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Keywords

counterspace; equity; healing-centered; inclusion; inclusive science; intersectionality; science communication; science policy

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ReclaimingSTEM: A healing-centered counterspace model for inclusive science communication and policy training

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The dominant U.S. cultural norms shape science, technology, engineering, and math (STEM), and in turn, these norms shape science communication, further perpetuating oppressive systems. Despite being a core scientific skill, science communication research and practice lack inclusive training spaces that center marginalized identities. We address this need with a healing-centered counterspace grounded in the key principles of inclusive science communication: ReclaimingSTEM. ReclaimingSTEM is a science communication and science policy training space that centers the experiences, needs, and wants of people from marginalized communities. ReclaimingSTEM problematizes and expands the definitions of “what counts” as science communication. We organize ReclaimingSTEM with intentionality, emphasizing inclusion at every part of the process. Since initiating in 2018, five ReclaimingSTEM workshops have been held in multiple locations, both in-person and virtually, reaching more than 700 participants from all over the globe. In this paper, we share our model for ReclaimingSTEM, reflections of workshop participants and speakers, barriers faced during organizing, and recommendations for creating truly inclusive practices in science communication spaces.

KEYWORDS

science communication, science policy, inclusion, intersectionality, equity, inclusive science, counterspace, healing-centered

Introduction

Science, technology, engineering, and mathematics (STEM) are shaped by the values of the dominant U.S. cultural norms that are Eurocentric, white, masculine, heteronormative, non-disabled, affluent, and neurotypical (Traweek, 1988; Seymour and Hewitt, 1997; Eisenhart and Finkel, 1998; Cobern and Loving, 2001; Johnson, 2001; Medin and Bang, 2014; Nespore, 2014; Atchison and Libarkin, 2016; Chambers, 2017; Finlay et al., 2021). Success in STEM fields privileges these dominant cultural traits,

structural inequities that further marginalize scientists of non-dominant identities (Wilder, 2013; Cech and Pham, 2017; Isler et al., 2021). These STEM cultural norms directly impact science communication as the primary voices across the field are predominantly white, educated, and male (Puritty et al., 2017). The current demographic make-up of science communicators also affects marginalized individuals' science communication efforts, influencing what "counts" as science communication and therefore who can participate (Reich et al., 2010; Dawson, 2014a). This further perpetuates the systems of oppressions within science communication fields (Bonilla-Silva, 2006).

There has been increasing value in science communication and public engagement and, with it, an increase in training programs (Chilvers, 2013; Dudo and Besley, 2016). However, there is a lack of inclusive science communication and policy training spaces (Canfield et al., 2020), and participants from marginalized backgrounds remain largely overlooked and undervalued in science communication (Dawson, 2014b; Feinstein and Meshoulam, 2014; Streicher et al., 2014; Judd and McKinnon, 2021). Furthermore, research shows that marginalized communities living in Western countries experience science communication as Eurocentric and filled with racist stereotypes, recreating the systems that marginalize people (Dawson, 2019). As a result, marginalized groups' involvement in science communication has remained narrow, as they experience exclusion due in part to feelings of powerlessness and cultural imperialism (Dawson, 2018). Recent studies have advocated for radical change within science communication spaces to counter the dominant practices that cause the exclusion of marginalized communities, highlighting a critical need for science communication and policy training that accounts for the historical oppressions, discriminations, and inequities of marginalized communities (Dawson, 2019; Brown et al., 2020; Canfield et al., 2020; Márquez and Porras, 2020; Mignan, 2020; Neeley et al., 2020; Orthia, 2020; Rasekoala and Orthia, 2020; Smith et al., 2020; Finlay et al., 2021; Judd and McKinnon, 2021). Science communication and policy training needs to account for the challenges individuals from marginalized communities face.

ReclaimingSTEM workshops train scientists to situate their science communication efforts at the intersection of research and social justice. By design, ReclaimingSTEM programs decenter whiteness and cisheteronormativity and center marginalized identities instead. This is partly achieved by identifying and inviting trainers and speakers who are from historically marginalized communities. ReclaimingSTEM have been hosted five times since 2018 and have reached over 700 participants internationally. The overwhelming response to these workshops demonstrates the necessity of spaces to discuss diversity, inclusion, justice, and advocacy within science communication training spaces.

In this paper, we present our workshop model for ReclaimingSTEM as an example of an inclusive approach to science communication training. Grounded in healing centered engagement, our framework addresses the key traits of inclusive science communication: intentionality, reciprocity, and reflexivity (Canfield et al., 2020). First, we present our guiding framework for creating and implementing inclusive science communication training. Then, we describe the outcomes and participant reflections on our workshop. Finally, we discuss implications

and recommended practices for creating inclusive science communication spaces.

Positionality statement

This paper arose from an increased need for spaces like ReclaimingSTEM and the desire to share the workshop model. ReclaimingSTEM was organized by the main co-authors (E.V-W, L.A.C, R.N.U, and T.M). Authors E.V-W and R.N.U often faced toxicity in their own STEM spaces based on their identities (E.V-W: hispanic, cis-woman, queer, previously undocumented; R.N.U: biracial, Southeast Asian, non-binary, queer), and science communication became a way to give back to their communities. In designing these workshops, they found community and a brave space.

As E.V-W, L.A.C, R.N.U, T.M, and K.K.T are natural scientists, they sought the outside expertise of N.B, A.M, and S.M, who are in social science fields and/or have expertise in science communication. Collectively, the co-author identities include Asian, Black, Latina, White, cis woman, heterosexual, non-binary, queer, Autistic, disabled, chronically ill, first generation, religious minority, and sexual harassment and assault survivors.

A healing-centered approach to inclusive science communication training

Traditional science communication training models

We define science communication broadly as community engagement about science that includes informal science learning, journalism, and formal science education, through varying methods (art, music, podcasts, media, etc.) (Canfield et al., 2020; Márquez and Porras, 2020; Kearns, 2021; Hernandez, 2022). Scientists are increasingly called upon to engage with public audiences to broaden participation and create a sense of belonging in STEM (Brossard and Scheufele, 2013). While many institutions and organizations have increased science communication training programs in response, these training programs lack racial and ethnic diversity among their trainers and participants (Besley et al., 2018), and training programs often fail to meet the needs of participants (Ecklund et al., 2012; Canfield and Menezes, 2020; Dudo et al., 2021).

Organizers of science communication trainings may not be intentional in their efforts to broaden participation (Besley et al., 2018b) nor in the audiences they aim to engage (Dudo et al., 2021). Moreover, they may not center or implement inclusive approaches (Yuan et al., 2017; Besley et al., 2018a; Canfield and Menezes, 2020; Dudo et al., 2021). Designing science communication training with inclusive practices can promote a sense of belonging for participants who are marginalized in STEM (42). It has been widely documented that bias, harassment, discrimination, and other exclusionary behaviors create especially hostile STEM spaces for people from marginalized backgrounds (Wechsler et al., 2005; Huntoon and Lane, 2007; Miller et al., 2007; Baber et al., 2010;

Atchison and Martinez-Frias, 2012; Mattheis et al., 2019a; Stokes et al., 2019; Berhe et al., 2020; Dutt, 2020). Inequities within STEM spaces prevail along with the cultural norms that are associated with privilege and dominance in society, and when training models lack inclusion, they lack accessibility and lead to explicit exclusion of marginalized identities.

Research continues to document hostile work environments for people from marginalized backgrounds, including scholars who identify as BIPOC, White women, transgender, gender queer, gender non-conforming, religious minorities, academics with disabilities, and foreign born or international (Camacho and Lord, 2011; Davis et al., 2015; Postel, 2015; Atherton et al., 2016; Sian, 2017). For example, scientists who identify as LGBTQIA+ are less likely than their heterosexual counterparts to feel safe or supported in their STEM spaces and do not disclose their sexual identity (Mattheis et al., 2019b), leading LGBTQIA+ scientists to publish less in science (Nelson et al., 2022). Scientists with disabilities are also underrepresented and often also do not disclose their disabilities due to exclusionary practices and ableism (Hawley et al., 2014; Nature editorial, 2021).

Furthermore, science communication currently excludes Indigenous communities and their knowledge due to its focus on Western scientific knowledge (Rigney, 2001; Singh and Major, 2017; Bang et al., 2018).

For science communication to be inclusive, it must be intentional in centering scientists from marginalized backgrounds in STEM programming (Judd and McKinnon, 2021). Without inclusive approaches, training can further perpetuate inequities within science communication fields (Dawson, 2014a; Medin and Bang, 2014; Taylor, 2018; Smith et al., 2020; Finlay et al., 2021) (Figure 1). This can affect who can access these trainings, who feels welcome to those training spaces, and who is included in science communication. Therefore, we must root training in an ethic of inclusion and equity (Canfield et al., 2020).

3.2. ReclaimingSTEM: A healing-centered counterspace approach

The ReclaimingSTEM workshop decenters whiteness and cisheteronormativity. We design the events with a healing-centered framework (Ginwright, 2018) rooted in the key principles of inclusive science communication: intentionality, reciprocity, and reflexivity (Canfield and Menezes, 2020; Canfield et al., 2020) and in doing so we create a counterspace (Figure 1). Counter-spaces are locations where the dominant cultures of STEM are intentionally disrupted (Ong Maria Janet et al., 2018) and offer valuable spaces for marginalized individuals to persist in STEM. Additionally, counterspaces offer a space that promotes the psychological wellbeing of people who are being oppressed (Case and Hunter, 2012).

Racial trauma is often shaped by oppression, racism, and structural violence, and this impacts people of color. Ginwright (2018) writes that trauma-informed approaches can often limit the practitioners' view of individuals through their trauma. Instead, engagement that centers around healing acknowledges that trauma and healing are experienced collectively. Approaching engagement

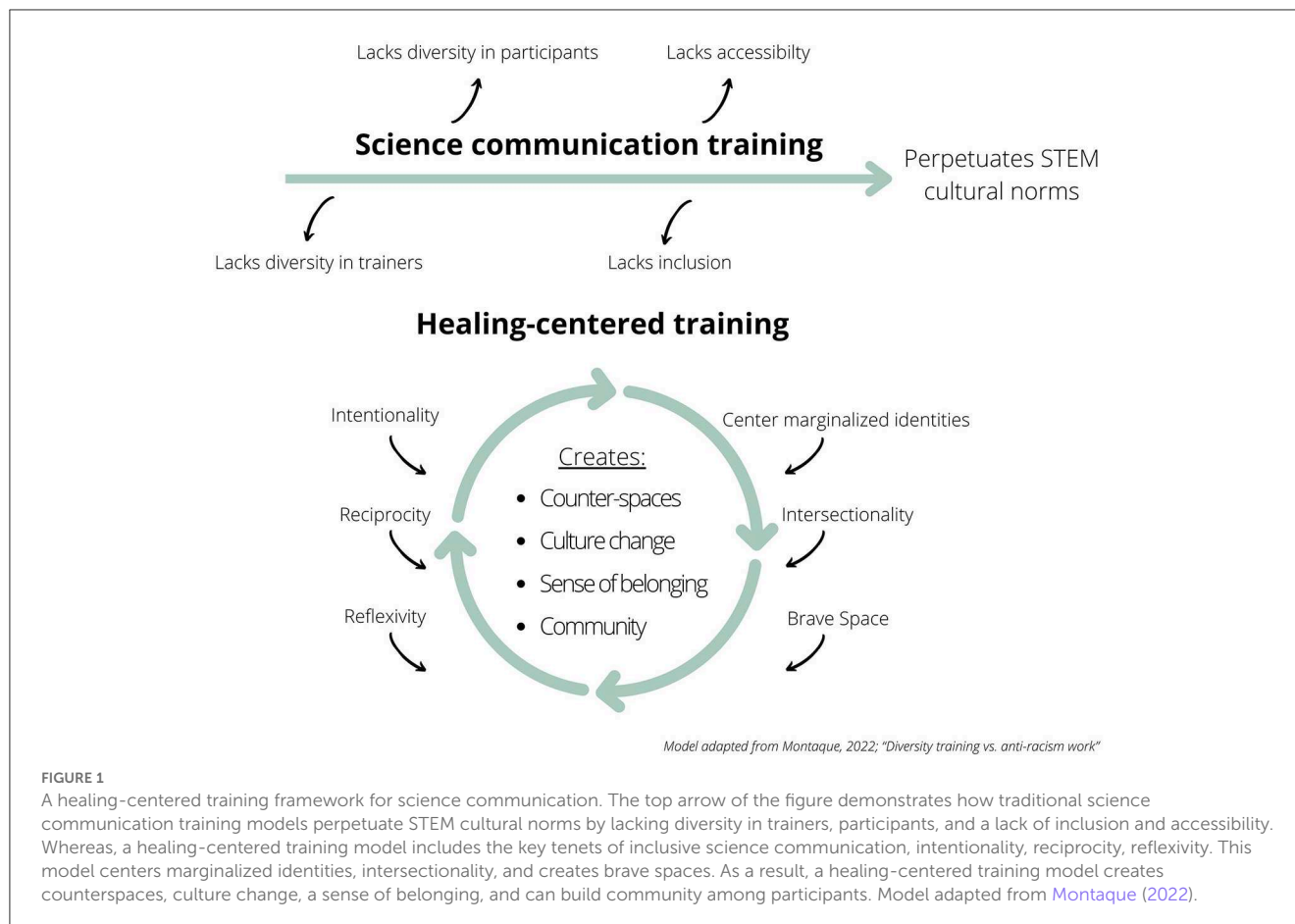
as healing-centered in training practices can offer a more holistic approach to fostering the wellbeing of marginalized participants. Healing-centered engagement starts with empathy, emphasizes collectivity, spirituality, embodiment, and uses radical imagination to intentionally confront racism and racial inequity.

We give speakers the freedom to share their stories. This includes them presenting their own obstacles and experiences navigating STEM. Additionally, topics of conversation have included queer identity, diversity, extra labor by marginalized individuals, social justice, and more. Participants in our workshops share their own stories and experiences with each other, exchanging trauma. We changed our approach after a 2019 ReclaimingSTEM reflection blog piece mentioned "I felt the weight of the diversity problem in STEM, and honestly, I had to step out of the workshop...I was overwhelmed, and sad, and tired. Minority scientists are tired," (Hoefelle, 2019). This piece sparked the realization that we had not created spaces for healing, nor provided the tools to help participants cope. We switched our workshop approach from trauma-inducing to a healing-centered approach. Now, ReclaimingSTEM workshops begin with self-care sessions and allocate time to heal in solidarity. These sessions include coping practices such as meditation, yoga, journaling, and learning to say "no." In switching to a model that centers healing, we build a stronger, more resilient community.

ReclaimingSTEM specifically caters to our key trainee audience: early career scientists who are members of marginalized groups. Our workshop approach accounts for intersectional identities. The key tenets of inclusive science communication, intentionality, reciprocity, and reflexivity (Canfield et al., 2020), are embedded in our workshop design to create effective programming. Intentionality is defined as being deliberate about how marginalized identities are represented and supported. It purposefully names how terms in science communication are defined and considers the audiences scientists aim to engage. Reciprocity is creating equitable relationships that recognize and value the various forms of expertise in science communication. It advances asset-based approaches and ensures benefits are co-created between audiences and communicators, researchers, and practitioners. Lastly, reflexivity is an ongoing, critical, and systematic reflection on the communicators and their audience's personal identities, practices, and outcomes. It is followed by adapting as needed to remedy inequitable interactions.

3.2.1. Centering marginalized identities to create a counterspace

Our workshop aims to address the needs of marginalized communities in science communication spaces. We define marginalized communities as those that have been systematically excluded from the mainstream social, economic, educational, and/or cultural life (Sevelius et al., 2020). These include groups that are excluded based on their sexual orientation, gender identity, race, physical abilities, age, language, and/or immigration status (Sevelius et al., 2020). Power imbalances between social groups can also drive marginalization (Baah et al., 2019). Our workshops were designed by placing marginalized identities and experiences



at the center of our training. Centering marginalized identities and experiences allows ReclaimingSTEM to serve as an identity-affirming “counterspace” (Carter, 2007; Tatum, 2017; Margherio et al., 2020; Isler et al., 2021), a resistance space in which participants can maintain a strong sense of their own intersectional identities while pursuing excellence in science communication, policy, and advocacy.

Our workshop content reaches beyond typical science communication skill-building and includes sessions on identity, community engagement, advocacy, education, and social justice. By centering marginalized identities in the design, our workshop is mindful of the inequities, discrimination, and oppressions faced by our participants. As a “counterspace” (Carter, 2007; Tatum, 2017; Isler et al., 2021), ReclaimingSTEM offers participants a reprieve from the psychological, emotional, and physical stress associated with oppressive environments; it is a space to claim as their own, reducing the alienation and otherness felt in mainstream STEM. ReclaimingSTEM serves to elevate marginalized voices in science communication and provides a brave space to build community among marginalized participants to discuss the challenges faced in STEM fields.

Creating a truly inclusive workshop starts with our leadership team. Composed of people from marginalized identities, ReclaimingSTEM’s leadership stands in contrast to many other science communication organizations, which have low diversity in their leadership (Dudo et al., 2021). The diverse

leadership of ReclaimingSTEM not only resists the racialization of organizations but also interrupts and resists the reproduction of social inequity (Ray, 2019). Because our leadership is representative of marginalized identities, we can ensure we broaden our reach of our participants and can account for marginalized perspectives in the yearly trainings we design.

For ReclaimingSTEM, we seek speakers and trainers who are from marginalized backgrounds, which enables participants to envision themselves and want to engage, in science communication spaces (Baram-Tsabari and Lewenstein, 2017). This practice increases representation of who can do science communication and demonstrates the variety of forms that science communication can take. We also remove barriers to participation for both speakers and participants through free attendance, providing meals (when in-person), providing ASL and captioning services while in-person and online, and compensating speakers for the time and energy required to share their experiences in our workshops.

3.2.2. Embracing intersectionality

ReclaimingSTEM intentionally addresses the intersectionality of the participants. The term intersectionality is a theory that helps to understand how identities are developed, enacted, understood, and marginalized or privileged in an existing social structure (Crenshaw, 2013). The workshop design considers that participants each have individual characteristics, such as sexual orientation,

gender, race, physical abilities, and socioeconomic status that can overlap with one another, and this can generate complex inequities as our participants navigate STEM spaces (Collins, 2015).

Our applications ask participants, “What groups do you self-identify with?” This question is left as an open-ended question, leading participants to share more identities than one could assess with predefined categories or check boxes. Having participants self-identify rather than using conventional categories allows for a multidimensional and intersectional view of individuals; rather than the flattening and invisibilizing effects that historical census-based survey items confer (Irizarry, 2015; López et al., 2018). Most of our participants are Black, Latinx, LGBTQIA+, first generation students, disabled, and women, along with many other identities. Based on this information, we make sure to include workshops that address themes such as navigating STEM spaces, exploring identity and intersectionality, and topics on self-care.

3.2.3. Brave spaces challenge the cultural norms

Safe spaces are typically used in higher education settings with the intention to create an “environment in which students are willing and able to participate and honestly struggle with challenging issues” (Holley and Steiner, 2005, p. 49), but these spaces can suffer from “happy diversity” discourse that conceptualizes diversity abstractly without connecting it to inequity or power (Bell and Hartmann, 2007). Safe spaces are intended for discussions that are free from risk, danger, harm, controversy, and other difficulties. Arao and Clemens (2013) argue the term “safe” is problematic, as it is not possible to remove the risk from engaging in controversial issues (p. 136). They further explain that saying safe space is misleading and can be counterproductive (p. 140).

Prior to the workshops, we inform our participants of the expectations in our time and space together, including a code of conduct. We also inform our speakers and participants of the various identities and demographics in the space we share. We repeat this at the start of each workshop to set the tone and intention of the workshops, as this will be spaces where a lot of feelings will be shared. We do this with the intention to create brave spaces. When facilitating spaces on topics of social justice and advocacy, participants need to feel they can authentically engage with gender, cis/binary privilege, heteronormative power, and oppression (Flensner and Von der Lippe, 2019), emphasizing the need for brave spaces. Brave spaces are places that emphasize braveness—the courage to take risks for change and sets the tone for engagement (Arao and Clemens, 2013). Brave spaces in our workshops create a challenging environment where there is equal participation across representative identities. In these spaces, discomfort and controversy are welcomed to enact change toward a more inclusive culture (Arao and Clemens, 2013).

Participant recruitment and demographics

ReclaimingSTEM has been hosted five times since 2018. Years 2018 and 2019 were in-person hosted on the west and/or

east coasts, while years 2020 and 2021 were virtual via Zoom. We advertised the workshops as science communication and policy training at the intersection of social justice. We explicitly say “our workshops are open to scientists with diverse backgrounds, preferably those from under-represented groups (including BIPOCs, first generation, minorities, women, LGBTQIA+, people with disabilities, etc.). This event is FREE and includes instruction from amazing diverse speakers!” We also describe our various tracks available for workshops, including science communication (writing, podcast, etc.), science policy (with a subgroup focused on elections, education reform, etc.), social justice (advocacy movements, pushing for change, etc.), and education (tips from academic reform work, etc.).

The workshops hosted on the West coast were held at the University of California Irvine (UCI), over the course of a single day. The 1-day workshop on the East coast was hosted at the University of New Hampshire (UNH). The virtual workshops were hosted over the course of 3–4 Saturdays, lasting 3 h each day. In total, we have had over 700 participants for the workshop over the past 5 years. We have reached our participants through Twitter advertisements, announcing our workshop as a place where science communication merges with social justice. Our application is completed via Google Forms, with short answer questions. We also email advertisements through listservs with our collaborators or sponsors, but most participants indicated applying via Twitter advertisements.

Our application questions are as follows:

- Level of education
- What groups do you identify with?
- How would the ReclaimingSTEM experience benefit your career? Reflect on your current level of experience in communicating science.
- How does your identity influence and impact your science and communication style?

Of 712 participants, the majority of our participants were students: 348 Ph.D. students, 109 undergraduate students, and 88 master’s students. The remainder were postdoctoral scholars, faculty, or participants from industry settings. Regarding participant identity, the majority included intersectional identities that included Black, Latinx, LGBTQIA+, first generation students, disabled, and women.

Following the workshops, we asked participants and speakers to share their experiences in a feedback survey via Google Forms. We provide the respondents 2 weeks to offer their reflections. This paper presents the workshop model and provides reflections based on their written responses to the application form and feedback survey. For ethical review, this study was determined exempt under the UCI Exempt Self-Determination Tool obtained from the IRB department. As part of using the Exempt Self-Determination Tool, the lead researchers provided their assurance that they followed relevant Human Research Protection Program policies and procedures, among other criteria. Written informed consent

was obtained from the participants for the publication of this case report.

ReclaimingSTEM workshops in action

This first 2018 workshop was a 1-day event. A keynote speaker opened the day by discussing their position in academia and how they advocate for social justice. Our next sessions during the day broke into two skill-building tracks: science communication or science policy. The workshops included topics such as “How to build your brand,” “How to write an op-ed,” and “How to make engaging STEM presentations,” “Science policy and advocacy,” and “How to contact policy makers.” This was followed by a panel that included a range of speakers who shared their experiences fighting for social justice through forming non-profits, working in industry and academia, or starting marginalized-focused organizations on campus. We closed with a keynote speaker who addressed intersectionality and approaching STEM spaces unapologetically. Every speaker spoke about their identities and navigating STEM spaces. This aspect of the workshop became the key to future workshops, as we realized there was an immense need to center topics of identity, intersectionality, and navigate STEM fields unapologetically.

In 2019, we expanded our reach, hosting in-person, 1-day workshops on the east and west coasts. For these workshops, we brought back skills building workshops. However, we started the day with keynote speakers and conversations highlighting topics such as intersectionality, queer identity, the extra labor of marginalized scientists, and diversity in academia. These workshops were aimed at teaching scientists to be unapologetic about their identities and to use their identity as a source of strength in their science communication and policy work.

In 2020 and 2021, with the transition to a virtual format due to the global coronavirus pandemic, we adapted our content to an online platform while staying true to our core values of equity and inclusion. We chose a format everyone could have free access to (Zoom) and ensured accessibility online. We refused to use auto-captioning systems as they can be inconsistent and unreliable (Képuska and Bohouta, 2017). Therefore, our budget accounted for hiring live captioners and ASL interpreters and providing transcripts following our workshops (University Information Technology Services., 2022).

To avoid Zoom fatigue, we split up our virtual training over the course of four Saturdays in 2020 and three Saturdays in 2021. We chose Saturday as most of our participants have either full time class or work schedules during the regular workweek. Each day began with a self-care session and included main keynote sessions that addressed key conversations on topics of being disabled, Native, and Black in STEM. We also had workshops for four breakout tracks: advocacy, education, science communication, and policy.

Our online event was able to expand our reach to new audiences, leading to more participants who were not able to attend our workshop before. For the first time, ReclaimingSTEM was able to reach international participants and include international speakers. Additionally, we saw an increase in participants from these backgrounds, suggesting that the virtual format was more accessible for caregivers and disabled participants. We suspect this

is due to increased access via a virtual format, and the day of the week our workshops are held. We also created a community by engaging participants on Slack and hosting coffee hours in between workshops. These considerations are critical as we can move toward always providing hybrid attendance options to increase accessibility of events.

Participant reflections and responses

Our workshops merge identities and lived experiences in a way that addresses participants’ goals; they simultaneously aim to improve science communication skills, increase representation in STEM, and reach diverse audiences with their communication efforts. Many applicants want to reach beyond general knowledge-sharing in science communication, they want to change the meaning of who belongs and feels included in STEM. While mainstream science communication continues to rely on the deficit model (one-way knowledge sharing that assumes a lack of information on the part of the audience), this is often at the expense of more diverse and effective approaches (e.g., relational communication) (Simis et al., 2016; Dudo et al., 2021).

The responses from ReclaimingSTEM participants suggest that diversifying who participates in and what counts as science communication may be a key route to richer forms of science-society interactions. One applicant in 2020 wrote, “Having an invisible disability has often made me feel like I don’t belong, like I’m incapable, and like I’m way behind my peers...I don’t have any experience in science communication, but if I could get involved in it and impact even a single person’s perception about how they view their disability, or their ethnicity, or their socioeconomic status in relation to STEM and academia, that would be so rewarding.”

Our speakers are integral to our workshop model design. As they are also from marginalized backgrounds themselves, we take care not to tokenize them. We ensure our speakers are paid for their labor and encourage them to speak on a topic of their choice. In our invitations we write “this is your platform to lead the session in any way you’d like, any format. There is no need for filters or code-switching.” Code-switching is a concept that describes changes in speech, manner, or appearance by an individual adjusting to the norms of a dominant culture; while many people code-switch, for BIPOC scientists it can be a mandatory coping strategy to protect oneself from oppression (Dickens et al., 2019). This can sometimes leave speakers feeling nervous, and they often ask us for guidance. We reassure them that they are experts on their topics and their stories. This is their chance to have a platform to teach a workshop or lead a talk in any way they wish.

After the 2021 workshop, one speaker reflected: “Even though I tend to present myself consistently across all spaces, I usually feel varying degrees of anxious activation when speaking from my heart in spaces that I know are not going to hold my heart with respect and kindness. While presenting at ReclaimingSTEM, I felt more comfortable than I ever have, knowing that my WHOLE self was not only accepted, but requested! I was able to share my expertise... completely openly, and without fear/expectation of being received with criticism and disrespect. This made everything easier: coming up with a title, deciding what content to share, preparing slides, even getting dressed for the event was easier,

because I didn't have to fight through a fog of anxiety and white expectations."

Inviting speakers in this way not only brings about unique content but allows speakers to bring their authentic full selves into these spaces. ReclaimingSTEM intentionally acknowledges sources of community cultural wealth (Yosso, 2016), rather than privileging traditionally revered forms of capital. In these ways, the ReclaimingSTEM counterspace invites participants to affirm their intersectional identities, especially those that are perceived negatively or stereotyped in mainstream STEM spaces. Participants can be their authentic selves, drop code-switching behaviors, and embrace style, speech, behavior, and ways of thinking that perform and reclaim their intersectional identities (Carter, 2007; Tatum, 2017; Margherio et al., 2020; Isler et al., 2021).

Finding and building community

ReclaimingSTEM may be the first-time marginalized participants are in community with each other. Speakers who bring their whole-selves can influence how participants see and envision themselves in science communication spaces. One 2018 participant reflected, "The WokeSTEM presentation had the greatest impact because I had never seen a Black scientist present their science in a raw manner that didn't censor their identity."

Many participants have mentioned feeling excluded in STEM spaces and aimed to find a community with "like-minded people." ReclaimingSTEM addresses the participants' desire to mobilize and build community. This notion is often not rewarded in STEM spaces, as social justice or science communication activities often do not count as academic. ReclaimingSTEM brings participants together in ways that are novel for them and that build solidarity. Rather than asking participants to assimilate to the dominant STEM culture, ReclaimingSTEM encourages the development of critical consciousness that challenges conformity and embraces authentic expressions of intersectional identity (Solórzano and Delgado Bernal, 2001).

We also design our space to include time to have participants connect, network, and collaborate. Therefore, our workshop is designed with awareness of participants' lived experiences (Banks et al., 2007; Hernández-Saca et al., 2018; Calabrese Barton and Tan, 2019). When asked "What was the most memorable thing you learned or best piece of advice from ReclaimingSTEM?", one participant wrote: "I learned that the feeling I have always had in my heart, that academia is stacked against anyone who is different, is actually true. I affirmed my own feeling of not belonging. I think the best advice to tackle this is to make my non-conformity look intentional."

Additionally, bringing together diverse backgrounds and experiences creates and encourages innovative ways to communicate science and reach new audiences that have been historically excluded (Cheng et al., 2018). A 2021 participant reflected, "The most memorable thing I've learned...is that we have the power to reimagine STEM if we decide to come together so that

we can achieve the belonging, purpose, and joy in our STEM journey."

Barriers to organizing inclusive science communication training spaces

Funding was our main barrier in building this workshop. As this effort was led by graduate students, it was limited to small grants from organizations or school departments, which often came with spending limitations. This constraint made it especially difficult to pay speakers, who are central to the workshop design. Institutional rules on spending significantly limited options and ultimately led to our decision to register as a public non-profit. Furthermore, the spaces we could reserve to host workshops were at universities, which can cause or recall trauma. Hosting in-person workshops also limited who could access our workshops if they could not travel or had other accommodation needs.

Additionally, work outside of STEM research is generally frowned upon. We faced push back from those in positions of power who did not view this work as important. This work must be more supported, encouraged, and championed among STEM spaces, especially when done by students from marginalized communities and often by providing free labor.

Discussion

Science communication trainers and organizers have a compelling position: they have the power to influence and change the environment that currently exists in STEM. Often, this burden is primarily felt and taken on by marginalized scientists. We recommend that this burden be shared, as the STEM community as a whole should aim to change the culture of STEM. Additionally, as science communication spaces are often a reflection of STEM spaces, training spaces should examine their own cultures and assess whether they are fostering belonging as more marginalized scientists are seeking training in their programs.

We are often asked how we can recommend that other spaces create inclusive practices. There is no simple procedure that will create an inclusive space. While a counterspace can provide some reprieve from the hostile STEM environments that participants face on a daily basis, counterspaces alone will not be able to change the culture of STEM spaces. Creating inclusive STEM spaces requires systemic restructuring and moving beyond a checklist of actions. This means starting with uncomfortable self-reflection about the ways in which organizations and individuals may be continuing to reproduce social inequities. This often means taking into account the complex historical context for systemic racism in STEM spaces and the ways in which it continues to harm people from marginalized backgrounds (National Academies of Sciences, 2023).

We recommend placing a strong emphasis on supporting existing programs led and/or conceived by people from marginalized communities. Doing so will help to change the culture of STEM spaces and help to promote equity and inclusion of marginalized communities in STEM and beyond.

Inclusion begins with leadership, and no space will feel welcoming if there is a strong history of oppression, exclusion, or marginalization. We suggest organizations begin with restructuring their leadership, mission, vision, and values. We recommend organizations first reflect on their own leadership and practices: Who are you? What do you represent? What is your organization's history? Identify aspects that can be changed to create intentional inclusion at every level of the organization. It is important to note that inclusion practices require extensive, ongoing, and recursive reflections and actions. We recommend the work of Callwood et al. (2022) in which the authors call out that racism remains a root cause of underrepresentation across STEM and contributes to a lack of diversity in science communication. The underrepresentation affects the types of science stories that are told and the communities science communicators seek to engage. The paper also identifies reflection questions that could be useful for trainers and organizers (Callwood et al., 2022).

To radically change science communication training spaces and increase participation of marginalized communicators, intentional organizing is vital. Starting with organizational leadership and values all the way to facilitating the space, it is imperative that inclusive practices are interwoven throughout every part of the organizing process. Treating inclusion as an afterthought is detrimental. By centering inclusive practices, ReclaimingSTEM serves as a valuable and authentic model for inclusive science communication and policy training.

Data availability statement

The datasets presented in this article are not readily available because data contains sensitive information that would require IRB approval to share. Requests to access the datasets should be directed to Evelyn Valdez-Ward, evaldezward@uri.edu.

Ethics statement

Ethical approval was not provided for this study on human participants because, this study was determined exempt under the UCI Exempt Self-Determination Tool obtained from the IRB department. As part of using the Exempt Self-Determination Tool, the lead researchers provided their assurance that they followed relevant Human Research Protection Program policies and procedures, among other criteria. The patients/participants provided their written informed consent to participate in this study.

Author contributions

EV-W was the main author of the manuscript. EV-W and LC originally founded ReclaimingSTEM and developed the model. LC, RU, and TM aided in creating the workshop and collecting survey data. EV-W, LC, TM, and RU procured

funding for and organized ReclaimingSTEM events. RU provided substantive edits throughout the entire process. NB, SM, AM, and KT provided important feedback, ideas, and edits that contributed to the final product of this paper. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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