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Examining The Unique Experiences Of Underrepresented Minority STEM Faculty: How Discrimination, Microaggression, And Allyship Relate To Sense Of Relatedness, Motivation, And Perceived Success

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Examining the Unique Experiences of Underrepresented Minority STEM Faculty: How Discrimination, Microaggression, and Allyship Relate to Sense of Relatedness, Motivation, and Perceived Success

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This dissertation, submitted by Mojdeh J. Mardani, in partial fulfillment of the requirements for the Degree of Doctor of Philosophy from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done, and is hereby approved.

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PERMISSION

Title: Examining the Unique Experiences of Underrepresented Minority STEM Faculty: How Discrimination, Microaggression, and Allyship Relate to Sense of Relatedness, Motivation, and Perceived Success

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Table of Contents

ACKNOWLEDGEMENTS VII

ABSTRACT 1

INTRODUCTION TO THE PROGRAM OF RESEARCH 2

Overview of Study 1 4
Overview of Study 2 8
Overview of Study 3 12
Summary 17
References 18

STUDY I: EXAMINING UNDERREPRESENTED MINORITY STEM FACULTY MEMBERS' MOTIVATION FOR RESEARCH 23

Abstract 26
Examining Underrepresented Minority STEM Faculty Members' Motivation for Research 27
Motivation for Research 29
Current Study 34
Method 35
Participants and Procedure 35
Measures 36
Results 38
Faculty Identification as URM 38
URM Faculty Discrimination 39
URM Faculty Motivation for Research 39
Discrimination Related to URM Motivation and Research Success 40
Discussion 42
Limitations and Future Directions 44
References 45
Figures 51
Tables 53

STUDY 2: INFLUENCE OF WORKPLACE MICROAGGRESSIONS ON ENGINEERING FEMALE FACULTY MOTIVATION TO DO RESEARCH 60

Abstract: 60
Theoretical Framework and Objectives: 61
Methods and Materials 63
Participants and Procedure: 63
Measures: 65

MICROAGGRESSIONS: 65
TABLE 2 65
SDT PSYCHOLOGICAL NEEDS: 66
RESULTS 67
DESCRIPTIVE STATISTICS: 67
TABLE 3 67
GROUP DIFFERENCES, GENDER MICROAGGRESSION: 68
GROUP DIFFERENCES IN RACIAL AND/OR ETHNIC MICROAGGRESSION: 68
TABLE 4 68
CORRELATIONS: 69
TABLE 5 69
TABLE 6 70
CONCLUSIONS AND SIGNIFICANCE OF STUDY 70
REFERENCES: 73

STUDY 3: ALLYSHIP, FROM THE VIEWPOINT OF UNDERREPRESENTED-MINORITY FACULTY: TESTING THE IMPACT ON MOTIVATION AND WORKPLACE RELATEDNESS 78

THEORETICAL FRAMEWORK AND OBJECTIVES 80
CURRENT STUDY 81
METHOD AND MATERIALS 82
PARTICIPANTS AND PROCEDURES 82
MEASURE 82
RESULTS 84
ALLYSHIP SCALES 90
GROUP DIFFERENCES 85
CORRELATIONS 85
DISCUSSION AND SIGNIFICANCE 86
REFERENCES 89
TABLES 93
TABLE 1 93
TABLE 2 94
TABLE 3 94
TABLE 4 95
TABLE 5 95
TABLE 6 96
TABLE 7 97
TABLE 8 97
FIGURES TITLE 98
FIGURE 1. 98
FIGURE *2.* 99
APPENDIX 100
RACE\ETHNICITY-BASED ALLYSHIP SCALE 100
GENDER-BASED ALLYSHIP SCALE 101
UNDERREPRESENTED MINORITY (URM 102

CONCLUSION: 103

FINDINGS OF THIS STUDY: 103
IMPLICATION, SHORTCOMINGS, AND FUTURE RECOMMENDATION 104
REFERENCES 106

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Abstract

Results from empirical studies reveal underrepresented minority, URM, university faculty experience biases, discrimination, and affiliated stress that can impact multiple aspects of their work such as research performance (Fisher et al., 2019; O'Meara et al., 2020; Stolzenberg et al., 2019; Stupnisky et al., 2015), isolation, and lessened relatedness to colleagues (Zambrana et al., 2017; 2021), which may affect their motivation to conduct research. This dissertation is a collection of three separate but complementary research studies examining the effects of various forms of discrimination and the role of allyship in shaping the motivation of URM faculty members to engage in research, their perception of success, and their sense of relatedness to both their colleagues and their workplace. The first study explored the impact of workplace discrimination. The second study examined the consequences of experiencing microaggression. In the third study, two survey scales were created to capture the perspective of URM population on allyship. These scales were subsequently employed to investigate the possible influence of allyship on URM's relationship with colleagues and their workplace, perceived success, and motivation to engage in research. The research findings explored the significance of the experiences of URM faculty and contributed to the research literature on URM faculty development, research success, and motivation.

Introduction to the Program of Research

A growing body of empirical studies has found motivation to be an essential factor determining faculty success in teaching (Daumiller et al., 2020; Stupnisky et al., 2018), and conducting research (Stupnisky et al., 2019). Researchers have linked various types of motivation to the general faculty population's research productivity, such as intrinsic positively relating or amotivation negatively relating to success (Hardré et al., 2011; Stupnisky et al., 2017 & 2019). This dissertation describes a program of study on a specific group of faculty, namely underrepresented minority (URM) in science, technology, engineering, and math (STEM), and examines the effects of discrimination, microaggression, and allyship on their motivation to conduct research, perceived success, and sense of relatedness to their colleagues with three empirical studies.

According to 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. For example, according to the United State Census Bureau (2021), women make up nearly half of the US workforce, however they only hold 27% of the jobs in the STEM sectors. Numerous factors, from personal choices to institutional barriers, might limit women's participation and success in STEM fields (Ceci & Williams, 2010). Recognizing the underrepresentation of female faculty in STEM fields (Carrigan et al., 2011), they produced fewer scholarly publications, cited less (Sugimoto et al., 2013), and received less funding for research than their male peers (Beaudry & Larivière, 2016). URM faculty motivation, specifically to conduct research, may be uniquely impacted by any workplace discrimination they experience.

A leading perspective on motivation, self-determination theory (SDT; Deci & Ryan, 1985; Deci et al., 1997) defines competence, relatedness, and autonomy as three core innate human psychological needs that contribute to an individual's motivation and perception of success. If individual's needs are supported for a particular task, in this case research, they will experience optimal, autonomous motivation (task engagement because it is enjoyable [intrinsic] and/or valuable [identified]) and be more likely to produce scholarly work. A critical assertion of SDT is that the *type* of motivation is more important than the quantity of motivation in predicting outcomes (Deci & Ryan, 2008). These basic psychological needs could influence and motivate URM faculty to survive and thrive challenging atmospheres of STEM disciplines (Lechuga, 2012).

How motivation affects the research success of URM faculty has mainly been studied regarding gender differences. Utilizing SDT, Deemer et al. (2012) found that men and women are motivated by different extrinsic and avoidance factors. Stupnisky et al. (2019) similarly found male faculty, compared to female, reported more research autonomy and perceived success; furthermore, white faculty, relative to non-white faculty, reported more autonomous motivation and perceived success in research but also more introjected and external motivation. A limitation of those studies was that neither examined how motivation was differentially associated with research success for URM faculty; in other words, they compared mean levels but not differences in associations.

This researcher and her Ph.D. advisor, Dr. Stupnisky, have conducted a series of empirical studies with the following purposes: In Study 1, we inquired who self-identifies as URM faculty, aimed to explore their experiences of workplace discrimination, and delved into how these encounters affected their self-determined motivation to conduct research. Moving on

to Study 2, our primary objective was to examine the prevalence and consequences of experiencing microaggression among all underrepresented groups and subgroups including those with intersectional identities, such as women of color. In Study 3, we investigated the possible impact of allyship on how URM population interpreted their success, motivation to engage in research, and their relationship with colleagues and their workplace. To do so, we developed two allyship survey instruments, one Gender-based allyship and one Race- and Ethnicity-based allyship. The data gathered using these surveys provided a unique perspective on allyship as perceived by URM faculty members. Below is a summary of each of the three studies, which is followed afterwards by the full study articles or manuscripts.

Overview of Study 1

A growing body of empirical studies has found motivation to be critical to faculty success in teaching (Stupnisky et al., 2018; Colbeck et al., 2002) and research (Lechuga, 2012a; Daumiller et al., 2020). Studies on URM faculty have found discrimination and affiliated stress impact multiple aspects of their work, including their self-determined motivation to conduct research (Fisher et al., 2019; O'Meara et al., 2020; Stolzenberg et al., 2019; Stupnisky et al., 2015). These workplace discriminations could further impact URM faculty by manifesting in other harmful conditions such as depression, isolation, and lessened relatedness to colleagues (Zambrana et al., 2017; 2021). URM faculty motivation, and specifically to conduct research, may be uniquely impacted by any workplace discrimination they experience, yet this has rarely been studied.

The overarching objective of this study was to evaluate how URM status relates to faculty motivation to conduct research and perceived research success. The major research questions of this study were:

1. Who self-identifies as an underrepresented minority faculty?
2. Among URM, what level of discrimination do they self-report?
3. What level of motivation and success do URM faculty report, and how do these compare to non-URM faculty?
4. Is the level of discrimination (gender, race/ethnicity) related to URM motivation and perceived success in research?

In addition to studying the mentioned effects on the whole group, we examined URM subgroups based on discipline, gender, race, and ethnicity to discover explicit as well as overlapping characteristics of each subcategory. The research found evidence of correlations between experiencing discrimination at work with motivation and perceive of success in research.

This study was described in a manuscript and was published in the journal of Interdisciplinary Educational Psychology in 2023. In addition to the researcher, Muhammad Salahuddin, one of her research cohorts, and Dr. Rob Stupnisky, her Ph.D. faculty advisor, are noted as the co-authors on this paper. The article has been provided in the appendix. Several papers resulting from this study were accepted and presented at various conferences including the 2021 and 2022 American Educational and Research Association, AERA, conferences, and 2021 Society of Women Engineers conference, We21. Part of this study was also presented at the 2021 UND Graduate Research Achievement Day and was the recipient of the Professional, Social Sciences, Humanities, and Arts award.

Method

In February of 2020, prior to the COVID-19 pandemic shutdown, 651 STEM faculty members from 10 USA Doctoral Universities (R2 Higher Research Activity Carnegie

Classification) completed an online survey The multi-scale measures consisted of Self-Determination Theory (SDT) psychological needs, Motivation, Success, and workplace Discrimination was utilized. To measured faculty members' perceived level of need satisfaction regarding their research the SDT Psychological Needs scale was adapted from Stupnisky et al. (2017). Motivation was measured using a scale adapted from Stupnisky et al. (2019). 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 using the 5-point scale by Stupnisky et al. (2019). Six questions from Zambrana et al. (2017) were used to measure workplace discrimination. This questionnaire included both gender-based and race- and/or ethnicity-based discrimination questions.

Results

The participant demographics indicated 37% self-identified as URM. The breakdown of URM based on gender, race, and ethnicity revealed 81.5% were women, 20% non-white, and 6.3% of Hispanic, Latin, or Spanish ethnicity. The cross-section of these three demographics showed that white, non-Hispanic, women (185) were the largest group, followed by non-white, non-Hispanic, women (38). Not surprisingly, the largest group of non-URM was white, non-Hispanic, males (335).

The results of *t*-test revealed URM faculty, compared to non-URM, reported lower levels of autonomy and autonomous motivation. The analysis discovered that experiences of gender-based discrimination for URM women were negatively correlated to autonomy and relatedness to others, and positively related to amotivation. No correlation was found between the gender-based discrimination and success. Alternatively, among URM non-white and Hispanic/Latinx/Spanish faculty, experiences of race/ethnicity discrimination correlated with greater perceived success,

perhaps indicating those who are performing well are more likely to experience discrimination from others.

This study used the R lavaan package (Rosseel, 2012) for all latent variable analyses. Results supported convergent validity based on strong factor loadings of items on latent variables and an acceptable goodness of fit (for all model fits please see Table 7 in Appendix A). For non-URM, autonomous motivation (enjoyment, value) positively related to research success, whereas for URM faculty a lack of introjected motivation (guilt) was the strongest predictor of research success. URM faculty motivation was fostered by autonomy, relatedness, and lower competence, which have implications for faculty development.

Discussion

A critical finding was that URM faculty experience motivation for research in ways differently than non-URM faculty. The study found that for URM faculty relatedness had a positive relation to autonomous motivation that was a much larger effect than for non-URM faculty. This supported past studies and verdicts that URM faculty maintain a sense of belonging by remaining connected to families, friends, and peers. We also found that introjected motivation, an internalized motivation that could negatively manifest as non-action, was a significant negative predictor of research success for URM. This finding aligned with previous studies supporting the perception that URM faculty negatively internalized the emotional stress related to institutional cultures that could affect their motivation to do research. A limitation of this study was that other URM groups were not measured, such as based on socioeconomic status, disability, and sexuality. Furthermore, the current study examined the influences of those biases that were evident and based on conscious behaviors. This shortcoming was fulfilled in the

second study, by investigating the impact of unconscious negative stereotypes and slights toward underrepresented minority populations.

Reference

Mardani, M., Salahuddin, M., & Stupnisky, R. H. (2023). Examining underrepresented minority STEM faculty members' motivation for research. *Interdisciplinary Educational Psychology*, 3(1):4.

Overview of Study 2

Microaggressions are everyday discriminatory and degrading slights and behaviors manifested from negative and often unconscious beliefs and stereotypes about marginalized groups, including people of color and women. This term was coined 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 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). Assumptions of inferiority emanated from microaggression were negatively correlated with job satisfaction (Carr, 2017) and research productivity (Zambrana et al., 2021). Microaggressions in the context of social settings in education have a negative impact

on URM faculty's perceptions of their competence, sense of relatedness and belonging, causing failure in the institutional retainment of URM faculty, especially in STEM fields (Mountz, 2016; Payton et al., 2018; Ryan & Niemiec, 2009; Williams 2020).

This study utilized self-determination theory (SDT; Deci & Ryan, 1985; Deci et al., 1997) as a framework to understand faculty motivation for research (Stupnisky et al., 2019). The researcher first examined the relationship between STEM URM faculty members' perceived gender and racial microaggressions and their motivation to conduct research and records of productivity. She further investigated the percentage of gender and/or racial/ethnic microaggressions experienced by various URM faculty subgroups and any possible correlation with motivation to do research, productivity, and perceive of success?

One of the populations of significant interest within URM was 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 & Rosenburg, 2020). This study additionally investigated if reports of microaggressions increased for URM with intersecting identities, and whether these incidences influence the motivation and perceive of success for this population.

Several papers resulting from this study were accepted and presented at various conferences, including the 2023 American Educational and Research Association, AERA conference in Chicago, presented by the co-author Dr. Stupnisky, and another one at the 6th International Conference on Gender Research (ICGR) in Ulster University, Northern Ireland, UK (2023), which resulted in the publication of this paper in the proceedings of this conference,

under the title "Influence of Workplace Microaggressions on Engineering Female Faculty Motivation to do Research."

Method

This quantitative research study used the data from an online survey conducted in February of 2021. The participants consisted of 611 STEM faculty members from 10 USA Doctoral Universities (R2 Higher Research Activity Carnegie Classification).

In addition to the multi-scale measures of SDT psychological needs, Motivation, and success used in the first study (Stupnisky et al., 2017; Stupnisky et al., 2019), two separate scales of microaggressions, one for race and ethnicity and one for gender microaggressions was adapted. The racial and ethnic microaggressions scale (REMS) was a five-item on a five-point scale (1 = *Never*, 5 = *Very often*) adapted from Nadal (2011) and a five-item scale from Yang and Carroll (2018) was adapted for the gender microaggression.

Results

Descriptive statistical analysis revealed among the 611 faculty, 39% self-identified as URM, out of which women with 77.12% were the biggest demographic, 30.60% were non-white, and 17.45% had Hispanic, Latinx, or Spanish ethnicity. The URM faculty included 57 (23.65%) women who also reported other intersecting marginalized identities.

The study on group differences in gender microaggression revealed that on average, URM women were 50% more susceptible to gender microaggressions. Women with intersecting identities experienced both forms of gender and racial/ethnic microaggressions. Results from group differences in racial and/or ethnic microaggression showed non-white URM faculty reported racial and/or ethnic microaggressions 38% more than non-URM faculty. A considerable number of male faculty who self-identified as URM, 28.7%, reported experiencing racial and/or

ethnic microaggressions. Our descriptive analysis of URM women with intersecting identities showed that 43% of them were subjected to racial/ethnic microaggressions at work, the highest percentage among all the URM subgroups.

This study found a moderate negative correlation between gender microaggressions and autonomy and competency among all URM faculty, and a positive correlation to amotivation. That means gender microaggressions are related to several maladaptive motivational states for URM faculty.

Unexpectedly, among URM faculty there is a low positive correlation between racial/ethnic microaggression and perceive of success. Further investigation into the URM subgroups showed a positive correlation between racial\ethnic microaggressions and external motivation, for the URM faculty who did not identify as white, although it was small. Another unexpected discovery was among the URM women with intersecting identities, they showed a significant moderate positive correlation between racial/ethnic microaggressions and competence, which correlated negatively with autonomy and competence, and positively with amotivation. Racial\ethnic microaggressions correlated positively with external motivation, among non-white URM faculty and competence among non-white URM women, which were 43% more likely to experience it.

Discussion

Some of the critical findings such as reports of various forms of microaggressions based on gender, race and\or ethnicity are in line with previous studies (Lui, 2019; O'Meara et al., 2000; Pierce, 1995; Stolzenberg et al., 2019; Young et al., 2015). The researchers' examination of URM women with intersecting identities revealed that this population was more likely to experience more than one form of microaggressions, based on their gender as well as their race

and/or ethnicities, which compounds the negative effects of discrimination and microaggressions (Essed,1990; Stergiopoulos, E., & Rosenburg, N., 2020). Their analysis supported previous studies' claims that workplace discrimination and microaggressions were negatively correlated with job satisfaction research, productivity, autonomy, and competence, but a positive correlation to amotivation, among different URM faculty subgroups.

Reference

Mardani, M., & Stupnisky, R. H. (2023, April). Influence of Workplace Microaggressions on Engineering Female Faculty Motivation to do Research. *International Conference on Gender Research* (Vol. 6, No. 1, pp. 168-176).

Overview of Study 3

Following the first two studies, the researcher shifted her attention toward possible actions counteracting some of the discriminatory treatments of URM faculty. The third study is rooted in the concepts of ally and allyship and their possible impacts on empowering URM faculty in STEM. Ally is someone from a dominant group or majority who is aware of their privilege(s) and actively supports and advocates for marginalized and underrepresented individuals and/or groups with the intent of creating equity and promoting their visibility (Briodo, 2000; Washington and Evans, 1991). Allyship is the act of advocacy and support of underrepresented and disadvantaged groups and individuals toward equity and justice (Nash et al., 2021).

Investigating the roles of allies in academic settings, Veer et al. (2021) affirmed that allies and diversity champions could have a profound effect on creating and nurturing a sense of belonging and relatedness for URM faculty at their institution. Allies' actions are not for their own benefit or advancement, instead, their aim is to eradicate those patterns of differences and

concessions that facilitated their privileges (Washington & Evens, 1991) and in doing so, they risk experiencing alienation themselves (Malott et al.2019). There are few means to label and identify one as an ally and validate the outcomes and impacts of allyship (Williams& Sharif,2021). Most allyship studies focus on perspectives of dominant groups regarding their actions as allies toward non-dominant groups (Ostrove & Brown 2018). The current study, however, examines the notions of allyship from the viewpoint of underrepresented minority, URM, faculty and its potential impact on their motivation to conduct research and their sense of relatedness within workplace.

In a study regarding the roles of allies in academic settings, URM faculty ranked inclusion, acceptance, and a sense of belonging the highest value in an organization (Brooks et al., 2009). Similarly, Veer et al. (2021) concluded that allies have a profound effect on creating and nurturing a sense of relatedness for URM faculty at their institution, since allies' actions and solidarities with underrepresented minority individuals or groups could help foster a culture of inclusion and a sense of belonging in the workplace. Other studies have shown that in some situations the act of allyship from the opposite gender could be more effective than same-gender colleagues, lessen the sense of not-belonging, and identity safety, especially for women in male-dominated fields such as STEM (Exley & Kessler, 2019; Pollock, 2020).

Williams and Sharif (2021) confirm that measuring the impacts of allyship, and validating and labeling individuals as allies are complicated processes. Most existing studies rely on individuals to self-report their act of allyship toward non-dominant individuals or groups, instead of allowing others to entrust them with allies' adjectives (Carlson et al. 2020). This type of discussion centers around the dominant groups awarding them with ally labels based on their self-evaluations, by asking them who allies are rather than measuring the impact of their action

(Patton et al., 2015). Unfortunately, this approach fails to cross-assess these self-reported allyship claims with perspectives of URM members who are experiencing this act (Brown et al., 2013).

As alluded in the above section, in her literature review, the researcher was not successful in identifying any established allyship measure that examined the effect of allyship from the viewpoint of URM's experiences. She did, however, come across a few surveys related to allyship but was not successful in gaining permission to access and adopting those scales.

In the third study, the researcher aimed to address this deficiency and the nuances and complexities of measuring allyship by developing two unique instruments, named Race\Ethnicity-based Allyship and Gender-based Allyship. After investigating and establishing the validity and reliability of these two scales, they were utilized in conjunction with other established scales of motivation, STD, and success to collect and analyze data to gain a deeper insight into URM's perceptions of allies and allyship.. The study research questions included: Does belonging to a URM population or knowing a close person who belongs to a URM population increase being an ally? Do all faculty, URM and non-URM, experience the same level of support and allyship? Would experiencing allyship affect URM faculty's sense of relatedness to their colleagues? Do URM faculty who experience allyship have a higher degree of perceived success compared to the rest of URM and other faculty? Does experiencing allyship impact faculty members' motivation to engage in research?

Another population of significant interest within URM is 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 microaggressions (Essed, 1990; Stergiopoulos and Rosenburg, 2020). This study examined the level of allyship.

A paper resulting from this study was submitted for the 2024 American Educational and Research Association, AERA conference in Philadelphia, PA, and several presentations and training was conducted based on the findings of this study.

Method

This quantitative research study used data from an online survey of higher education faculty members in the spring of 2023. Only data from participants who had completed all the allyship-related questions were considered in the study analyses, resulting in a final sample size of 184. The researcher's two newly developed Allyship instruments were also employed: The Race\Ethnicity-based Allyship and the Gender-based Allyship scales each consisted of nine items measured on a five-point Likert scale (1 = *Strongly Disagree*, 5 = *Strongly Agree*). Additionally, the survey contained multi-item scales measuring self-determination motivation, research success, and the basic psychological need of relatedness (Stupnisky et al., 2017; Stupnisky et al., 2019).

Results

Test of group differences did not find any evidence that identifying as URM or knowing someone who identifies as URM increases the tendency to be an ally. The analysis of group differences however, provided evidence that on average, URM faculty experienced significantly lower levels of allyship support than non-URM faculty in both Race\Ethnicity-based as well as Gender-based allyship categories. Notably, URM women faculty with intersecting identities (women of color) reported the lowest levels of allyship among URM and all other participants.

The correlation analysis on URM faculty population confirmed that all items in both Race\Ethnicity-based allyship and Gender-based allyship have a significant positive correlation with the basic psychological need for relatedness. Our data revealed a negative correlation between amotivation and the Accepted factor of Race\Ethnicity-based allyship scale.

Discussion

Inclusion, acceptance, and a sense of belonging to the organization ranked top when asked URM individuals what they want from allies and allyship (Brooks, A. K., & Edwards, K., 2009). Our analysis for both Race\Ethnicity-based and Gender-based allyship supports confirm a significant interrelation between URM faculty members experiencing allyship and a sense of belonging to their workplace and colleagues, as one of the basic human psychological needs.

The result of this research contributes to the literature on development, motivation, and successful research outcomes for URM faculty. The findings could interest government and higher education administrations in developing, adapting, and implementing effective institutional policies and procedures such as inclusive leadership and allyship training to address the specific needs and challenges of the URM faculty population (Munoz & Thomas, 2006). Embracing these approaches and policies could create an inclusive culture where faculty from all backgrounds, identities, abilities, and experiences feel supported and accepted (Brooks & Edwards, 2009).

Reference

Mardani, M., & Stupnisky, R. H. (under review). *Allyship, From the Viewpoint of Underrepresented-Minority Faculty: Testing the Impact on Motivation and Workplace Relatedness.* Paper submitted to the American Educational Research Association Conference, April 2024, Philadelphia, PA.

Summary

The program of research focused on URM faculty in STEM and examined how experiencing discrimination and day-to-day microaggressions could impact some aspects of their professional success and emotional wellbeing. Additionally, two new allyship scales were developed, to investigate possible impact of URM's perceived act of allyship on their motivation and sense of relatedness and its possible counteraction with ramifications of discrimination and microaggressions. This research contributes to the research literature on faculty development, research success, and motivation. An implication of these findings is to make a positive impact on higher education as a whole and mostly the improvement of the treatment of URM faculty and students in STEM. The findings could interest higher education in curtailing the challenges of their recruitment and retention of URM, by adapting effective institutional policies and procedures and implementing frequent and recurrent diversity, inclusion, and allyship training to management and employees to address the specific needs and challenges of URM population (Brooks, A. K., & Edwards, K., 2009, Munoz, C. S., & Thomas, K. M., 2006).

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Study I: Examining Underrepresented Minority STEM Faculty Members' Motivation for Research

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Dr. Robert Stupnisky arrived at UND in 2010 after completing his PhD at the University of Manitoba and a postdoctoral fellowship at Laval University. He is interested in how motivation and emotions affect individual's success higher education, initially studying college students and more recently focusing on university professors as director of the Faculty Motivation Research Group. Dr. Stupnisky teaches educational psychology, research methods, statistics, structural equation modeling, learning analytics, R programming, and data literacy. Rob is also the Associate Dean of Research and Faculty Development in the UND College of Education and Human Development, Director of the Bureau of Evaluation and Research Services (BEARS) at UND, coordinator of the graduate certificate in Learning Analytics. He is the receipient of the 2023 W. J. McKeachie Career Achievement Award from the Special Interest

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Abstract

Underrepresented minority (URM) university faculty can be identified as those whose representation based on gender, race, and/or ethnicity in particular fields, such as Science, Technology, Engineering, and Math (STEM), are smaller than in the US population. Studies on URM faculty have found discrimination and affiliated stress impact faculty in many aspects of their work, such as performance in research. In the current study, we examined STEM faculty who self-identify as URM, their experiences of workplace discrimination, and how these encounters affect their self-determined motivation to conduct research. Six-hundred and fifty-one faculty from 10 US institutions completed an online survey. Of the participants, 37.5% self-identified as URM, of which 81% were women, 20% non-white, and 6% Hispanic/Latinx ethnicity; notably, the data shows that 24% of women and 56% of non-white faculty did not self-identify as URM. More than 87% of URM reported workplace bias, which correlated with significantly lower autonomy and relatedness with coworkers. URM women reported gender discrimination at work was common and upsetting, which related to greater amotivation. Non-white and Hispanic/Latinx/Spanish URM who reported high success in research also cited more discrimination. URM faculty motivation was fostered by autonomy and competence, and much more by relatedness compared to non-URM faculty. For non-URM, autonomous motivation (enjoyment, value) positively related to research success, whereas for URM faculty a lack of introjected motivation (guilt) was the strongest predictor. Discussion focuses on implications for future studies of faculty motivation and strategies to promote URM faculty research productivity.

Keywords: Underrepresented Minority, STEM, Faculty, Motivation, Research, Discrimination

Examining Underrepresented Minority STEM Faculty Members' Motivation for Research

Underrepresented minority (URM) individuals are defined as those whose representation are smaller than in the US population, typically based on gender, race, and/or ethnicity. Among university faculty URMs are particularly visible in the fields of Science, Technology, Engineering, and Math (STEM) (National Science Foundation, National Center for Science and Engineering Statistics, 2020). Results from empirical studies reveal URM university faculty experience biases, discrimination, and affiliated stress that can impact multiple aspects of their work such as research performance (Fisher et al., 2019; O'Meara et al., 2020; Stolzenberg et al., 2019; Stupnisky et al., 2015). URM faculty workplace discrimination could further manifest itself in depression, isolation, and lessened relatedness to colleagues (Zambrana et al., 2017; 2021), which may affect their motivation to conduct research.

A growing body of empirical studies has found motivation to be critical to faculty success in teaching (Stupnisky et al., 2018; Colbeck et al., 2002) and research (Lechuga, 2012a; Daumiller et al., 2020). URM faculty motivation, and specifically to conduct research, may be uniquely impacted by any workplace discrimination they experience, yet this has rarely been studied. URM faculty reported spending more time teaching, mentoring, and advising, and less time on research which could be an indicator of motivation (O'Meara et al., 2020). The purpose of this study was to examine which STEM faculty self-identify as URM, their experiences of workplace discrimination, and how these encounters affect their self-determined motivation to conduct research.

URM Faculty

URM faculty face unique challenges in higher education. Regarding gender, fewer women are employed as faculty in STEM fields than men (Carrigan et al., 2011). Research

studies, including Beaudry & Larivière (2016) and Larivière et al. (2013), reveal a pattern where women, on average, produce fewer scholarly publications, receive fewer citations for their work, and secure less research funding compared to their male counterparts. Additionally, the impact of family dynamics on research productivity is evidenced by the work of Hunter and Leahey (2010), indicating that women often experience a decline in research output and visibility after becoming parents.

The academic environment further contributes to gender inequalities. Kaminski and Geisler (2012) and Hill et al. (2010) highlight that women are more likely to leave academia due to unfavorable workplace atmospheres, which may include limited support systems or discriminatory practices. Contrastingly, men's primary reason for leaving academia appears to be related to monetary factors. In line with these finding, Stupnisky et al. (2015) found significant differences between men and women faculty in terms of clear expectations, balance, and collegiality. Notably, new female faculty members experience lower satisfaction with their treatment by their senior faculty, compared to their male peers. Overall, research has shown that numerous factors, from personal choices to institutional barriers, can limit women's participation and success in STEM fields (Ceci & Williams, 2009, Kaminski & Geisler, 2012).

Regarding race and ethnicity, an analysis of over 4,000 tenure-track faculty from 40 public institutions (2015-16 AY) found black faculty accounted for just 0.7-2.9 percent and Hispanic faculty 2.5-5.1 percent of all faculty in biology, chemistry, and economics (Li & Koedel, 2017). A national study explored, despite a high number of applications submitted, African American and Black PI's were awarded fewer grants from the National Institute of Health than non-URM counterparts (Lauer, 2021). Faculty of color, compared to white faculty, had a lower publication record with respect to journal articles and books, yet a higher

commitment to research activities (Antonio, 2002). Considering discrimination aspects, African American and Asian/Pacific Islander faculty members were found to be less satisfied with their collegial relationships compared to white faculty (Ponjuan et al., 2011).

Intersectional studies that considered gender, race, and/or ethnicity revealed STEM disciplines can be particularly challenging for URM faculty. In their analysis of the successful transition of URM and women Ph.D. students to the professoriate in STEM programs, some of the underlying academic culture could lead to gender, race, and ethnic-based disparities(Fisher et al., 2019); in addition to the normal workplace stresses, women of color endure have to endure extra strain stemming from the presence of sexism and racism (Wilkins, 2017). Moreover, gender and racial stereotypes negatively impact the selection of minority candidates and limit their chances of getting accepted in STEM post-doctoral opportunities (Ethan et al., 2019). Finally, stresses related to microaggression are more prevalent among URM STEM faculty compare to non-URMs (O'Meara et al., 2020). These studies indicate URM faculty are susceptible to unique challenges, yet the motivation of URM faculty and its relationship to productivity, specifically for research, has yet to be sufficiently studied.

Motivation for Research

A leading perspective on motivation, self-determination theory (SDT; Deci & Ryan, 1985; Deci et al., 1997) suggests the degree to which three basic psychological needs are satisfied will determine motivation: autonomy (freedom to choose), competence (perceived expertise or skill), and relatedness (feeling connected with others). If individual's needs are supported for a particular task, in this case research, they will experience optimal autonomous motivation (task engagement because it is enjoyable [intrinsic] and/or valuable [identified]) and are more likely to produce scholarly work. Not all faculty are ideally motivated though, as

external influences such as funding to conduct research, annual evaluations, submission deadlines, and difficult interactions with students and colleagues can lead to controlled motivation (task performance to prevent guilt or anxiety [introjected] and/or to gain rewards or avoid punishment [external]) and lower productivity. The worst psychological state for productivity, amotivation, is a total absence of task engagement. A critical assertion of SDT is that the type of motivation is more important than the quantity of motivation in predicting outcomes (Deci & Ryan, 2008).

There is growing empirical evidence of the important relationship between faculty motivation and research success (Stupnisky et al., 2017; 2019). A survey of 781 faculty members from 28 US institutions found intrinsic motivation for research had a significant positive relationship with perceived value of conducting research, which in turn predicted research effort and productivity (Hardré et al., 2011).

In an study conducted by Stupnisky et al. (2017), involving 105 pre-tenure faculty members from two Midwestern doctoral US universities, it was observed that faculty members whose basic psychological needs of autonomy and competence were fulfilled were more likely to report higher levels of intrinsic motivation and perceived success in research. This implies that when faculty members feel a sense of control over their work and believe in their ability to achieve their research goals, they are more driven to engage in research activities and experience a sense of accomplishment. Building upong this idea, Stupnisky et al. (2019) expanded the scope of their investigation to 1846 US faculty across 19 US institutions. They reaffirmed the significance of autonomy and competence in predicting autonomous motivation among faculty members. Moreover, autonomous motivation was found to mediate the relationship between faculty members' psychological needs satisfaction and their self-reported research productivity.

Interestingly, external rewards and introjected motivation (motivation driven by guilt or external pressures) did not show a substantial connection with research success, highlighting the distinct role of intrinsic motivation in academic achievement.

In parallel, a study concerning 173 teacher education faculty in Pakistan (Angaiz et al., 2021) yielded analogous conclusions. Here, intrinsic motivation, coupled with effective work habits, research knowledge, and skillsin research, emerged as pivotal contributors to research productivity. Notably, extrinsic motivation and socialization exhibited negligible links to productivity, reiterating the dominance of internal factors.

URM Motivation for Research

The influence of motivation on the research success of underrepresented minority (URM) faculty has primarily been examined through the lens of gender differences, with a lesser focus on the application of Self-Determination Theory (SDT). Several studies have explored this connection, revealing various insights.

In the earlier study by Wiley et al. (1979), which applied attribution theory to editorial decisions and publication outcomes involving 233 faculty members, it was discovered that irrespective of the outcome, women tended to attribute relatively more importance to uncontrollable causes compared to men. This indicates a potential gender-based variation in how attribution and motivation intersect within the context of research publication decisions. Similarly, in a study involving 337 academics from major Australian universities (Schoen & Winocur, 1988), a gender-related disparity in confidence emerged. Female academics exhibited lower confidence in research tasks compared to teaching and administrative duties, while male academics displayed equal confidence in performing both research and administrative tasks. This

underscores a gender-related variance in perceived competence across different academic responsibilities.

Delving further into the gender dynamic, Landino and Owen (1988) investigated departments at a large New England university and observed that departments with higher percentages of female full-time faculty had lower research self-efficacy on average per faculty member when compared to departments with a greater proportion of male faculty. In a parallel vein, research by Vasil (1992) involving 240 university faculty from a large southern US university found that male faculty members reported significantly stronger research self-efficacy beliefs, devoted more time to research activities, and achieved higher research productivity compared to their female counterparts. Interestingly, within the Iranian university context, Shavaran et al. (2012) discovered no distinguishable differences in research self-efficacy between male and female faculty members among 261 participants. This suggests that the connection between gender and research self-efficacy can be context-dependent and influenced by cultural and institutional factors.

The application of Self-Determination Theory (SDT) to understanding motivation among faculty members reveals intriguing insights, as evidenced by the two following studies. In their study involving 337 faculty members in STEM disciplines across Canadian and American colleges and universities, Deemer et al. (2012) employed SDT to examine differences in factor loadings related to failure avoidance and extrinsic rewards. Their findings suggest that men and women in the STEM fields are influenced by distinct extrinsic and avoidance factors. This underscores the significance of considering gender-specific motivations within the context of extrinsic rewards and the desire to avoid failure. Similarly, Stupnisky et al. (2019) contributed to this understanding by exploring the gender-based dynamics in motivation among faculty

members. Their research revealed that male faculty, when compared to their female counterparts, reported higher levels of research autonomy and perceived success. Moreover, racial differences were also noted; white faculty members exhibited greater autonomous motivation and perceived research success, relative to non-white faculty, but also demonstrated higher levels of introjected and external motivation. This implies that intrinsic motivation and self-perceived success might be more pronounced among male and white faculty members, while external and internal pressures might differ across gender and racial lines.

The research landscape presented certain limitations in the studies discussed. These studies primarily focused on comparing average levels of motivation and its connections to research success among various groups, yet they didn't thoroughly explore if these associations varied for URM faculty. Barnett et al. (1998) contributed to this area by investigating a larger sample of faculty members from 24 medical schools in the US. They delved into the associations between intrinsic motivation, extrinsic career motivation, and research success among a diverse group of 1,764 faculty members. Interestingly, they found that intrinsic motivation had a positive relationship with publications, while extrinsic career motivation had a negative association. Crucially, these associations held consistently across genders, indicating that the impact of these motivational factors on research success was not influenced by gender.

Given the unique circumstances and challenges URM faculty might face, there's an imperative need for further investigation in this area. Understanding how motivation interacts with productivity in research within the context of URM faculty can provide valuable insights into fostering equitable and supportive environments that cater to the diverse motivational needs of faculty members from underrepresented backgrounds. In essence, while existing studies offer

valuable perspectives, the relationship between motivation and research success for URM faculty remains an area deserving of more comprehensive exploration.

Current Study

The overarching objective of this study was to evaluate how URM status relates to faculty motivation to conduct research and perceived research success. The major research questions of this study were:

1. Who self-identifies as an underrepresented minority faculty?
2. Among URM, what level of discrimination do they self-report?
3. What level of motivation and success do URM faculty report, and how do these compare to non-URM faculty?
4. Is the level of discrimination (gender, race/ethnicity) related to URM motivation and perceived success in research?

Following research questions and based on previous study findings, we hypothesized:

1. Faculty who are female, non-white, and of Latino ethnicity will be most likely to self-identify as URM (Carrigan et al., 2011; Li & Koedel, 2017).
2. URM faculty members are likely to report experiencing a significant degree of discrimination within their academic workplaces (O'Meara et al., 2020; Wilkins, 2017).
3. URM faculty would report lower levels of autonomous motivation for research than non-URM faculty (Stupnisky et al., 2019; Deemer et al., 2012)
4. URM faculty would report higher levels of discrimination and amotivation, while experiencing lower levels of autonomy, relatedness, and perceive of success in

research, despite one known study on gender with evidence to the contrary (Barnett et al., 1998).

By examining URM faculty with a large representative sample, established multi-item measures, and a well-grounded theoretical framework (see Figure 1), this study has the potential to fill critical gaps in research literature on faculty development, motivation, and research success, and to inform university administrators.

Method

Participants and Procedure

In February of 2020, 821 STEM faculty members from 10 US Doctoral Universities (R2 Higher Research Activity Carnegie Classification) completed an online survey. We limited data analysis to faculty who had completed at least the majority of the survey and who reported some research requirements on their contracts, resulting in a final analyzed sample of was 651 faculty.[1] Participant demographic and position details are in Table 1. More than half of the respondents were male (50.6%) and most of them were white (81.6%). Most of the faculty (92.5%) classified themselves as not of Hispanic, Latinx, or Spanish origin. Approximately one-quarter of faculty labeled themselves as international (27%). Most important to this study, 37.0% identified themselves as URM faculty.

More than one-third of the participants identified as an assistant professor (33.6%), however more than half (57.8%) of the respondents had a tenured position. The average career age (time from Ph.D.) was 13.65 years (*SD* = 10.1), and participants worked an average of 51.4 hours per week (*SD* = 10.4). Faculty reported the expected time on their contracts 40.4% (*SD*=20.5) research, 36.4% (*SD*=19.4) teaching, 12.9% (*SD*=10.5) service, and 7.5% (*SD*=16.6) other/administration.

Measures

SDT Psychological Needs

A scale adapted from Stupnisky et al. (2017) measured faculty members' perceived level of need satisfaction regarding their research (see Table 2). Following the question, "Regarding your RESEARCH, to what extent do you agree with the following?" were twelve 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.].").

Motivation

Motivation was measured using a scale adapted from Stupnisky et al. (2019). Regarding the question, "To what extent are the following reasons for why you engage in RESEARCH?" (1=*Strongly disagree*, 5=*Strongly agree*), faculty members responded to three items for each of five subscales (15 items total): 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 should be combined to form the autonomous motivation subscale, which is consistent with past research on faculty motivation for teaching and research (Stupnisky et al., 2018; 2019).

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)*: "Your own standards", "Your department's standards for tenure and promotion", "Colleagues in your department", and "Colleagues in your field(s)" (Stupnisky et al., 2019).

Bibliometric indicators of faculty research success were also collected from the Web of Science that included publications, citations, and field-normalized citations (Waltman et al., 2011a, 2011b) over the three years prior to the survey. Outliers were identified as those scores falling outside 97.5% of all scores and were trimmed; specifically, 12 faculty with more than 33 publications, and 12 faculty with more than 234 citations were removed.

Discrimination

Six questions from Zambrana et al. (2017) were used to measure workplace discrimination. In response to the question, "During your professional career, have you ever encountered the following?", participants were asked to rate three items for both gender and race/ethnicity on a four-point scale (1=*Never*, 2=*Rarely*, 3=*Often*, 4=*Always*). The items were, "Gender [race/ethnicity] discrimination by superior or colleague" and "Left out of opportunities based on gender [race/ethnicity]." They were then asked to "Please rate how upsetting these experiences based on gender [race/ethnicity] were" (1=*Not at all upsetting*,…, 4=*Extremely upsetting*).

Rational for Analysis

We used the R lavaan package (Rosseel, 2012) for all latent variable analyses. Criteria used to assess the model goodness of fit included: chi-square (χ^2), the comparative fit index (CFI > .95 indicates a well-fitting model, < .90 requires respecification; Bentler, 1990; Hu & Bentler, 1999), the root mean square error of approximation (RMSEA < .08 indicates an acceptable-fitting model, Browne & Cudeck, 1993; < .10 MacCallum, Browne, & Sugawara, 1996), and

standardized root mean square error (SRMR < .05 indicates well-fitting model, Byrne, 2010; < .08, Hu & Bentler, 1999; < .10, Kline, 2005).

Results

Faculty Identification as URM

Data analyses were conducted in R (R Core Team, 2020). Of the 651 faculty analyzed in this study, 241 (37%) self-identified as URM (see Table 3). Those URM faculty identified primarily as women (81%) and to a lesser extent a non-white race (20%), or Hispanic, Latin, or Spanish ethnicity (14%). Cross-sections of the demographics revealed that the largest group of URM was white, non-Hispanic, women (150), followed by non-white, non-Hispanic, women (27). Expectedly, the largest group of non-URM faculty was white, non-Hispanic, males (279). Data showed that women made15% of non-URM and and non-white faculty made 16% of this group, which was surprising as these two groups are among the NFS's defined URM categories for STEM fields (NCSES, 2020). Also, 25% of self-identified URM participants identified as "international" faculty member (born and raised outside of the US).

Considering job characteristics of self-identified URM, 37% were assistance professors, 25% associate professors, and 29% full professors, while the fewest were instructors, teaching professors, and research scientists at just over 9% (non-URM were 28.5% assistant, 31.7% associate, 34.9% full, 4.9% other). URM faculty were 52.7% tenured, 33.6% on tenure track, and 13.7% not on tenure track (non-URM were 60.4% tenured, 31.5% on tenure track, 7.4% not on tenure track). On average, URM faculty were lower ranked and less tenured.

Breakdown of URM by disciplines revealed the vast majority of women in Engineering, CISE, Geoscience, Physics and Astronomy, Chemistry, and Mathematical Sciences identified as URM (56 URM, three non-URM). Alternatively, in Life Sciences (e.g., biology) women made

up 43% of the faculty population, of whom 69% identified as URM. Of the remaining women who did not identify as URM, 22% were non-white. In the combined fields of Psychology and Sociology, women made up 59% of the faculty population. Despite being the majority, 72% of the women in these two fields identified as URM while less than 1% of the men self-identified as URM. Fifty-four percent of the faculty in STEM Education Learning Research were women compared to 43% men, however 80% of these women identified as URM compared to 2% of the men.

URM Faculty Discrimination

Among self-identified URM women, 86.6% reported experiencing some gender discrimination from a superior or colleague, and 80.7% felt that they have been left out of opportunities based on their gender (see Table 4). Only 8% of URM women who have experienced gender bias said that they were not upset at all, compared to 53.2% who said they were very or extremely upset.

For UMR race, 77.6% of non-white URM faculty have been discriminated by superiors or colleagues based on their race or ethnicity, and 66.7% perceived that they have been left out of opportunities. Of those individuals, 45.2% of the URM posted high levels of discomfort (very or extremely upset) based on perceived discrimination.

URM Faculty Motivation for Research

The results of *t*-test revealed few significant differences (see Table 5). URM faculty, compared to non-URM, reported lower levels of autonomy ($t = 2.40$, $p < .05$) and autonomous motivation ($t = 2.11$, $p < .05$). Surprisingly, there were not many mean level differences between URM and non-URM faculty.

Correlations revealed that for URM women, eperiences of gender discrimination were negatively linked to autonomy (r = -.18, p <.01) and relatedness to others (r = -.31, p <.001), and positively related to amotivation (r = .18, p <01; see Table 6). There were no correlations between the gender discrimination items and success. Alternatively, among URM non-white and Hispanic/Latinx/Spanish faculty, experiences of race/ethnicity bias correlated with greater perceived success, perhaps indicating those who are performing well are more likely to experience discrimination from others.

Discrimination Related to URM Motivation and Research Success

Analyses began by fitting a measurement model with all study latent variables. Results supported convergent validity based on strong factor loadings of items on latent variables and an acceptable goodness of fit (see Table 7). Next, we analyzed the hypothesized structural model, which posited that faculty basic psychological needs for research were positively associated with autonomous motivation and in turn positively related to self-reported success; alternatively, extrinsic and amotivation would have small or negative relationships with basic needs and success. Finally, faculty self-reported URM vs. non-URM was included as a moderator in a multi-group analysis.

The configural structural model, which analyzed the regression paths for both groups (no constraints), had adequate goodness-of-fit to the data (see Figure 2). This indicates the two groups conceptualized the underlying latent constructs similarly. Metric (weak) invariance was tested by constraining all latent variable factor loadings and reanalyzed, with the result showing no difference from the configural model. This result suggests roughly equivalent strength of relations between items and latent constructs for URM versus non-URM faculty. Next, structural invariance was tested by constraining all regression paths and latent covariances, which yielded a

significant difference between the groups compared to the configural model. Paths with the largest differences between the groups were systematically freed until the model became nonsignificant in a partial structural invariance model, and those paths were deemed different between the groups.

For both groups, autonomy ($\beta = .38$ for URM & $\beta = .56$ for non-URM, $p < .01$) and competence ($\beta = .20$ for URM & $\beta = .22$ for non-URM, $p < .01$) had significant positive predictive relationships with autonomous motivation, accounting for 39-43% of the variance. In turn, autonomous motivation was positively related to research success, however only significantly so for non-URM faculty ($\beta = .38$, $p < .01$). Interestingly, URM faculty had a significantly weaker connection of autonomous motivation to self-reported research success. For both groups, competence was significantly negatively related to introjected motivation ($\beta = -.28$ for URM & $\beta = -.22$ for non-URM, $p < .05$); furthermore, autonomy positively predicted introject motivation among non-URM while for URM this was slightly negative. Introjected motivation was a significant negative predictor of research success for URM ($\beta = -.25$, $p < .01$), but not for non-URM. For both groups, autonomy had large significant negative paths to amotivation ($\beta = -.60$ for URM & $\beta = -.65$ for non-URM, $p < .05$). The remaining paths in the model were not statistically significant, although there were some significant differences between the groups in their strength. For instance, the connection of relatedness with autonomous and introjected motivation was positive for URM faculty, but negative for non-URM faculty. Also, amotivation was negatively related to research success for URM faculty, but nearly zero for non-URM.

Discussion

The current study examined how faculty who identified as an underrepresented minority (URM) in STEM reported discrimination, and how that experience related to their motivation and success in conducting research. We first examined which of the STEM faculty in our sample self-identified as URM. They were primarily white women, and not of Hispanic/Latinx/Spanish ethnicity, which is consistent with past studies (Carrigan et al., 2011; Li & Koedel, 2017). Interestingly, 15% of those not identifying as URM were women and 16% were non-white faculty, despite being among the NFS's defined URM categories for STEM fields (NCSES, 2020). This may be due to working in STEM disciplines that have more diversity (e.g., social sciences), or purposefully disassociating themselves with minority status for reasons that require further research. It was also found that URM faculty were lower ranked and less tenured than non-URM faculty, which is a unique finding but in line with other studies finding lower research productivity for URM faculty (Antonio, 2002; Lauer, 2021).

As expected, URM faculty disclose substantial levels of workplace discrimination based on gender and race/ethnicity (O'Meara et al., 2020; Wilkins, 2017); however, this study was the first to examine how these experiences correlated with URM faculty motivation to conduct research. URM women reported substantial levels of gender-based discrimination in their workplace that correlated with less autonomy and relatedness with colleagues, as well as increased amotivation. The findings may provide some rationale for why women, relative to men, have been found to have fewer publications, citations, and grants (Larivière et al., 2013; Beaudry & Larivière, 2016) and report an inadequate work environment (Hill et al., 2010; Kaminski & Geisler, 2012; Stupnisky et al., 2015). Faculty who identified as non-white or of Hispanic, Latinx, or Spanish ethnicity also reported workplace discrimination, although to a

lesser degree than URM women. Interestingly, the research success of non-white and Hispanic/Latinx/Spanish faculty was correlated with increased discrimination, perhaps indicating that successful URM faculty were resented for their success. This finding aligns with some studies referring to URM faculty's lower number of journal articles, books publications, and research productivity, despite their high commitment to research activities (Antonio, 2002). As well as why pre-tenure female faculty and faculty of color reported less satisfying collegial relationships (Ponjuan et al., 2011).

Mean level comparisons showed URM faculty reported less autonomy and lower autonomous motivation than non-URM faculty. This supports decades of research indicating URM faculty have unique motivational experiences (Schoen & Winocur, 1988; Wiley et al., 1979), and specifically supports prior studies finding differences on SDT variables of autonomy and autonomous motivation (Stupnisky et al., 2019). We found no significant differences on research success measures, either self-reported or bibliometric from Web of Science, which is not consistent with past research (Beaudry & Larivière, 2016; Larivière et al., 2013).

The most unique contribution came from the SEM analyses that found the associations between motivation and research success was unique for URM faculty. As expected, autonomous motivation was strongly related to research success for non-URM faculty (Stupnisky et al., 2017), however for URM faculty this effect was much smaller. Alternatively, URM research success was more strongly predicted by low levels of introjected and amotivation. The more predominant role of maladaptive motivations is troubling as they could negatively manifest as non-action and lower productivity. This finding aligned with Lechuga's perception that URM faculty negatively internalize the emotional stress related to institutional cultures that could affect their motivation to do research (2012a; 2021b). URM faculty were also unique because

relatedness had a positive relation to autonomous motivation. This supported the findings by Kumar and Ratnavelu (2016), as well as Lechuga (2012a), that URM faculty value networking and collaborations more than non-URM researchers.

Limitations and Future Directions

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 of this study was that other URM groups were not measured, such as those related to socioeconomic status, disability, and sexuality, which should be considered for future studies. Furthermore, the data for the current study was cross-sectional and thus the predictive validity is limited. Implications for faculty development include support for diversity training among university faculty and administrators as discrimination based on gender and race/ethnicity was found here to have an impact on faculty motivation.

Footnotes

[1] The breakout of the missing data indicated that out of original participants 56 (6.8%) had next to no data entries and most of their variables missing; 38 (4.6%) were missing the majority of data entries in the motivation and perceived success sections; 5 (0.6%) had a substantial number of variables missing; and 71 participants (8.6%) had zero research percentage.

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Figures

Figure 1

Conceptual Model of Faculty Motivation and Research Success Moderated by URM vs. non-URM.

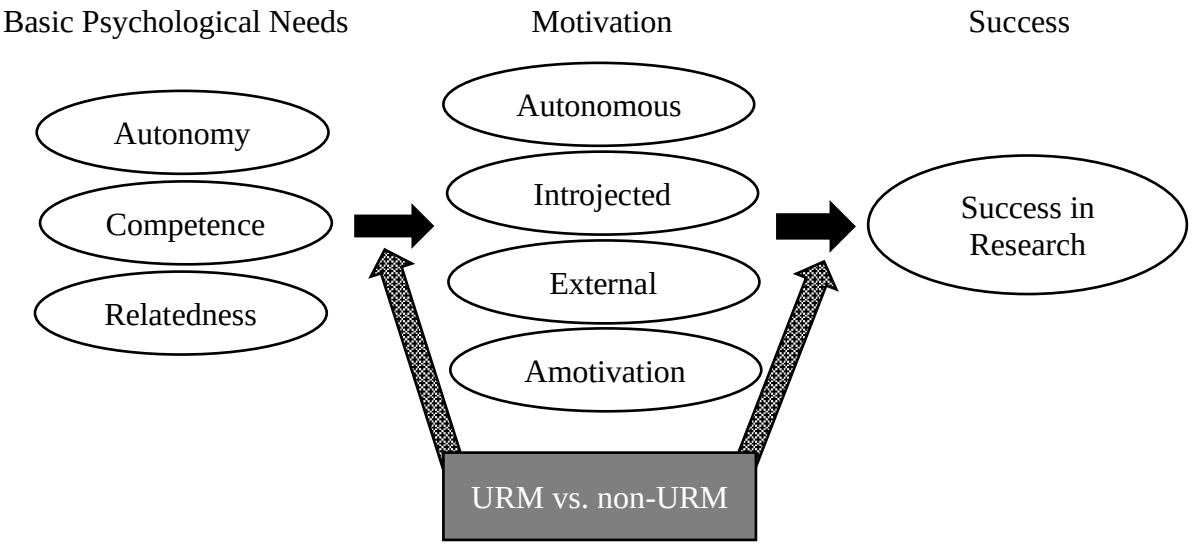
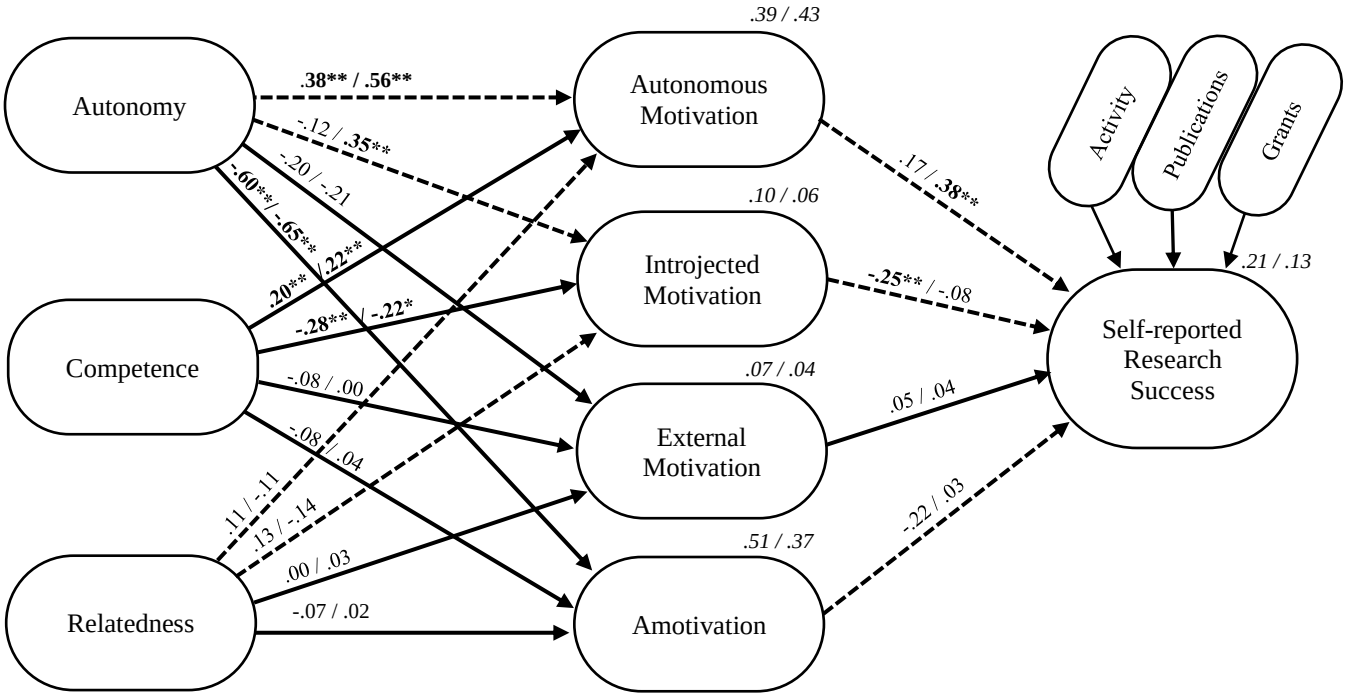


Figure 2

Configural Structural Model of Faculty Motivation and Research Success



Note. URM coefficients appear left of slash, and non-URM coefficients on right. Bold coefficients with stars are significant at * $p < .05$, ** $p < .01$. Dashed lines are significantly different across groups.

Tables

Table 1

Full Sample Participant Characteristics

		Count	Percent
Primary Disciplinary Area	Life sciences	178	27.3
	Social sciences	97	14.9
	Engineering	85	13.1
	Psychology	50	7.7
	Geoscience	46	7.1
	Mathematical sciences	36	5.5
	Chemistry	33	5.1
	Physics and astronomy	33	5.1
	STEM education learning research	30	4.6
	CISE	25	3.8
	Materials research	5	0.8
	No response	33	5.1
Academic Rank	Assistant Professor	219	33.6
	Associate Professor	178	27.3
	Full Professor	212	32.6
	Instructor/teaching professor	9	1.4
	Research scientist/analyst	8	1.2
	Other	25	3.8
Tenure Status	On tenure track but not tenured	209	32.1
	Tenured	376	57.8
	Not on tenure track	63	9.7
	Other	3	0.5
Gender Identity	Man	388	59.6
	Woman	255	39.2
	I prefer not to respond	8	1.2
Racial Identification	White	531	81.6
	Asian	82	12.6
	Multiracial	15	2.3
	Other	11	1.7
	Black or African American	5	0.8
	No response	7	1.8
Ethnicity	Not of Hispanic, Latinx, or Spanish origin	602	92.5
	Yes, of Hispanic, Latinx, or Spanish origin	42	6.5
	No response	7	1.1
International	No	471	72.4
	Yes	176	27.0
	No response	4	0.6
Underrepresented minority (self-identified)	No	407	62.5
	Yes	241	37.0
	No response	3	0.5

Table 2

Full Sample Scale Reliabilities and Descriptive Statistics

Measure	α	# items	*M*	*SD*	Actual range	Skew	Kurtosis
Basic Needs							
Autonomy	.83	4	4.11	0.77	1-5	-0.95	1.49
Competence	.83	4	4.23	0.58	1.75-5	-0.58	0.59
Relatedness	.86	4	3.93	0.71	1-5	-0.65	0.69
Motivation							
Intrinsic	.85	3	4.51	0.59	2-5	-1.37	2.08
Identified	.67	3	4.40	0.59	1.67-5	-1.17	1.70
Autonomous	.86	6	4.45	0.55	2-5	-1.27	1.92
Introjected	.84	3	3.42	1.02	1-5	-0.46	-0.53
External	.61	3	3.53	0.83	1-5	-0.43	-0.25
Amotivation	.82	3	1.86	0.84	1-5	1.14	1.21
Research Success							
Activity	.81	3	3.35	0.76	1-5	-0.38	-0.09
Publications	.88	3	3.32	0.90	1-5	-0.28	-0.36
Grants	.90	3	3.15	1.00	1-5	-013	-0.09
Overall	.91	12	3.34	0.75	1.17-5	-0.13	-0.09
Publications	-	1	7.75	7.13	1-33	1.50	1.66
Citations	-	1	27.20	39.71	0-225	2.45	6.55
Field-normalized Citations	-	1	0.81	0.71	0-3.59	1.24	1.66

Table 3

Self-identified URM by Gender, Race, and Ethnicity

URM x Gender			URM (241)		Non-URM (407)	
Men (388)			44	19%	344	85%
Women (255)			194	81%	60	15%
URM x Race						
White (531)			189	80%	342	84%
Non-white (112)			49	20%	63	16%
URM x Ethnicity						
Not Hispanic Latinx Spanish (602)			204	86%	398	98%
Yes, Hispanic Latinx Spanish (42)			34	14%	8	2%
Gender x Race x Ethnicity			**URM**		**Non-URM**	
Men	White	Not Hispanic	12	4%	335	67%
		Hispanic	18	6%	10	2%
	Non-white	Not Hispanic	14	5%	65	13%
		Hispanic	2	1%	1	.1%
Women	White	Not Hispanic	185	64%	77	15%
		Hispanic	11	4%	2	.1%
	Non-white	Not Hispanic	38	13%	8	2%
		Hispanic	8	3%	0	0%

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.

Table 4

Responses to Discrimination items by URM faculty

	Percent of Responses						
Gender for URM females	1	2	3	4	*M*(*SD*)	skew	kurtosis
Discrimination by superior or colleague	13.4	42.3	38.7	5.7	2.37(0.79)	-0.03	-0.53
Left out opportunities	19.3	44.3	31.3	5.2	2.22(0.82)	0.15	-0.60
Discrimination was upsetting	8.0	38.7	28.3	24.9	2.70(0.94)	0.03	-1.06
Race for URM non-whites							
Discrimination by superior or colleague	22.5	46.9	28.6	2.0	2.10(0.77)	0.10	-0.78
Left out opportunities	33.3	47.9	18.8	0.0	1.85(0.71)	0.21	-1.08
Discrimination was upsetting	23.8	31.0	19.1	26.2	2.48(1.13)	0.11	-1.43

Note. Responses for gender discrimination shown only for self-identified URM women (n = 194), and for race discrimination only for self-identified URM nonwhites (n = 49) The top two bias questions were answered on the response scale: 1=*Never*, 2=*Rarely*, 3=*Often*, 4=*Always*. The third bias question was answered on the scale 1=*Not at all upsetting*,…, 4=*Extremely upsetting*.

Table 5

Descriptive Statistics and t-tests for Self-identified URM vs. non-URM

Variable	URM	*n*	*M(SD)*	*t*	*Cohen's d*
Basic Needs					
Autonomy	No	399	4.16(0.60)	2.40*	.20
	Yes	235	4.03(0.74)		
Competence	No	402	4.25(0.54)	1.63	.14
	Yes	233	4.17(0.64)		
Relatedness	No	401	3.92(0.70)	-0.33	.03
	Yes	233	3.94(0.73)		
Motivation					
Autonomous	No	394	4.49(0.51)	2.11*	.18
	Yes	234	4.39(0.59)		
External	No	396	3.54(0.80)	0.38	.03
	Yes	238	3.51(0.88)		
Introjected	No	399	3.38(1.01)	-1.54	.13
	Yes	240	3.51(1.03)		
Amotivation	No	396	1.82(0.81)	-1.39	.12
	Yes	238	1.92(0.89)		
Success					
Overall, Self-report	No	399	3.35(0.73)	0.50	.04
	Yes	233	3.32(0.77)		
WOS Publications	No	262	7.31 (6.62)	-1.02	.11
	Yes	147	8.08 (7.73)		
WOS Citations	No	261	25.54 (37.60)	-0.06	.00
	Yes	148	25.76 (38.25)		
WOS Field Normed Citations	No	249	0.79 (0.75)	-0.30	.03
	Yes	133	0.77 (0.65)		

* $p < .05$, ** $p < .01$, *** $p < .001$
WOS = Web of Science bibliometric data

Table 6

Correlations for URM faculty between Motivation, Bias, and Success

	Gender Discrimination			Race/ethnicity Discrimination		
	By superior or colleagues	Left out of opportunities	Upsetting	By superior or colleagues	Left out of opportunities	Upsetting
Autonomy	-.18**	-.18**	-.15*	.01	.03	-.02
Competence	.04	.01	.03	.12	.14	.00
Relatedness	-.31***	-.29***	-.21**	.02	-.05	.09
Autonomous	-.01	-.09	.01	.17	.09	.25
Introjected	-.04	-.02	.04	.05	-.02	.17
External	.02	.01	.03	-.15	-.09	-.12
Amotivation	.18**	.22***	.09	-.19	-.10	-.19
Self-report Success	.07	-.02	-.02	.27*	.23*	.10
Publications	.00	.05	-.01	-.18	-.19	-.16
Citations	.14	.09	.04	.00	-.09	.04
FN Citations	.12	.07	-.08	.16	.12	.04

Note. Correlations for gender bias were analyzed only for self-identified URM women (194), and correlations for race/ethnicity bias were analyzed only for self-identified URM who were non-white or Hispanic/Latinx/Spanish ethnicity (83). FN = Field Normalized Citations

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 7

Model Goodness of Fit

Model	df	χ^2	RMSEA	CFI	SRMR	Δ CFI	Δ χ^2 (df)	*p*
Measurement model	657	1510.23	.047	.939	.056			
Configural (baseline) model	1318	2367.82	.052	.926	.074			
Metric invariance	1349	2402.31	.052	.926	.076	.000	34.49 (31)	.30
Structural invariance	1374	2463.71	.052	.923	.082	.003	95.89 (56)	<.001
Partial structural invariance	1363	2423.12	.052	.926	.087	.000	55.30 (45)	.14

Note. The full model tested the hypothesized structure with no groups, the configural model had the URM groups specified with no constraints, the metric invariance model contained the factor loadings to be equal across the groups, the structural invariance model constrained the regression paths and latent covariances across the groups, while the partial structural invariance model freed the regression paths and latent covariances with the largest differences between the groups until the model was no longer significant different from the metric invariance model.

Study 2: 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

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.

Methods and Materials

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
	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

Measures:

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.

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.].").

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).

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)".

Results

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 (l7)	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.

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.

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.

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

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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Study 3: Allyship, From the Viewpoint of Underrepresented-Minority Faculty: Testing the Impact on Motivation and Workplace Relatedness

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Abstract

Most allyship studies focus on perspectives of dominant groups regarding their actions as allies toward non-dominant groups. In the current study, authors developed two allyship survey instrument to examines the notions of allyship as perceived by underrepresented minority (URM) faculty. Furthermore, this study investigated potential impact of allyship on this group's motivation to conduct research and sense of relatedness. An online survey was completed by 184 faculty. Analysis indicated URM faculty experienced significantly lower levels of support from allies compared to non-URM faculty, and women with intersectional identities experienced the least allyship support. Furthermore, allyship is positively correlated with relatedness, and negatively with amotivation. Insights into the impact of allyship on URM populations will help university administrators implement effective strategies to achieve a more inclusive and equitable environment advocating for URM advancement.

***Keywords*:** Allyship, Relatedness, Underrepresented Minority Faculty, Intersectionality, Motivation

Allyship, From the Viewpoint of Underrepresented-Minority Faculty: Testing the Impact on Motivation and Workplace Relatedness

Underrepresented Minority (URM) faculty are defined as those who have historically had limited representation in the fields they work or study in (NCSES, 2020). These faculty members face numerous challenges including lack of mentors (O'Meara et al., 2020), cultural prejudices (Fisher et al., 2019), discrimination, and social stereotypes (Stolzenberg et al., 2019). Workplace discrimination could further manifest itself in depression, isolation, and lessened relatedness to colleagues (Zambrana et al., 2017; 2021), which may negatively affect their motivation to conduct research (Stupnisky et al., 2019) and a sense of belonging to establish meaningful connections with others. Therefore, it is imperative to explore countermeasures and behaviors that may redress some of the negative effects of discriminatory workplace on URM faculty.

Allyship is the act of advocacy and support of underrepresented and disadvantaged groups and individuals toward equity and justice (Nash et al., 2021). An ally is someone from a dominant group (such as cisgender men) who recognizes their privileges and takes active steps to advocate for marginalized and underrepresented individuals and groups (like People of Color) to promote equity and social justice (Broido et al., 2005; Washington & Evans, 1991). Allies' actions are not for their own benefit or advancement, instead, their aim is to eradicate those patterns of differences and concessions that facilitated their privileges (Washington & Evens 1991) and in doing so, they risk experiencing alienation themselves (Malott et al.2019).

In a study regarding the roles of allies in academic settings (Brooks et al., 2009), inclusion, acceptance, and a sense of belonging to the organization were ranked top by URM faculty. Similarly, Veer et al. (2021) concluded that allies have a profound effect on creating and nurturing a sense of relatedness for URM faculty at their institution. Other studies have shown

that in some situations the act of allyship from the opposite gender could be more effective than same-gender colleagues, lessen the sense of not-belonging, and identity safety, especially for women in male-dominated fields such as STEM (Exley & Kessler, 2019; Pollock, 2020). Allies' actions and solidarities with underrepresented minorities could help foster a culture of inclusion and a sense of belonging in the workplace (Veer et al., 2021).

Developing valid measures for identifying individuals as allies, to then predict the outcomes of allyship is complicated (Williams & Sharif, 2021). Most existing studies rely on individuals to self-report their act of allyship toward non-dominant individuals or groups, instead of allowing others to entrust them with allies' adjectives (Carlson et al. 2020). This form of discourse revolved around the dominant groups bestowing ally labels upon themselves based on their self-evaluations, by asking who allies are rather than measuring the tangible impact of their actions (Patton et al., 2015). Unfortunately, this approach fails to assess the impact of these self-proclaimed allyship claims from the standpoint of URM members who ostensibly undergo these acts (Brown et al., 2013).

The Current Study

The current study examines the notions of allyship from the viewpoint of URM faculty, aiming to understand the potential impacts of perceived allyship on their sense of relatedness, motivation to conduct research, and perceived research success.

To gain deeper insights into the possible impact of allyship on URM faculty, the authors developed two unique instruments, named Race\Ethnicity-based Allyship and Gender-based Allyship. The authors then used these two instruments to assess the perceptions of URM individuals when encountering any act of allyship. Our research questions included:

- Does belonging to a URM population or knowing a close person who belongs to a URM population increase being an ally?

- Do all faculty, URM and non-URM experience the same level of support and allyship?
- Would experiencing allyship affect URM faculty's sense of relatedness to their colleagues?
- Do URM faculty who experience allyship have a higher degree of perceived success compared to the rest of URM and other faculty?
- Does experiencing allyship impact faculty members' motivation to engage in research?

Another population of significant interest within URM is 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 microaggressions (Essed, 1990; Stergiopoulos and Rosenburg, 2020). This study examined the level of allyship reported by this group and the possible correlation to their relatedness, motivation and success.

Method and Materials

Participants and Procedures

In the spring of 2023, higher education faculty members were recruited via social media to participate in an online survey. Only participants who had completed all the allyship-related questions were considered in the study analyses, resulting in a final sample of 184 participants. A significant majority of the participants identified themselves as women (82.07%), approximately one-quarter identified as members of the LGBTQ+ community, and one-quarter identified as person with a disability. Most of the faculty identified their race as white (86.06%), and 42.93% self-identified as URM, out of which 88.6% identified as women. Looking at intersecting identities of Race\Ethnicity and gender, 42% of URM women identified as non-white (see Table 1 for more detail).

Measures

Self-Determination Motivation. Motivation was measure using the Stupnisky et al. (2019) scales that assessed faculty motivation based on STD (Intrinsic, Identified, Negative Introjected, External, and Amotivation). Each scale consisted of three items measured on a five-point Likert scale (1=*Strongly Disagree*, 5=*Strongly Agree*). Examples items are: "I find research work interesting." (intrinsic), " My research helps my students develop their own scholarly skills." (identified), " I feel bad if I do not regularly engage in research." (introjected), " Because my university requires me to do research." (external), and " Honestly, I don't know why I do research" (amotivation).

Race/Ethnicity-based Allyship. The authors developed a novel survey instrument (see Appendix) to assess allyship perceived among URM faculty based on their race and\or ethnicity. In response to the request, "Please indicate the extent to which you agree with statements regarding your peers and colleagues at your current institution who are outside of your racial/ethnic group," faculty responded to statements such as: "I believe they advocate for me. " (Promoter), "I believe they listen to my point of view. " (Attender), "I believe they have positive attitudes about me. " (Accepted). Responses were measured on a 5-point scale (1=*Strongly Disagree*, 5=*Strongly Agree*). The confirmatory factor analysis, CFA, for this survey and exploratory factor analysis, EFA which resulted in creating the three sub-scales described above are explained in the Result section.

Gender-based Allyship. The authors also created a the allyship survey questionnaire measuring the URM's perception of allyship based on their gender (see Appendix). Participants were asked to express their level of agreement with statements concerning their perception of the level of allyship offered by their peers and colleagues who are outside of their gender group. Sample items included: "I feel comfortable when I socialize with my peers outside my gender

group. " (At Ease), "I believe they advocate on my behalf. " (Proponent). Each item was assessed using a five-point Likert scale (1=*Strongly Disagree*, 5=*Strongly Agree*). The Results section described the outcomes of the CFA and EFA, which led to the development of the two factors mentioned above.

Basic psychological needs. Faculty basic psychological needs were measured with three scales from Stupnisky et al. (2017) that captured Autonomy, Competency, and Relatedness. This study used the Relatedness scale comprised of four items, including "When I am at work, I feel close with people who are important to me."

Research success. Faculty members were asked to evaluate their success in research over last year compared to four criteria: "Your own standards", "Your department's standards for tenure and promotion", "Colleagues in your department", and "Colleagues in your field(s)" (Stupnisky et al., 2019). The rating was based on a 5-point scale (1=*Well below average* to 5=*Well above average*).

Results

Race/Ethnicity-based and Gender-based Allyship Scales

The analysis of the Race/Ethnicity-based Allyship Instrument yielded valuable insights into its reliability and validity. This instrument aimed to assess individuals' perception of allyship towards different race/ethnicity groups. To evaluate the instrument's validity, both exploratory (EFA) and confirmatory factor analyses (CFA) were performed. The exploratory factor analysis provided insights into the underlying factor structure and item composition of this instrument, confirming a three sub-scale structure of Promoter, Attender, and Accepted (shown in Figure 1) based on acceptable goodness of fit (Table 2). Subsequently, the confirmatory factor analysis was conducted to confirm the factor structure identified in the exploratory phase. The Cronbach's

alpha coefficients were computed for each of the three factors, resulting in values ranging between .84 and .91. These high coefficients indicate strong internal reliability and consistency among the items in measuring the construct of Race/Ethnicity-based Allyship, while descriptive analysis supported normal distributions of the scale (Table 3).

The analysis of the Gender-based Allyship followed a similar approach as the one explained for the Race\Ethnicity-based survey. The exploratory factor analysis supported a two-factor structure named Proponent, and As-Ease (shown in Figure 2) based on acceptable goodness of fit shown in Table 4. The Cronbach's alpha coefficients for each of the factors showed values between .89 and .96. which are indicative of strong internal reliability and consistency among the items in this instrument. Furthermore, tests of reliability demonstrated internal consistency, and descriptive analysis supported normal distributions of the data (Table 5).

Group Differences

Test of group differences did not find any evidence that identifying as URM, or knowing someone close who identifies as URM, increases the tendency to be an ally. The analysis of group differences, however, provided evidence that on average URM faculty experienced significantly lower levels of allyship support than non-URM faculty (Table 6) in both Race\Ethnicity-based as well as Gender-based allyship categories. Notably, URM women faculty with intersectional identities (women of color) reported the lowest levels of allyship, both Race/Ethnicity and Gender, compared to URM and non-URM participants. No significant differences were found for motivation, research success, or relatedness among URM subgroups and non-URM faculty.

Correlations

The correlation analysis on URM faculty population confirmed that all three items of Race\Ethnicity-based allyship have a significant positive correlation with the basic psychological need for relatedness. Our data reviled a negative correlation between amotivation and the Accepted factor of Race\Ethnicity-based allyship (Table 7). We run the correlations analysis of Race\Ethnicity-based allyship for the URM women faculty members and found a significant positive correlation between the Accepted Allyship and perceived success in research for this population. Values in Table 8 demonstrated that both factors of Gender-based allyship have a positive correlation with the basic psychological need for relatedness, but no significant correlation with any other item.

Discussion and Significance

The objectives of this study were to explore the impact of experiencing allyship on URM faculty's motivation to do research, perceived success in their research, and sense of relatedness to their colleagues. Our analysis regarding our first questions aligns with Leong et al. (2020) who included numerous examples in their book demonstrating that identifying as a URM individual does not default to acting as an ally or even understanding the degree or extent of what other URMs might be experiencing.

The second inquiry explored the possible effects of experiencing allyship on URM faculty's sense of relatedness to their colleagues. Our analysis for both Race\Ethnicity-based and Gender-based allyship supports indicated a significant positive interrelation between URM faculty members experiencing allyship and a sense of relatedness to their colleagues, as one of the basic human psychological needs (SDT; Deci & Ryan, 1985). This finding confirmed Brooks et al. (2009) and Veer et al.'s (2021) claims regarding the roles of allies in inclusion and improvement of a sense of belonging in academic settings.

This study found that for URM women faculty, perceived research success has a positive correlation with Race\Ethnicity-based allyship and a negative relation with amotivation, which means their lack of motivation could diminish if they experience allyship and support (Stupnisky et al., 2023).

Our last inquiry was to evaluate the impact of perceived allyship (for both Race\Ethnicity-based and Gender-based) on URM faculty members' motivation to engage in research. Our data revealed the Accepted factor of Race\Ethnicity-based allyship scale has a negative correlation to amotivation, which means feeling accepted by colleagues of difference race\ethnicity alleviated their lack of motivation. We found no significant correlation with any other motivation type.

Academic context and research institutions provide great settings to study effective ways to raise awareness about issues and challenges that URM population endure and to explore strategies to implement positive changes to benefit everyone specifically the URM population (Gedro, 2007). By gaining a comprehensive understanding of the possible impact of allies and allyship on URM faculty members' motivation in scholarly activities, we can develop strategies to foster an inclusive and equitable culture to promote a sense of relatedness for URM faculty members and motivate their advancement in research activities.

This research contributes to the literature on the development, motivation, and successful research outcomes for URM faculty. The findings could interest government and higher education administrations in developing, adapting, and implementing effective institutional policies and procedures such as inclusive leadership and allyship training to address the specific needs and challenges of the URM faculty population (Munoz & Thomas, 2006). Embracing these approaches and policies could create an inclusive culture where faculty from all

backgrounds, identities, abilities, and experiences feel supported and accepted (Brooks & Edwards, 2009). It should be noted that the authors recognize the importance of inclusivity and are aware of the necessity to develop allyship surveys tailored to other underrepresented minority groups. As evidence, they are in the process of developing a Gender-based allyship scale and analyzing the gathered data as part of their future research plans.

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Tables

Table 1

Sample Participant Characteristics

Baseline Characteristic	N	%
Gender		
I identify as female	151	82.06
I identify as male	29	15.76
I identify as another gender	4	2.14
I prefer not to respond	0	0
Race		
White/Caucasian	152	82.07
Other	8	4.34
Asian	10	5.43
Multiple	2	1.08
American Indian/Alaska Native	1	.5
Black or African American	2	1.08
Hispanic Origin		
No	168	91.30
Yes	16	8.69
LGBTQ		
Yes	48	26.09
No	136	73.91
Disable		
Yes	136	74.73
No	25.27	26.09
NA	2	
Academic Discipline		
Social Sciences	53	28.80
Health related	21	11.41
Humanities	17	9.24
Education	13	7.07
Business	13	7.07
Biological sciences	10	5.48
Physical Sciences	13	7.07
English	10	5.48
History or Political Science	7	3.80
Mathematics or Statistics	5	2.72
Engineering	4	2.17
Agriculture or Forestry	3	1.63
Fine Arts	3	1.63
Other discipline	12	6.52

Table 2

Goodness of Fits for the Race\Ethnicity-based Allyship scale

	Chi-square	df, *p*	RMSEA	SRMR	CFI
CFA	115.258	17, >.001	.051	.018	.996

CFAs. For the three-Factor Race\Ethnicity -based Allyship scales.

Table 3

Descriptive Statistics and Reliabilities for the Race\Ethnicity-based Allyship scale

	M (SD)	Skew	Chronbach's α	R^2
Ally-Accepted			.91	
REally_2	3.91(0.79)	-0.63		.43
REally_5	4.18(0.85	-1.19		.84
REally_9	4.12(0.90)	-1.26		.74
Ally-Attender			.91	
REally_6	3.92(0.93)	-0.95		.80
REally_7	3.58(1.03)	-0.49		.87
Ally-Promoter			.84	
REally_3	3.41(0.90)	-0.02		.83
REally_4	3.36(0.95)	-0.08		.95
REally_8	3.23(0.98)	-0.18		.06
REally_1	4.40(0.68)	-0.88	.92	

Note. Ally-Accepted and Ally-Promoter each has three items, Ally-Attender has two items.
All item response scales were 1 = Strongly Agree, 5 = Strongly Disagree.
R^2 is the same as AVE = Average variance explained from CFAs. Descriptive statistics are regarding averaged multi-item scales.

Table 4

Goodness of Fits for the Gender -based Allyship scale

	Chi-square	df, *p*	RMSEA	SRMR	CFI
CFA	158.299	26, >.001	0.167	0.061	0.92

CFAs. For the two-Factor Gender-based Allyship scales.

Table 5

Descriptive Statistics and Reliabilities for the Gender-based Allyship scale

	M (SD)	Skew	Chronbach's α	R^2
Ally-At Ease			.89	
GEally_1	3.85(1.089)	-0.77		.55
GEally_5	3.81(1.06	-0.90		.90
GEally_9	3.87(1.05)	-0.97		.85
Ally-Proponent			.96	
GEally_2	3.36(1.06)	-0.72		.72
GEally_3	3.23(1.11)	-0.13		.83
GEally_4	3.12(1.11)	-0.19		.84
GEally_6	3.56(1.12)	-0.61		.77
GEally_7	3.29(1.19)	-0.32		.82
GEally_8	2.97(1.06)	-0.01		.78

Note. Ally-At Ease has three items, Ally-Proponent has six items.
All item response scales were 1 = Strongly Agree, 5 = Strongly Disagree.
R^2 is the same as AVE = Average variance explained from CFAs. Descriptive statistics are regarding averaged multi-item scales.

Table 6

Tests of Group Differences on Race\Ethnicity-based Allyship, Gender-based Allyship, SDT Basic Needs, SDT Motivation, and Perceive of Success in Research

	URM		Non-URM		
	M	*SD*	*M*	*SD*	t
Race\Ethnicity-based Allyship					
Promoter	3.19	0.99	3.46	0.77	***-2.02**
Attender	3.53	1.09	3.94	0.78	***-2.9**
Accepted	3.93	0.87	4.19	0.59	***-2.42**
Gender-based Allyship					
At-Ease	3.52	1.13	4.13	0.82	***-4.09**
Proponent	2.99	1.09	3.58	0.85	***-3.95**
SDT Basic Needs					
Relatedness	3.23	0.94	3.49	0.91	-1.85
SDT Motivation Types					
Amotivation	2.75	1.02	2.57	0.88	1.21
External	2.92	0.96	2.75	0.83	1.23
Identified	3.98	0.75	3.89	0.79	.66
Intrinsic	4.12	0.83	4.19	0.89	-.51
Introjected	3.29	1.16	3.28	1.11	.03
Perceived Success					
Research	2.89	0.85	3.12	0.92	-1.72

*Statistically significant t-test differences indicated by **
** $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$*

Table 7

Correlations: URM Faculty Members
Allyship Factors (Accepted, Attender, Promoter), Perceived Success in Research Motivation Types, and Relatedness

Variables	1	2	3	4	5	6	7	8	9
1. Ally-Accepted	-								
2. Ally-Attender	.75**	-							
3. Aly-Promoter	.58**	.71**	-						
4. Perceived Success	.23	.15	.09	-					
5. Amotivation	-.28*	-.20	-.11	-.48**	-				
6. External	-.0**9**	-.08	-.01	-.13	.58**	-			
7. Introjected	-.15	-.14	-.12	-.02	.34**	.34**	-		
8. Identified	.14	.06	.03	.25*	-.51**	-.36**	-.17	-	
9. Intrinsic	.22	.08	-.04	.43**	-.60**	-.33**	-.25*	.65**	-
10. Relatedness	.30**	.40**	.40**	.19	-.20	-.03	-.21	-.04	.03

Note. * indicates $p < .05$. ** indicates $p < .01$.

Table 8

Correlations: URM Faculty Members
Gender-based Allyship Factors (At Ease, Proponent), Perceived Success in Research, Motivation Types, and Relatedness

Variables	1	2	3	4	5	6	7	8	9
1. Ally-Accepted	-								
2. Ally-Attender	.78**	-							
3. Perceived Success	-.05	.07							
4. Amotivation	-.13	-.14	-.48**	-					
5. External	-.07	-.07	-.13	.58**	-				
6. Introjected	-.20	-.17	-.02	.34**	.34**	-			
7. Identified	.13	.14	.25*	-.51**	-.36**	-.17	-		
8. Intrinsic	.13	.09	.43**	-.60**	-.33**	-.25*	.65**	-	
9. Relatedness	.42**	.50**	.19	-.20	-.03	-.21	-.04	.03	

Note. * indicates $p < .05$. ** indicates $p < .01$.

Figures Title

Figure 1.

Factor loadings for the three-factor model of Race/Ethnicity-based Allyship

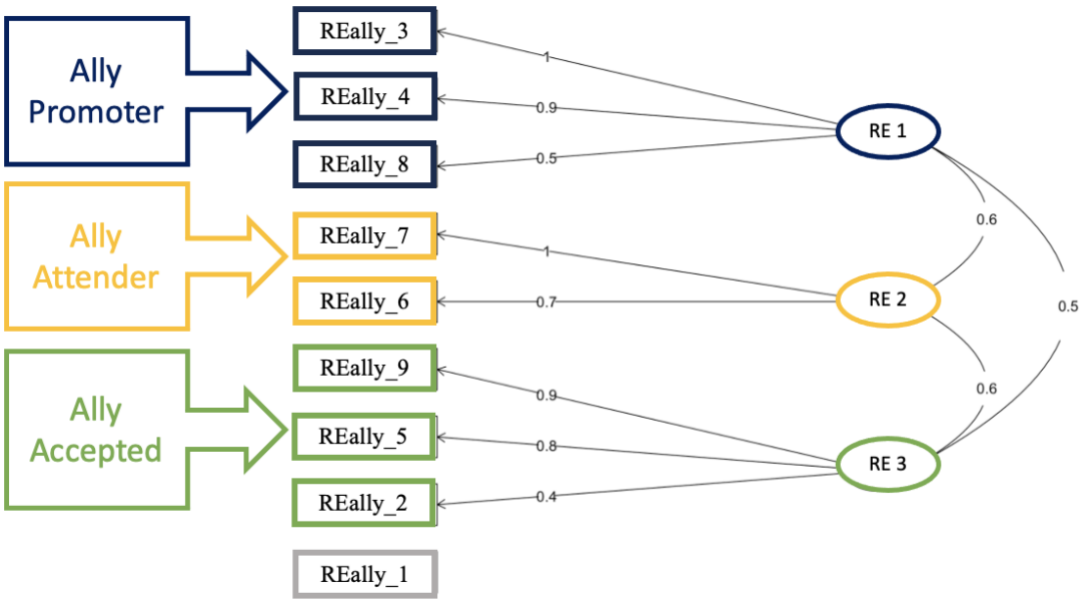
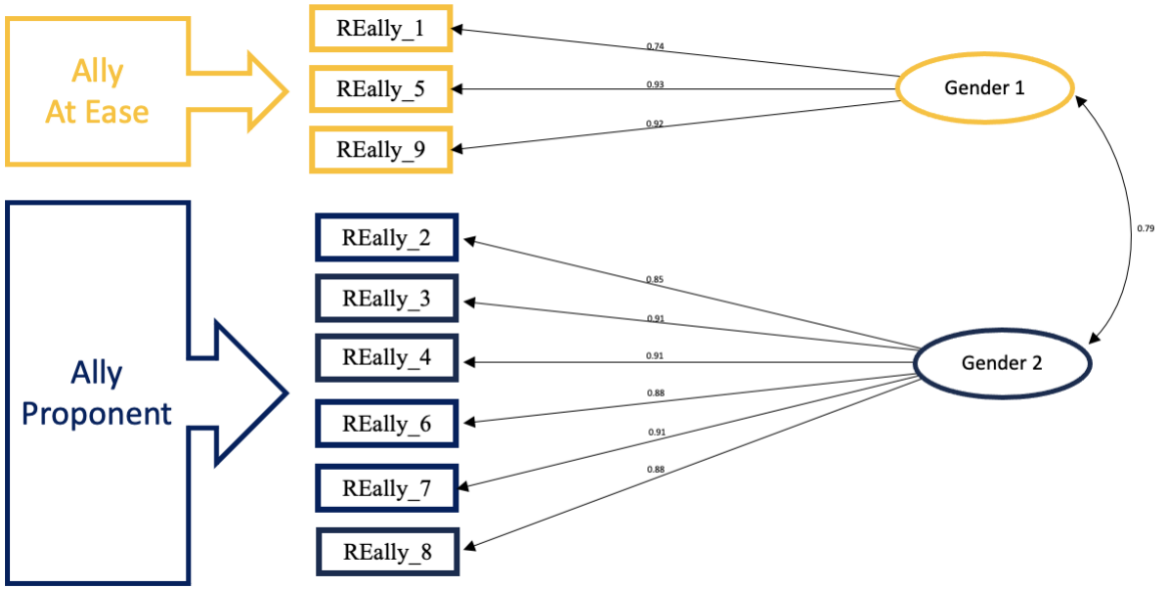


Figure *2.*

Factor loadings for the two-factor model of Gender-based Allyship



Appendix

Race\Ethnicity-based Allyship Scale

Nine Original items in the Race/Ethnicity-based Allyship survey

Please indicate the extent you agree with statements regarding your peers and colleagues at your current institution who are OUTSIDE of your racial/ethnic group.

(Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)

Name	Items
REally_1	I have a positive attitude about the peers and colleagues outside of my racial/ethnic group.
	Ally Promoter
REally_3	I believe they advocate for me.
REally_4	I believe they speak up in my defense.
REally_8	I believe they promote my point of view.
	Ally Attender
REally_6	I believe they listen to my point of view.
REally_7	I believe they are truly interested in understanding my point of view.
	Ally Accepted
REally_2	I believe they have positive attitudes about me.
REally_5	I feel at ease around my peers outside my racial/ethnic group.
REally_9	I feel comfortable when I hang out with my peers outside my racial/ethnic group.

Gender-based Allyship Scale

Nine Original items in the Gender-based Allyship survey

Please indicate the extent you agree with statements regarding your peers and colleagues at your current institution who are OUTSIDE of your gender group.

(Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)

Name	Items
	Ally At Ease
GEally_1	I have a positive attitude about the peers and colleagues outside of my racial/ethnic group.
GEally_5	I feel at ease around my peers outside my racial/ethnic group.
GEally_9	I feel comfortable when I hang out with my peers outside my racial/ethnic group.
	Ally Proponent
GEally_2	I believe they have positive attitudes about me.
GEally_3	I believe they advocate for me.
GEally_4	I believe they speak up in my defense.
GEally_6	I believe they listen to my point of view.
GEally_7	I believe they are truly interested in understanding my point of view.
GEally_8	I believe they promote my point of view.

Allyship (22): *Definision forURM and Ally included in the survey databook*
Underrepresented minority (URM)*: those populations or individuals that historical and social disadvantages prevented them from obtaining the same privileges and advantages as the traditional majority population.*

Ally: *Someone who uses their privilege and/or positions to advocate for underrepresented individuals and groups with the intent of creating opportunities and promoting their visibility.*

(Scale: 1 = Yes, 2 = No)	
URM_22_1	Do you consider yourself an underrepresented minority at your current institution, such as based on gender, race/ethnicity, etc.?
URM_22_2	Do you have friends and/or close peers who consider themselves an underrepresented minority, such as based on gender, race/ethnicity, etc.?
All_22	Do you consider yourself an ally to underrepresented minorities based on gender and/or race/ethnicity?

Please indicate the extent you agree with statements regarding your peers and colleagues at your current institution who are OUTSIDE of your racial/ethnic group.

(Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)	
really_1	I have a positive attitude about the peers and colleagues outside of my racial/ethnic group.
really_2	I believe they have positive attitudes about me.
really_3	I believe they advocate for me.
really_4	I believe they speak up in my defense.
really_5	I feel at ease around my peers outside my racial/ethnic group.
really_6	I believe they listen to my point of view.
really_7	I believe they are truly interested in understanding my point of view.
really_8	I believe they promote my point of view.
really_9	I feel comfortable when I hang out with my peers outside my racial/ethnic group.

Please indicate the extent you agree with statements regarding your peers and colleagues at your current institution who are OUTSIDE your gender group.

(Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)	
geally_1	I have a positive attitude about the peers and colleagues outside of my gender group.
geally_2	I believe they have positive attitudes about me.
geally_3	I believe they advocate for me.
geally_4	I believe they speak up in my defense.
geally_5	I feel at ease around my peers outside my gender group.
geally_6	I believe they listen to my point of view.
geally_7	I believe they are truly interested in understanding my point of view.
geally_8	I believe they promote my point of view.
geally_9	I feel comfortable when I hang out with my peers outside my gender group.

Conclusion:

This chapter summarizes the findings of the program of research described above, presents the implications, acknowledges limitations and shortcomings, and offer some suggestions for future studies.

According to self-determination theory (SDT; Deci & Ryan, 1985; Deci et al., 1997), humans' motivation and feelings of accomplishment thrive when individuals experience a sense of belonging, competence, and sense of control within a particular context or with respect to someone. Under these circumstances, individuals will experience optimal motivation and are more likely to produce favorable results. These basic psychological needs could influence and motivate URM faculty to survive and thrive in less than an amiable atmosphere of STEM disciplines and to overcome tremendous challenges they face (Lechuga, 2012).

This program of study has drawn from SDT in all three research papers to impart some knowledge on how facing discrimination (Study 1), enduring microaggressions (Study 2), and experiencing allyship (Study 3) could reflect on motivation, perception of successful, and interpersonal relationship to colleagues, among underrepresented minority population in STEM faculty.

Findings Summarized

In the first study, as expected URM faculty disclose substantial levels of workplace discrimination based on gender and race/ethnicity (O'Meara et al., 2020; Wilkins, 2017); however, this study was the first to examine how these experiences correlated with URM faculty motivation to conduct research.

This research showed URM women reported substantial levels of gender-based discrimination in their workplace and they were 50% more susceptible to gender-based

microaggressions. A considerable number of male faculty who self-identified as URM, 28.7%, reported experiencing racial/ethnic microaggressions. Furthermore, URM faculty experienced significantly lower levels of support in both areas of gender- and race\ethnicity-based allyship compared to those faculty who were not part of the minority population. Moreover, women with intersecting identities faced the highest percentage of both gender- and racial/ethnic-based microaggressions and the lowest levels of allyship among all URM population and subgroups. Our investigation into this group found a significant positive correlation between racial\ethnic microaggression and competence.

When investigating if and how these experiences could affect URM faculty, the results revealed that these group of faculty reported lower levels of autonomy, autonomous motivation, and research success compared to their colleague who were not underrepresented in their fields. In addition to encountering the same negative effects, URM women also reported a substantial lower level of relatedness to their colleagues, and higher level of amotivation which is a sign of total lack of motivation. Unexpectedly, we found that URM faculty who have reported experiencing racial/ethnic microaggression reported a relatively higher perceive of success.

On the allyship front, this study confirmed that those who experience allyship feel a sense of belonging to their place of work and a sense of relatedness to their colleagues (Veer et al., 2021). Our data revealed the Accepted factor of Race\Ethnicity-based allyship scale has a negative correlation to amotivation, which means feeling accepted by colleagues alleviated their lack of motivation.

Implication, Shortcomings, and Future Recommendation

Inclusion, acceptance, and a sense of belonging to the organization ranked top when asked URM individuals what they want from allies and allyship (Brooks, A. K., & Edwards, K.,

2009). The findings in this program of study could interest government and higher education administrations in developing, adapting, and implementing effective institutional policies and procedures such as inclusive leadership and allyship training to address the specific needs and challenges of the URM faculty population (Munoz & Thomas, 2006). Embracing these approaches and policies could create an inclusive culture where faculty from all backgrounds, identities, abilities, and experiences feel supported and accepted (Brooks & Edwards, 2009).

This study could also have economic implications by reducing the rate of URM faculty leaving their institutions because of maltreatment. Literature shown inadequate workplace atmosphere is the leading cause of women leaving academia (Hill et al., 2010, Kaminski and Geisler, 2012), and institutional barriers can limit women's participation and success in STEM fields (Ceci & Williams, 2010). The finding in this study could interest higher education in curtailing the challenges of their recruitment and retention of URM.

One of the limitations of this study was that the discrimination and microaggressions scales were not adapted to measure against other URM groups and various dimensions of diversity, such as neurodiversity, socioeconomic status, disability, and sexuality, LGBTQ+, and class distinctions. In future studies, it is essential to broaden this research focus beyond URM (Underrepresented Minority) groups solely characterized by race, ethnicity, and gender. It is imperative to encompass various facets of diversity and acknowledging those groups and identities that have endured historically and ongoing discrimination. A comprehensive approach may involve examining these experiences through a cross-cultural, -nationality, and perspective, considering the influence of various factors such as countries, geopolitics, and other. Another limitation was regarding cross-sectional of the data for the current study, which resulted in a limited predictive validity.

Recognizing and comprehending the experiences of discrimination and their potential repercussions is crucial. Equally significant is the pursuit of effective actions and the implementation of policies that go beyond denouncing and prohibiting these incidents. Such actions should also encompass providing support and empowerment to underrepresented minority (URM) populations (Munoz & Thomas, 2006). with the goal of ensuring equity for marginalized and underrepresented individuals and groups. This process includes promoting their visibility through allies and their allyship deeds, to enable them to seize the equal opportunities available in their respective professional domains. To do that, future research could build upon the third study, by expanding the allyship survey questionnaire and its latent variables to broaden the perspective of URM population of allies and allyship and to establish an allyship scale with a high degree of reliability and validity. This will enable other studies to adapt this allyship scale beyond the realms of race, ethnicity, and gender.

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