale, which is consistent with past research on faculty motivation for research (Stupnisky et al, 2017, 2019, 2022).

2.2.4 Success

Faculty rated their perceived success in research over the last three academic years in three areas: conducting research activities, publishing research, and securing external grant funding for research. In each area they rated four items on a 5-point scale (1 = *Well below average*, 3 = *Average*, *5 = Well above average*; Stupnisky et al, 2019): "Your own standards", "Your department's standards for tenure and promotion", "Colleagues in your department", and "Colleagues in your field(s)".

3. Results

3.1 Descriptive Statistics

Table 3 displays a breakdown of who self-identified as URM based on gender, race, and ethnicity. Among the 236 (38.6%) faculty who self-identified as URM, women (77.12%) were the biggest demographic, one-third were non-white (30.60%), and 17.45% had Hispanic, Latinx, or Spanish ethnicity. The URM faculty included 57 (23.65%) women who also reported other intersecting marginalized identities. As for those who did not identify as URM, the majority were men (300, 80.4%), while 70 (18.8%) were women.

Table 3: Self-Identified URM by Gender, Race, and Ethnicity

URM x Gender	URM (236)		Non-URM (373)	
Women (254)	182	77.1%	70	18.8%
Men (347)	47	19.9%	300	80.4%
I prefer not to respond/Other	7	2.97%	3	0.80%
URM x Race				
White (484)	161	68.2%	323	86.6%
Asian (73)	32	13.8%	41	11.0%
Multiracial (I7)	13	5.60%	3	0.80%
Other (15)	12	5.17%	2	0.54%
Black or African American (12)	11	4.74%	1	0.27%
American Indian or Alaska Native (3)	3	1.29%	1	0.27%
No response (7)	4	1.69%	1	0.27%
URM x Ethnicity				
Not of Hispanic, Latinx, or Spanish origin	194	82.2%	366	98.12%
Yes, another Hispanic, Latinx, or Spanish origin	20	8.90%	2	0.54%
Yes, Mexican, Mexican American, Chicano	21	8.47%	2	0.54%
No response	1	0.42%	3	0.80%
URM Women with Intersecting Identities				
Women who are not white and/or have Hispanic, Latinx, or Spanish origin	57	24.15%		

Note. Full sample counts for gender, race, and ethnicity in parentheses in first rows and column. Percentages may not sum to 100% due to rounding.

3.2 Group Differences, Gender Microaggression

Comparing URM women to non-URM faculty, our study revealed on average URM female faculty were 50% more susceptible to gender microaggressions; case in point, 35.2% believed their opinions were overlooked in a group discussion because of their gender. Women with intersecting identities, such as women of colour, experienced

compounded forms of gender and racial/ethnic microaggressions; specifically, they reported being ignored at work, being treated differently, and their opinion being overlooked based on their gender and/or their race/ethnicity.

3.3 Group Differences in Racial and/or Ethnic Microaggression

Results showed that non-white URM faculty reported racial and/or ethnic microaggressions 38% more than non-URM faculty (Table 4). Our descriptive analysis of URM women with intersecting identities showed that this group is 43% more susceptible to racial microaggressions at work than their non-URM peers, which is the highest percentage among all the URM subgroups. Responding to the survey questions, 28.1% of this subgroup disclosed that they were treated differently than their co-workers of another race/ethnicity by an employer or colleague.

Table 4: Level of Agreement With Gender and Race/Ethnicity on Respective Microaggression Items

	Gender Microaggression Questions				
Question 1	An employer or co-worker was unfriendly or unwelcoming toward me because of my gender.				
Question 2	My opinion was overlooked in a group discussion because of my gender.				
Question 3	I was ignored at work because of my gender.				
Question 4	Someone assumed that my work would be inferior to people of other gender.				
Question 5	An employer or co-worker treated me differently than co-workers of another gender.				
	Percent of Responses				
Gender Microaggressions	Question1	Question 2	Question 3	Question 4	Question 5
URM	25.34	32.58	23.60	25.79	32.58
URM Women	37.65	26.47	30.00	37.03	24.53
URM Women with Intersecting Identities	24.53	28.30	18.87	20.75	26.42
	Racial/Ethnic Microaggression Survey Questions				
Question 1	An employer or co-worker was unfriendly or unwelcoming toward me because of my race.				
Question 2	My opinion was overlooked in a group discussion because of my race.				
Question 3	I was ignored at school or work because of my race.				
Question 4	Someone assumed that my work would be inferior to people of other racial groups.				
Question 5	An employer or co-worker treated me differently than co-workers of the other race/ethnicity.				
		Percent of Responses			
Racial/Ethnic Microaggressions	Question1	Question 2	Question 3	Question 4	Question 5
URM	13.38	14.61	10.96	05.55	16.97
URM Women with Intersecting Identities	20.75	28.85	22.64	16.98	30.19
URM non-white and with Hispanic, Latinx, or Spanish Ethnicity	23.16	26.60	21.28	17.89	28.42

Note. Responses for gender microaggressions shown for all URM (236), self-identified URM women (*n* = 182) and URM Women with Intersecting Identities (*n* = 57), and racial/ethnic microaggression shown for all URM (236), self-identified URM nonwhites (*n* = 75), and URM Women with Intersecting Identities (*n* = 57). All the microaggression questions were answered on the response scale: *1 = Never, 2 = Infrequently, 3 = Sometimes, 4 = Frequently, 5 = Very often*. The values shown in this table are the average of options 3 and above.

3.4 Correlations

We found a moderate negative correlation between gender microaggressions and autonomy and relatedness among all URM faculty (Table 5). We also found a positive correlation between gender microaggression and

amotivation. Both results indicate gender microaggressions related to maladaptive motivational states for URM faculty. Unexpectedly, among URM faculty there was a low positive correlation between racial/ethnic microaggression and perceive of success.

Table 5: Correlations Microaggressions, Motivation, Perceived Success for URM

	Gender Microaggression		Racial/ethnic Microaggression
Autonomy	-.21**		-.01
Competence	-.08		.12
Relatedness	-.30**		-.10
Autonomous	-.09		-.10
Introjected	.09		-.08
External	.09		.03
Amotivation	.17*		.09
Self-report Success	-.06		.16*

Note. Correlations for gender and racial/ethnic microaggression were analyzed all self-identified URM faculty (236).

* $p < .05$, ** $p < .01$

For the URM faculty who did not identify as white, we were surprised to find a positive correlation between racial\ethnic microaggressions and external motivation, although it was small. Another unexpected discovery was among the URM women with intersecting identities, they showed a moderate positive correlation between racial/ethnic microaggressions and competence (Table 6). We did not find any correlation between perceive of success and any form of microaggressions for these specific groups

Table 6: Correlations Microaggressions, Motivation, Perceived Success Broken Down by Groups: Gender, Race/Ethnicity

	URM Race/Ethnicity		URM Women		URM Women with Intersecting Identities		
	Racial/ethnic Microaggression		Gender Microaggression		Racial/ethnic Microaggression		Gender Microaggression
Autonomy	-.06		-.11		.14		-.09
Competence	.18		.02		.36*		.05
Relatedness	-.08		-.22**		.18		.05
Autonomous	-.08		-.01		-.06		-.17
Introjected	-.07		-.10		.10		.02
External	.18*		.01		.08		.03
Amotivation	.08		.06		-.07		.05
Self-report Success	.03		.04		.21		.13

Note. Correlations for gender and racial/ethnic microaggression were analyzed for all self-identified URM faculty (236). However, results for gender microaggressions are shown only for self-identified URM women (n = 182) and URM Women with Intersecting Identities (n = 57), and for race discrimination only for self-identified URM nonwhites (n = 75) URM Women with Intersecting Identities.

* $p < .05$, ** $p < .01$

4. Conclusions and Significance of Study

This study examined underrepresented minority STEM faculty and their experiences with race, ethnicity, and gender-related microaggressions, and how these experiences related to their motivation and success in conducting research. A critical finding was that URM STEM faculty reported various forms of microaggressions such as being treated differently, their opinions being overlooked, or being ignored in a group setting because of their gender, race and\or ethnicity. These discoveries are in line with previous studies (Lui, 2019; O'Meara et al, 2000; Pierce, 1995; Stolzenberg et al, 2019, 2020; Young et al, 2015). Our study also revealed that URM women with intersecting identities, in addition to gender microaggressions, were more likely to experience microaggressions based on their race and/or ethnicity that likely compounded the negative effects (Essed,1990; Stergiopoulos, E., and Rosenburg, N., 2020).

In a series of published studies, workplace discrimination and microaggressions were negatively correlated with job satisfaction (Carr, 2017) and research productivity (Zambrana et al, 2021). Our analysis supports these claims by finding significant negative correlations for gender microaggressions with autonomy and relatedness, as well as a positive correlation to amotivation, among URM women faculty.

This study contributes to the research literature on faculty development, research success, and motivation by examining URM faculty with a large representative sample, established multi-item measures, and a well-grounded theoretical framework. A limitation was that other URM groups were not measured, such as based on socioeconomic status, disability, and sexuality, which should be considered for future studies.

Implications for higher education include adapting effective institutional policies and professional training in support of diversity, inclusion, cultural competency, and cultural humility that could positively impact the motivation and productivity of URM faculty. Sue et al. (2019) insisted that inaction and passive bystanders are not effective ways to disarm microaggressions or protect the victims. Furthermore, establishing resources and adapting or initiating programs to address and diminish race, ethnicity, and gender-related misconduct could significantly decrease race-related stress among URM faculty especially the younger generation (Lui, 2019). While detecting bias and microaggression is crucial to acknowledge its occurrences, deliberate and precise actions are required to disrupt and prevent them from re-occurring (Haynes-Baratz et al, 2021). The three core innate human psychological needs described in self-determination theory (Deci and Ryan, 2008) could influence and contribute to URM faculty's motivation to survive and thrive in less than suitable atmosphere of STEM disciplines and to overcome the tremendous challenges they face (Lechuga, 2012). Hence, alongside current conventional faculty development programs, typically focused on advancing promotions and tenure, higher education administrators should consider adopting SDT as the framework to create a professional development curriculum addressing and advocating specific needs and challenges of underrepresented faculty and students to bolster their sense of relatedness, competence, and autonomy.

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