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WISER: Women in Science and Engineering Roundtable

Andrea M. Hauser

Alicia Robinson

Angela Clark-Taylor

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Flora Stone Mather Center for
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Andrea M. Hauser, Alicia Robinson, and Angela Clark-Taylor



FLORA STONE MATHER
CENTER FOR WOMEN

Contact Number: 216.368.0985
Address: Tinkham Veale
University Center, Suite 248
11038 Bellflower Road
Cleveland, OH 44106

Email: centerforwomen@case.edu
Website: <https://case.edu/centerforwomen/>



Women in STEM

Although women comprise nearly half of the U.S. workforce, the Census Bureau reports that women only account for 27% of workers in science, technology, engineering, and math (STEM) industries (Martinez & Christnacht, 2021). Moreover, representation of women of color in STEM industries is even smaller, with Asian women comprising 6% of workers, Black women representing 2.5%, Latinas 2.3% and American Indian/Alaska Native women at 0.1% (National Science Foundation, 2020). Since STEM occupations are projected to grow by 10.5% by 2030 (compared to their non-STEM counterparts at 7.5%) (U.S. Bureau of Labor Statistics, 2021), such gender and racial imbalances are troubling. Also concerning is the inherent limit of scientific advances given the lack of perspectives by women whose lived experiences differ from the status quo, leaving our collective scientific understanding biased toward masculine, positivist perspectives and inherently incomplete (Heybach & Pickup, 2017; Ropers-Hulman & Winters, 2011).

Women's lack of representation within STEM is best explained by centuries-long exclusion coupled with subsequent inclusion efforts met with systemic pushback. Nearly half of women working in STEM report experiencing gender discrimination and 22% report experiencing sexual harassment (Funk & Parker, 2018). Further, racial disruption of the white status quo further complicates efforts to include and advance scientific inquiry within STEM. About 62% of Black STEM workers report experiencing racial discrimination alongside 44% of their Asian colleagues and 42% of Hispanic workers (Funk & Parker, 2018). Combined, challenges to the white and male status quo within STEM further alienate women of color, particularly Black women, working within the industry. Such discrimination has resulted in as many as 52% of women in STEM leaving their job (Sherbin, 2018) and hindering efforts in scientific advancement.

While focus on retaining women within industry is critical, so too is their recruitment into the field. Higher education has a unique opportunity to respond calls for helping women and racially underrepresented groups enter STEM while simultaneously addressing the systemic practices that prevent their retention in the field (Espinosa & Posselt, 2021). Specifically, college campuses have an opportunity to increase belonging to help with retention efforts. Providing a space for women to engage with each other provides an opportunity to strengthen and expand the collective understanding of scientific inquiry currently existing within STEM disciplines.

Women in STEM on Campus

Despite some gains in women's degree earnings in STEM (National Center for Education Statistics, 2019; 2021), women continue to remain underrepresented within the disciplines, earning only 49% of science and engineering degrees in 2016 despite being 57% of all degree earners across disciplines (National Center for Science and Engineering Statistics, 2019). This lack of representation is amplified considering women's postsecondary enrollment has outnumbered men since the 1970s, at a rate of 16% higher in 2019, a trend that is projected to continue through at least 2029 (National Center for Education Statistics, 2021). Women of color remain in the periphery of the STEM disciplines, with Asian women comprising only 14.6% of women-identified STEM degree earners, Hispanic women 13.6%, Black women 9.8%, and less than 1% Pacific Islander or American Indian/Alaska Native (National Center for Education Statistics, 2019), reflecting an even wider degree attainment gap for women of color than their white peers.

This historic exclusion has resulted an overarching feeling of a lack of belonging or chilly climate (Hall & Sandler, 1982; Sandler & Hall, 1986; Šaras et al., 2018), which has persisted as a reflection of binary gendered norms inherent within STEM and the larger society. The importance of belonging on campus is well documented and feelings of belonging are linked to students’ social identities (Duran et al., 2020; Gaston Gayles & Smith, 2018; Strayhorn, 2019), adding weight to the notion that a lack of belonging affects women’s experience on campus, including in STEM. Research points to the necessity of counterspaces, both literal and figurative, that serve to increase women’s sense of belonging by creating community in otherwise oppressive environments (Ong et al., 2018).

The purpose of this research brief is to offer an exemplar counterspace program offered for women in STEM at CWRU, to situate its context within the university, higher education, and the larger society, and provide recommendations for praxis for other gender-based centers on college campus. We approach research from a critical constructivist paradigm and feminist theoretical lens, recognizing society and knowledge is historical and subjective and working within the belief that research should seek to promote higher education as a public good and transform social understandings toward a more equitable society. Subsequently, we embed the telling of this research initiative within constructivist perspectives, offering some quantitative data but emphasizing the qualitative descriptions of WISER member’s experiences as a valid and valuable source of data as it pertains to feelings of belonging within STEM.

WISER at The Flora Stone Mather Center for Women

About Case Western Reserve University

Case Western Reserve University (CWRU) is a private research-focused institution in Cleveland, Ohio founded in 1826. It is highly selective and ranked 42nd in national universities by U.S. News and World Report, with engineering and biological and biomedical sciences being the most popular undergraduate majors (U.S. News, 2021). In Fall 2021 the gender composition of undergraduate students was 47% women, a notable difference from women comprising the majority of undergraduates nationally. In Fall 2020, CWRU enrolled 5,430 undergraduate students and 6,035 graduate and professional students, 45% of whom were enrolled in STEM programs (CWRU, 2021). In 2021, women-identified students represented 40% of those enrolled in STEM, with higher representation in some disciplines rather than others (See Table 1). These numbers largely reflect the landscape of STEM degree earners. According to the National Science Foundation (NSF), in 2018 women earned roughly half of science and engineering baccalaureate degrees, but the gender distribution within the disciplines varies. Notably, women enrolled mostly in biology and psychology programs, with the smallest enrollment in engineering, computer science, and physics.

Table 1. Women-Identified Baccalaureate Enrollment by Discipline

Discipline	CWRU	Nationally
Computer Sciences	22%	20%
Engineering	36%	23%
Mathematics & Statistics	30%	42%
Earth & Physical Sciences	57%	21%

Note. Categories and statistics were drawn from the National Science Foundation’s 2021 report on Women, Minorities, and Persons with Disabilities in Science and Engineering. CWRU data drawn from institutional reporting for fall 2021.

About the Flora Stone Mather Center for Women & WISER

The Flora Stone Mather Center for Women (Mather Center) at Case Western Reserve University is a community space and a social innovator, empowering women and advancing gender equity through research-informed action. Whereas many efforts to articulate and rectify gender-based participation and achievement gaps in STEM education have focused on the deficits of women, more recent approaches examine the oppressive conditions in which women are asked to operate (American Association for the Advancement of Science, 2021; Heybach & Pickup, 2017). The Mather Center aligns its gender equity programming with critical approaches in that staff efforts for student-facing



programs center belonging and the assets of women as opposed to deficits of the women (e.g., negating imposter syndrome) or centering barriers (e.g., navigating harassment). While the Mather Center staff believe that alternate examples are important and often warranted, we respond to gender-based discrimination at the systemic institutional level while centering student belonging in our direct work at the micro level. We believe that this multi-level approach is important because it fully recognizes the contextual realities of living within the systems of oppression and exclusion as opposed to pinning perceived shortcomings on the individuals themselves while simultaneously allowing for gender equity work at the systemic and individual levels.

One of the key goals of the center is to support gender equity in STEM by facilitating community collaboration toward creating allies for women in STEM, funding STEM research by women, providing professional development for women in STEM, and fostering a sense of belonging for women students in STEM at Case Western Reserve University. The Women in Science and Engineering Roundtable (WISER) is a signature program within the Center. WISER is a student organization housed within the Mather Center that aims to promote the inclusion and success of all women pursuing a STEM-related discipline at CWRU. It is co-led between students and Mather Center staff, who advises the organization. It is trans-inclusive as members seek to support women of all gender expressions and identities. Undergraduate and graduate students are welcomed with a major or planning a career in science, technology, engineering, and medicine, but most members are undergraduate students. WISER was founded in the 1990s by three women faculty STEM who sought to support women students within the disciplines. WISER provides leadership development through service, peer networking through campus mixers, and a professional networking program in which students were paired with a mentor who was a working professional in STEM. In 2020 the Mather Center also added research and travel grant opportunities for WISER members that have since expanded to all students at CWRU.

Today, WISER is led by a student team that is advised by a staff member at the Mather Center and its purpose is centered on creating and sustaining a community counterspace for women in STEM. While a Mather Center staff member now coordinates

professional mentoring, the student arm of the organization coordinates an extensive peer mentoring program that has served as the centerpiece of many WISER member's experiences within the organization along with hosting a variety of organizational events.

240

Hours of mentoring between 32 mentors and 40 undergrads

84

Hours of mentoring between 10 mentors and 14 graduate students

20

Student-led events like orientation, trainings, industry info sessions, high school visits, service projects, and STEM competitions

WISER by the Numbers

Note. Due to the COVID-19 global pandemic, CWRU was fully remote; all events occurred in a virtual environment and/or following safety precautions advised by the University.

WISER's Reach

In fall 2020, WISER members numbered 256 and represented a wide number of STEM disciplines at CWRU. Currently, the Mather Center tracks representation of women-identified students both in and beyond WISER within STEM degree programs with aims to expand WISER participation in the future.

Table 2. Fall 2020 CWRU STEM Enrollment by All Undergrads, Women, & WISER Members

Major	Enrollment	Women	WISER Members
Aerospace Engineering	104	17	3
Civil Engineering	55	15	14
Computer Engineering	37	7	0
Computer Science	386	82	13
Electrical Engineering	135	32	4
Engineering Physics	12	1	1
Mechanical Engineering	286	56	15
Mathematics	58	17	3
Physics	47	12	4
Systems & Control Engineering	16	2	0



Student Voices in WISER

Student narratives provide valuable viewpoints of the impact of counterspaces on their experience in college, contextualizing the enrollment data on campus and highlighting the nuances of women's lived experiences. WISER students markedly reported improved sense of belonging within their fields, giving weight to the notion that belonging is rooted in engaging with others rather than simply representation in a field. For example, one member attributed her participation in WISER to her continued enrollment within her field:

WISER has been my biggest support system at CWRU. As a freshman, I considered switching out of STEM, and the people in WISER helped me feel confident in myself and keep me in the field I wanted to be in. They also made me not feel alone. At first, I knew no other female mechanical engineering majors, but I now know so many other women in the field and feel much more connected and comfortable in it. These connections have helped me learn from others, like my professional mentor, and help my peer mentees learn from my experiences.

She cited a need for connection with other women in order to feel comfortable in her field, an offset of belonging that highlights the value inherent in counterspaces. Notably, she also emphasized the importance of learning from others and helping others to learn, supporting the critical constructivist perspective that learning is a reciprocal process; that the learning she engages in strengthens and supports existing knowledge constructs in engineering that is otherwise incomplete.

Similarly, another student shared her need for belonging and how participation in WISER helped address feelings of hesitation in her field:

The WISER community is where I continue to be inspired by all the accomplished women who I look up to, and they are why I've realized how valuable it is to share my advice and experiences with other women in STEM. After joining WISER and being matched with a mentor I quickly realized the little doubts I had about engineering in high school were because I didn't know many women in science and engineering fields.

Again, shared identities validated the importance of counter spaces as a mechanism for dissipating doubts about her belonging within engineering as a woman. Still another student spoke about the importance of even the opportunity for belonging within STEM as a prospective CWRU student:

Even before I came to Case Western Reserve University, WISER was on my radar as an organization that I wanted to be a part of during my time as a student. WISER was the first club I signed up for at the activities fair and one I chose to continue participating in because of the passionate and supportive environment that resonates within the organization. I have gained tremendous confidence as a woman in STEM, from professional skills and networking to mentorship and volunteering. I truly appreciate how at each event every member is friendly and eager to engage with everyone...we are always excited to bond over the general body meeting topic or simply over the shared trait of being women in STEM.

For each of these WISER members, developing a sense of belonging through shared identities and experiences as women in STEM was an important part of their college experience. They engaged as both people and as knowledge-producers within their respective disciplines, supporting the notion that belonging matters and helps contribute to an expanded societal knowing in STEM.

Implications for Practice

Responding to the barriers that prevent women's full participation cannot solely rest on rectifying a lack of inclusion. Rather, advancement in the field must reflect a prioritization of feminist epistemologies and research approaches that reflect constructed and connected ways of knowing (Belenky et al., 1986) that truly add value to scientific inquiry and shift our efforts from including women to reaching equity rooted in deeply valued contributions. Doing so will allow STEM disciplines to work toward developing a comprehensive perspective of our shared world.

Change takes time which raises the question: what to do while these incremental shifts take place? As highlighted here, counterspaces provide a foundation for belonging necessary to validate women's shared marginalized experiences while in STEM while simultaneously verifying the worth of their full participation. Moreover, institutional context matters. While CWRU is a highly research-oriented institution and the Mather Center is well-resourced, we believe the mentoring model is highly transferable to a range of institutional types and gender-based centers. We deduce that the driving force behind its success is the Mather Center's asset-based approach that emphasizes belonging coupled with its student-centered leadership model. We are mindful to bring women together to discuss what they add to STEM rather than to focus on what they are missing, could do differently, or center the barriers they face. In this way, monetary and human resources are de-emphasized, and philosophical approach is highlighted to support programmatic success.

Implications for Research

Two areas for future research will strengthen our understanding of the impact of the WISER program, particularly on feelings of belonging. First, more information is needed on best practices on peer mentor programs. Much of what's published on peer mentoring has been centered on retention in STEM (Damkaci et al., 2017) or other academic measures like graduation and GPA (Spaulding et al., 2020) or any combination of the above (Ford et al., 2012) rather than sense of belonging. As seen here, mentoring programs likely affect feelings of belonging but additional research is needed to better understand the relationship.

Next, the Mather Center will continue to collect data regarding WISER members' participation and engagement in the WISER program. Specifically, tracking participation rates over time and event attendance as measures of assessment in place for the WISER program. Our aim is to strengthen and expand data to continually improve the program for students as the Center simultaneously executes gender equity initiatives across campus.



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