"Well, it's obvious": Students' Experiences with Mathematical Microaggressions

Anne Cawley
Cal Poly Pomona

Ryan Aniceto
Cal Poly Pomona

Seth Ricarte
Cal Poly Pomona

Robin Wilson
Loyola Marymount University

Mathematical microaggressions (MM) refer to the subtle ways in which mathematical authorities use language, behavior, and assumptions that communicate negative messages to students that they do not belong in mathematics (Su, 2015). This study analyzes the reflections of 173 undergraduate mathematics students who were asked to reflect on an article (Su, 2015) about MMs. Findings show that students experience different types of MMs, including microslights, microinsults, and environmental microaggressions. Our results indicate that female students were more likely to report experiences with MMs than male students. This research supports the need to investigate this phenomenon further and to develop initiatives at departmental and institutional levels to encourage more inclusive spaces in math classrooms.

Keywords: Mathematical Microaggressions, Microslights, Microinsults, Sense of Belonging

Microaggressions (MA) have been characterized as the intentional or unintentional indignities that communicate "hostile, derogatory, or negative" messages that target a person and/or their marginalized group (Sue, 2010). Within the realm of education, the prevalence and effects of MAs have been studied in relation to students' sense of belonging. Sense of belonging, in a university context, refers to the perceived social support and the experience of mattering or feeling cared about, accepted, respected, valued by, and important to the classroom and campus community (Strayhorn, 2018). Recent scholarship has revealed that MAs are prevalent in classrooms and inhibit students' sense of belonging, especially for students coming from marginalized groups (Solórzano et al. 2000; Yosso et al., 2009). As an example, Lewis et al. (2021) reported that a higher frequency of racial MAs significantly predicted lower overall sense of belonging for students of color, and similar connections between MAs and sense of belonging can be found in studies centered on women (McCabe, 2009).

Microaggressions have been well reported as widespread in academic spaces and detrimental to student outcomes. Within STEM departments, which already face issues in representation from marginalized communities, reports of MAs are distinctive. Students of color, especially Black students, report racial MAs from STEM instructors, advisors, and peers (Lee et al., 2020). Further work shows that the effects of MAs can be magnified in STEM spaces. Leyva and his colleagues (2021) report how discouraging classroom practices, many of which can be characterized as MAs, had discriminatory impacts on women and students of color. Marshall et al. (2021) noted that in the context of STEM, MAs hinder students' academic success and ability to participate in the academic pipeline, especially for students historically excluded from the sciences on the basis of race or ethnicity. MAs directly impact students' sense of belonging in STEM, and more needs to be done at an institutional level to better support student retention and sense of belonging within STEM fields (Lee et al., 2020; Rainey et al., 2018).

Our paper is framed through the subtle layers of microaggressions and how they can be received by mathematics students (Marshall et al., 2021; McKenna et al., 2021; Su, 2015). As an extension from discussions of racial microaggressions, Francis Su (2015) used the term

mathematical microaggression (hereby labeled as MM), which refers to the subtle ways that mathematical authorities (such as instructors, classmates, or textbook authors) communicate that one does not belong in mathematics. Su offered examples such as "It is obvious/clear/trivial that…", "The rest is just algebra," and "There's a trick for doing this" and elaborates that such comments can convey negative messages towards students (e.g., their knowledge is lacking, their questions are unwelcome, their potential in mathematics is limited). In order to highlight the undeliberate intentions in which MMs are often exchanged in math classrooms, he used the term *microslights*, which are defined as unintentional comments or language in which the aggressor is often unaware could be exclusionary. Accounting for more intentional and/or aggressive MMs from instructors toward students, McKenna et al. (2021) define *microinsults* as "intentional, subtle snubs" that can "demean one's racial heritage or identity," which we extend in the case of MMs to cover abrasive exchanges that targets students' mathematical identity and perception of ability. Marshall and her colleagues (2021) define *environmental microaggressions* (EM) as relating to MAs that exist in the environment in which a person exists, not directly received by an individual. We adapt Marshall et al.'s (2021) definition of EMs to include any MM that exists in the experience of learning but is not inflicted by any one person to another person directly. For example, an EM could be witnessing peers understand a topic quickly or a professor moving quickly through a mathematical explanation. Because a student understanding a topic quickly is not done purposely to harm another person, we categorize this MM as subtly different than microslights or microinsults, which are more directed towards individuals.

Our study focuses on the MMs that mathematics students reflect on experiencing throughout their learning. This paper focuses on the following three research questions: 1) How do mathematics students describe experiencing MMs? 2) What types of MMs do students experience? 3) How do students' experiences with MMs vary by gender?

Methods

This study took place at a large public university on the West Coast of the U.S., designated as a Hispanic-serving Institution. Data for this paper were collected between Fall 2019 and Spring 2022. The sample included 173 participants enrolled in calculus I (47 students in two sections) or abstract algebra (126 students in four sections), taught by the same instructor (Author 4). Course modalities included both in-person and virtual instruction. These classes incorporated inquiry-based learning and active learning and provided a significant amount of time for student collaboration and discussion during class instruction. Based on institutional data of the 173 students, 42.8% were female and 57.2% were male. 50.9% of the students were Latine[1], 3.5% were Black, 18.5% were AAPI, 13.3% were white, one student was Native American, 6.9% were undocumented[2], 3.2% two or more races, and 4% where race was unknown.

Throughout the course, students were asked to submit reflection assignments. In one of these assignments, students were asked to read Su's (2015) article on MMs, to reflect on the paper, and to describe if they have ever been made to feel like they do not belong in mathematics. Students could reflect on any moments in their math experience. The instructor created this assignment as part of a series of assignments for the purpose of creating a more inclusive classroom space for collaborative learning. The 173 reflections form the data set for this study; each reflection was given an identifier that included the course and students' gender, race/ethnicity, and major.

[1] *Latine* is a gender-neutral replacement of the term Latino. It has been used as a more linguistically natural alternative to Latinx or Latin@ for Spanish-speakers (Celis Carbajal, 2020).

[2] We note that "undocumented" is not a race or ethnicity, however, the university uses this category.

The data were analyzed using constant comparative methods (Corbin & Strauss, 2008). The first round of coding utilized deductive coding. All de-identified reflections were initially coded by all authors to identify microaggressions that students experienced in STEM, specifically mathematical, racialized, and gendered microaggressions. For purposes of this paper we focused on MMs and therefore analyzed these data in the second round of coding. First, we coded for *Who Received a MM* with four sub-codes emerging: i) student has directly received/experienced an MM, ii) student has never received/experienced an MM, iii) student has not directly received/experienced an MM but can imagine how it could affect others, and iv) student has inflicted an MM on another person (reflections could be coded for more than one sub-code). Next, for those students who indicated directly receiving an MM, we coded for *Type of MM discussed* and *Who/what inflicted the MM*. Finally, we coded for *Pushback to the concept of MM*. Pushback could include a student stating that MMs were not real or a student explaining away the MM by claiming that they themselves lacked discipline or knowledge or should be a better student. A third round of coding commenced where authors grouped types of MM directly received and labeled each as a microslight (Su, 2015), a microinsult (Mckenna et al., 2021), or an EM (Marshall et al., 2021). After each round of coding, the authors cross-coded a subset to verify validity of application of codes. Authors met to discuss any disagreements of codes.

Findings

From the 173 student reflections, 69.9% indicated having directly received a MM, 4% have never directly received a MM, 20.8% could imagine how MMs can negatively affect others, and 6.4% indicated that they have inflicted MMs on others. Students who directly received an MM (N=121) indicated 11 distinct types of MMs (see Table 1); 65.3% of students indicated a microslight, 16.5% indicated a microinsult, and 19.8% indicated an EM.

From the 121 students who received an MM, most indicated having received microslights, with 40.5% of students indicating the MM "It's obvious/trivial/easy". Representative of other entries, Edwin, a Black male student in abstract algebra said, "I heard…a professor say that a proof to a lemma was obvious. I didn't ask about it, although I didn't understand it, because I didn't want to look dumb in front of my peers for not seeing an obvious proof". Other students described similar experiences. Subsequently, 14% of students reported being told "You should have learned this before", and 9.9% reported hearing "The rest is just algebra" or not being given enough wait time. Typical of "No wait time" examples, Lianne, a white female student in abstract algebra described experiencing professors say, "Does anyone have any questions?" with a very short pause before moving on. "Sometimes it takes a few seconds to build up the courage to ask a question, but when the teacher moves on too quickly it makes you wonder, 'How does everyone else understand but me?'". The remaining three microslights represented less than 10% of student responses and will not be discussed here. 16.5% of the students reported hearing the microslights that Su (2015) wrote in his paper, but did not specify the type.

Table 1: Frequencies by type of mathematical microaggression students reported directly receiving (N=121)

Type of Mathematical Microaggression	Frequency (%*)
Microslight	**79 (65.3%)**
It's obvious, trivial, easy	49 (40.5%)
You should have learned this before	17 (14%)
"The rest is just algebra"	12 (9.9%)
No wait time	12 (9.9%)
Ignoring/dismissing questions, "see me after class"	8 (6.6%)

"The concept is not that bad"	6 (5%)
There is no such thing as a dumb question	6 (5%)
Microinsult	**20 (16.5%)**
Belittle/shame student	12 (9.9%)
Not believing in a student, "You're not good enough"	8 (6.6%)
Environmental	**24 (19.8%)**
Seeing others get it quickly	18 (14.9%)
Professor moves too quickly/Skips Steps	7 (5.8%)
MM not specified	**20 (16.5%)**
Other	**11 (9.1%)**

*Note that totals are greater than 100% as some students reported more than one MM

Students reported experiencing microinsults less often than microslights; 70% of microinsults were reported by students in abstract algebra. Students discussed instructors belittling them or shaming them (9.9%) or not having an instructor believing in their ability to do mathematics (6.6%). For example, Reese, a Latino male student, felt belittled during class when he wrote a problem that he struggled with on the board and recounted the instructor's response. "When she got to the problem she said, 'I'm not even going to do this problem because it's so easy, and if you need help on this problem you're in the wrong class'". This made Reese feel embarrassed and less intelligent than the other students in his class. Students described two ways of experiencing EMs; 14.9% of students indicated feeling like they did not belong when they saw other students understanding the material quickly while 5.8% of students described feeling excluded when instructors skipped steps or moved too quickly through the material.

Students who directly received a MM indicated receiving them from professors (63%), K-12 teachers (11.5%), peers (16.5%), and the textbook (6.6%). Alice, a female Asian American calculus student, explained how she experienced receiving MMs during class group work:

> There were times where I was in group work settings and I would ask a question and all the members would know how to do it. They would say, this is "obvious" and teach me briefly. It made me think that I am not qualified enough to be in this class because I was not able to learn my basics well enough.

Eleven students admitted to being a microaggressor toward a peer who was struggling with course material or students they were tutoring. All but two of these students were male. As an example, Douglas, a Latino male abstract algebra student mentioned, "I feel like [MMs are] very important as I've said some of these things to students I have tutored in the past. I didn't personally consider the perspective of students who may be experiencing these same topics which I've been practicing for 3 to 4 years". For most of these students, their reports of being microaggressors at a previous time were combined with reflections of their own teaching philosophy, newly informed by the potential negative effects of their previous comments.

Of the 173 reflections, 17 students (9.8%) demonstrated pushback against the discussion of MMs. Reasons behind pushback varied but largely arose from three perspectives toward MMs: i) MAs are unintentional and do not warrant emotional response, ii) MAs are an opportunity to call out a student's shortcomings, and iii) discourse regarding MAs is a politicized diversion from addressing lack of effort. An example provided by Garrett, a white male calculus student, exemplified how MMs are an excuse for students to maintain poor effort:

> I feel that the use of microaggressions as an excuse to why a student feels like they are failing a math class is concerning. I feel that too many students do not put in the effort to

learn how to do math and refuse to ask questions which results in students blaming so called "microaggressions" on their failure.

All but one of the 17 students who demonstrated pushback to the idea of MMs were majors within the colleges of science and engineering. Five of the 17 students who displayed some pushback against MMs were female. We should note that these five students focused on the unintentional nature of MMs as a reason to push back and argued that they themselves may have been "too sensitive" when reacting to the MM.

There is evidence to show other findings when comparing gender. Female students more frequently experienced MMs than male students; 78.4% of female students (N=74) reported experiencing an MM compared to 63.6% of male students (N=99). Female students indicated higher experiences with microslights and EMs. A notable discrepancy occurs specifically with reports of microslights, where 52.7% of the female students reported having experienced microslights, compared to the 40.4% of male students. Male and female students indicated receiving microinsults at similar rates (12.1% compared to 10.8%). It should be noted that all students who indicated that they had never experienced a MM were male; none were female.

Discussion

Our study showed that a large proportion of students have directly experienced a MM. Most students experienced the "It's obvious/trivial/easy" microslight. This microslight may have been discussed more than others as Su (2015) lists this in his paper as the first example of a MM. It is particularly notable that female students reported experiencing MMs more than male students. We believe that it is important for instructors to attend to the way these microaggressions acutely affect women. Findings indicate that the nature of MMs are carried on through students in their interactions with others. Microinsults are more severe forms of MAs, and even though they were less frequently referenced by students in their reflections, we need to consider how microinsults affect all groups of students. While students reported experiencing most MMs from instructors, students did indicate receiving them from peers, which is an important factor to consider when attempting to create a safe and welcoming classroom climate while utilizing active learning teaching techniques.

Types of MMs experienced align with previous findings, specifically that students do feel the impact of seemingly innocuous comments often found in mathematics classrooms (Leyva et al., 2021; Su, 2015). These MMs can directly impact a student's sense of belonging in STEM, and is very impactful on marginalized students (Rainey et al., 2018), specifically women. This study points out that more research is needed to understand the ways both students and instructors experience and internalize MMs. It also suggests potential for including MMs in professional development for college math instructors, specifically examples of MMs and how they are received by math learners. We hope to learn from the RUME community ways that they acknowledge MMs with their students to form a more inclusive learning environment, as well as different ways to interpret our data.

While this study focused on understanding and categorizing the types of mathematical microaggressions students have experienced, we have begun preliminary analysis of the data in other ways. First, we continue to analyze the MM data for any differences by participant race and gender. While the Su (2015) paper focused on mathematical microaggressions, some student discussed racialized or gendered microaggressions within their reflections. Future analysis will explore the ways students talk about these important microaggressions and how they impact sense of belonging in math classrooms.

References

Celis Carbajal, P. (2020, September 29). From Hispanic to Latine: Hispanic heritage month and the terms that bind us. https://www.nypl.org/blog/2020/09/29/hispanic-heritage-month-terms-bind-us

Corbin, J., & Strauss, A. (2008). Basics of qualitative research: Techniques and procedures for developing grounded theory (3rd ed.). Thousand Oaks, CA: Sage Publications.

Lee, M. J., Collins, J. D., Harwood, S. A., Mendenhall, R., & Huntt, M. B. (2020). "If you aren't White, Asian or Indian, you aren't an engineer": Racial microaggressions in STEM education. International Journal of STEM Education, 7(1), 1-16.

Lewis, J. A., Mendenhall, R., Ojiemwen, A., Thomas, M., Riopelle, C., Harwood, S. A., & Browne Huntt, M. (2021). Racial microaggressions and sense of belonging at a historically white university. American Behavioral Scientist, 65(8), 1049-1071.

Leyva, L. A., McNeill, R. T., Marshall, B. L., & Guzmán, O. A. (2021). "It seems like they purposefully try to make as many kids drop": An analysis of logics and mechanisms of racial-gendered inequality in introductory mathematics instruction. The Journal of Higher Education, 92(5), 784-814.

Marshall, A., Pack, A. D., Owusu, S. A., Hultman, R., Drake, D., Rutaganira, F. U., ... & Hinton Jr, A. O. (2021). Responding and navigating racialized microaggressions in STEM. Pathogens and disease, 79(5). https://doi.org/10.1093/femspd/ftab027

McCabe, J. (2009). Racial and gender microaggressions on a predominantly-White campus: Experiences of Black, Latina/o and White undergraduates. Race, Gender & Class, 133-151.

McKenna, H. J., Chang, K. L., & Mgonja, T. (2021). A framework to measure microaggressions in the mathematics classroom. SN Social Sciences, 1(5), 1-21.

Rainey, K., Dancy, M., Mickelson, R., Stearns, E., & Moller, S. (2018). Race and gender differences in how sense of belonging influences decisions to major in STEM. *International journal of STEM education*, *5*(1), 1-14.

Strayhorn, T. L. (2018). College students' sense of belonging: A key to educational success for all students. Routledge.

Su, F. E. (2015). Mathematical Microaggressions. MAA FOCUS, 36-37.

Sue, D. W. (2010). Microaggressions in everyday life: Race, gender, and sexual orientation. John Wiley & Sons.

Solórzano, D., Ceja, M., & Yosso, T. (2000). Critical race theory, racial microaggressions, and campus racial climate: The experiences of African American college students. *Journal of Negro education*, *69*(1/2) 60-73.

Yosso, T., Smith, W., Ceja, M., & Solórzano, D. (2009). Critical race theory, racial microaggressions, and campus racial climate for Latina/o undergraduates. *Harvard Educational Review*, *79*(4), 659-691.