Feminist Pedagogy in the STEM Research Laboratory: an Intersectional Approach

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Feminist Pedagogy in the STEM research laboratory: An intersectional approach

Black feminism: Understanding intersectionality for equitable STEM lab mentoring

Black feminist professor Kimberlé W. Crenshaw (1989) described intersectionality as a lens for observing how different inequalities operate together to worsen each other. Thus, discussions that isolate racial inequality from gender, class, sexuality, or other forms of inequity, overlook that those who grapple with multiple inequalities, do not experience them as the sum of their parts. Narrowly defined scientific standards have created a STEM culture that largely excludes individuals who experience intersecting systems of inequity. Specifically, Puerto Rico’s neocolonial environment informs a unique identity for university students on the archipelago (Lamba-Nieves, 2021). This reality impacts people already affected by other oppressive systems of power at the intersections of race, gender, and class (Crenshaw, 1989) and further exacerbated by multiple natural disasters (Rodriguez-Coss, 2020). Hence, the STEM laboratory must become a space to practice new ways of thinking of and engaging in scientific endeavors that counter the social-political terrain in Puerto Rico.

Caro-Diaz’ experience at UPR

My laboratory training began at the University of Puerto Rico (UPR) - Rio Piedras (RP) where two women Ph.D. students trained and mentored me through two years of an undergraduate research fellowship. At the time, UPR-RP’s Department of Chemistry was recognized as a nationwide leader in women Ph.D. graduates. More recently, UPR-RP reported graduating approximately twice as many women as men with baccalaureate and master’s degrees (UPR, 2023). Thus, it was no surprise that when I began at UPR as an assistant professor and principal investigator (PI) in 2018, most trainees in my research group were women. Despite high numbers of women within Puerto Rico’s public university, the socio-political climate continues to negatively impact women severely. For example, after months of pressure from feminist organizations (Lebrón, 2020), Puerto Rico’s government was forced to declare a national state of emergency over gender violence in January 2021 (Maldonado-Andreu, 2022). This landscape prompted me to question
standard educational practices, especially in the research lab setting, and to implement more equitable tools and frameworks derived from Black feminist theory to democratize our research culture and the laboratory.

Firstly, the group was renamed the Marine Natural Products Lab (no mention of my name), and we refer to it as "our group." This seemingly subtle terminology change generates a sense of collective accountability and names that we all participate in group operations. Meetings transcend science-only conversations with regular check-in exercises; discussions of assigned reading materials related to diversity, equity, and inclusion (DEI); and decisions concerning laboratory matters. Recently, our group embarked on its first retreat, where we dedicated our first day to discussing self-perceptions, mentee styles, and emotional perspectives on performing in science. These experiences have been crucial to informing how I approach mentoring based on how each member processes research-related experiences. They also incentivize self-development, mistake-making, learning, unlearning, and, most importantly, curiosity. These insights translate into our weekly one-on-one meetings where we discuss personal challenges, research progress, and goals. One-on-ones are only thirty minutes, since we focus on overall progress rather than project specifics. Understanding the complexity of each member's identity results in group members receiving detailed-oriented and equitable mentorship.

**Impact versus Intention: Member perceptions of our culture**

Mentors often believe that intentions are enough to provide healthy environments for learning and development, nonetheless we must make space for measuring the impact of our actions. After our annual lab retreats, group members are asked to complete a survey anonymously on their experiences. This information evaluates the gap between intended and actual outcomes. As part of developing this commentary, group members were asked to share their perspectives on our research group’s culture. They were provided with a draft of this commentary and a reference article that described the concept of feminist pedagogy. Without any guidance, these were their comments:

"In our laboratory, I have always felt in a safe space where we can allow ourselves to ask questions about science and not feel fear or humiliation for not knowing or making mistakes...."
“We have created a space where the work and efforts of each of the group members are recognized and we feel the support of a community greatly supported and represented mainly by women.”

“When it was believed that there was no space for women in science, our laboratory showed that science is and always will be for women.”

“In the past retreat, we were able to bond between the women who represent the laboratory, and this was a key and fundamental process in the creation of exponential support in our laboratory where we have shared ideas and helped each other in our daily academic projects.”

“I feel that my experience in our lab is greatly influenced through the tone set by our PI, mostly centered by the fact that have been given a space where we can all be leaders and through this, we generate the correct environment for a lab whose members are predominantly women.”

“…through frequent conversations with colleagues from other groups, I have noticed that a notable factor that sets our work dynamic apart is the immense receptiveness of our PI. This has promoted a safe space to have open and honest conversations without fear of judgment. By maintaining this open, secure environment, our mentor gets insight from both our academic and personal lives in a way that allows him to assess our needs and better support our work. Consequentially, his mentoring consistently fosters our professional success and incentivizes the motivation we need as students to further our STEM careers.”

“There should be an understanding of the multiple aspects that form the identity of the individual to develop the proper strategies and approaches needed to assess the needs, milestones, and goals of each member. I can say with certainty that our research group is the result of DEI and Female Pedagogy efforts in the UPR. Our mentor has ensured that every member, regardless of background, has had an equal opportunity to succeed.”
Caro-Diaz’ self-reflection as PI

During the construction of this commentary, one group member asked *what I had learned as a mentor?* Our research group is characterized by reciprocal learning while traversing many mistakes, misjudgments, and poor decisions. My biggest lesson has been that individuals navigate science differently based on their previous experiences (Seebacher et al., 2021). If we are to use an intersectional lens to redesign the STEM research laboratory classroom, we must become better listeners and lead with vulnerable curiosity. Vulnerable leadership reduces the power gap between research group members and PIs, promoting accountability and active participation in the learning experience while dismantling systems of power. Over the past five years, this approach has led to many positive outcomes, including multiple funded grants, graduate and undergraduate fellowships, travel awards, admissions into summer research and graduate programs, and fruitful collaborative projects. Most importantly, it has led mentees to find their paths in STEM and succeed on their terms.

To finalize this commentary, I would like to share a perspective from Dr. Shawntel Okonkwo (2019): “We need to build intersectionality into the cultural DNA of how we think about science, how we teach science, how we fund science and who science truly serves.”

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