Perspective

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Moving towards More Diverse and Welcoming Conference Spaces: Data-Driven Perspectives from Biology Education Research Scholars

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Academic conferences are integral to the dissemination of novel research findings and discussion of pioneering ideas across all postsecondary disciplines. For some participants, these environments are spaces to develop new collaborations, research projects, and social bonds; however, for others, conferences can be a place of marginalization and outright hostility. To assess how diverse individuals experience conference spaces, we interpreted results from a conference climate survey filled out by 198 of 482 registrants of the Society for the Advancement of Biology Education Research (SABER) West 2021 conference. Analysis of the survey data was conducted by six biology education researchers, who in addition to raising conference participant voices, provide insights, and next steps whose implementation can promote greater participant equity, representation, and engagement in future science, technology, engineering, and math (STEM) education conferences specifically and potentially all academic conference spaces more broadly.

KEYWORDS conference climate, DBER, SABER

PERSPECTIVE

The interdisciplinary field of discipline-based education research (DBER) combines the expertise of scientists with methods and theories to explain learning processes. Researchers of this field seek to understand how people learn the concepts and practices found in science. These approaches include the development and assessment of approaches that promote student academic success and broadening participation while contributing to a field of knowledge that translates DBER findings to classroom practices (1). Given that DBER is rooted in traditional science, technology, engineering, and math (STEM) disciplines, collaboration among researchers, professional development opportunities, and dissemination of novel findings most commonly occur through traditional structures, including education and/or scientific conferences.

The disciplinary-specific Society for the Advancement of Biology Education Research (SABER) was founded in 2010 with the mission to improve postsecondary biology education.

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In 2017, a group of SABER members established a regional meeting, SABER West, to be hosted annually at the University of California, Irvine. While sharing similar aims with the broader research-focused society, the SABER West conference was created with both discipline-based education researchers and biology educators in mind. The meeting goals included:

1. Increasing interactions among STEM educators and education researchers.
2. Fostering collaborations between 2-year and 4-year institutions.
3. Providing professional development enabling participants to conduct education research and implement evidence-based instructional practices.

These goals were formulated to specifically address a number of issues in biology education research (BER) that had been highlighted in the literature (2–5) as well as to provide anecdotal feedback that the SABER West organizers were aware of from our roles as faculty members, members of the BER community, and members of biology-specific disciplinary societies.

While inclusion has always been a central element of the SABER West conference, the exacerbation of inequities brought upon by the pandemic and the clear need for higher education to reevaluate its anti-Black, anti-Indigenous, and anti-Persons of Color (BIPOC) policies considering the killings of Black Americans, led SABER West organizers to recognize the need to make diversity, equity, and inclusion (DEI) more explicit. As such, the meeting goals now included:

4. Creating an inclusive and welcoming conference space that fosters the growth of attendees as STEM educators and education researchers.

Although promotion of academic success of diverse individuals is a central focus of DBER efforts, whether the SABER West conference, and conference environments more broadly, are inclusive and welcoming of diverse individuals remains to be characterized. In what follows, we present the challenge faced by STEM fields in promoting diversity, summarize evidence gathered from SABER West attendees through a preconference survey, and recommend approaches that could promote greater inclusivity in conference spaces.

THE NEED FOR DIVERSITY AND INCLUSION AT STEM CONFERENCES

DEI topics have been surging in conversations within STEM fields over the last 3 decades (6). Organizations and educational institutions have focused energies and finances on the recruitment and retention of students of color at both the undergraduate and graduate levels (7), yet we still see that white professionals are overrepresented in STEM fields. According to a recent National Science Foundation 2019 report (https://ncses.nsf.gov/pubs/nsf19304/digest/field-of-degree-women-men-and-racial-and-ethnic-groups), minoritized students (which we define as Latinx, Black, and Indigenous populations) represented only 21.6% of all bachelor's degrees, 13.2% of all master's degrees, and 8.8% of all doctoral degrees attained in 2016 (https://data.census.gov/cedsci/table?d=ACS%205-Year%20Estimates%20Data%20Profiles&tid=ACSDP5Y2016.DP0). In contrast, according to the 2016 census, minoritized people made up nearly 48% of the U.S. population.

Considerable evidence has highlighted institutional barriers and "chilly" STEM climates as causes for the attrition of individuals from the professional realm, including a wide array of racist, sexist, homophobic, and ableist policies as well as cultural norms that create STEM spaces that are unwelcoming to minoritized groups (8–10). These policies and norms keep BIPOC people, people with disabilities, lesbian, gay, bisexual, transgender, queer, and others (LGBTQ+) people, and people with intersectional identities (11) out of academic spaces. Of all full-time faculty in degree-granting institutions, when data are disaggregated by race and gender only, Black or Latinx males and females each comprise 3% of the professoriate, Asian or Pacific Islander faculty represent 7% male and 5% of female faculty, and American Indian or those who identify with two or more races make up less than 1% of full-time faculty, while 40% and 35% of faculty identify as White males and females, respectively (12). Not surprisingly, this is mirrored at STEM education conferences, where we see an overrepresentation of white participants and underrepresentation of all other demographics. Prior work has identified issues that are prevalent in STEM academic conferences broadly, including a lack of diversity in the conference speaker and conference organizer populations, issues with conference accessibility, and a lack of programming aimed at creating more inclusivity in that particular science field, among other barriers to conference inclusion (13–15). Our work aims to add to the existing literature by focusing specifically on the STEM education conference experience through the lens of the attendees of such events.

SABER WEST 2021

Considering the goal to create a more inclusive environment, the SABER West 2021 meeting aimed to examine STEM education conferences as spaces of marginalization and exclusion. This goal is particularly salient, as much of the field's research is focused on promoting inclusion in biology classrooms or laboratories (4, 16). SABER West's opening event, the town hall meeting titled, "Steps Towards a More Inclusive Conference Experience for All: a Community-Sourced Panel Discussion" was intended to initiate a dialogue to inform our community's insight into the current experiences of STEM education conference attendees.

To inform the town hall discussion, SABER West 2021 registrants were asked to complete a climate survey that incorporated Likert scale and free-response items from published instruments, centered on interrogating conference attendee experience. The preconference survey emphasized participants' general thoughts on STEM education conferences and included items about travel and family logistics or cost barriers, as well as participant

experiences of disrespect, bias, discrimination, or racism while attending conferences (17–19) (the survey instrument is included in the supplemental material). The survey was completed by 198 of the 482 SABER West 2021 registrants. There was broad representation of students, staff, and faculty from 2-year and 4-year primarily undergraduate and research institutions. The majority of respondents were biologists (76%), identify as female (79%), and were White (69%), with approximately 20% of individuals identifying as part of the LGBTQ+ community. Because we did not collect demographic information from all conference attendees, it is not possible to determine whether our survey respondent sample was representative of conference attendees as a whole. As such, our review of survey responses and corresponding recommendations may not reflect all attendees' perspectives.

TOWN HALL

The anonymized survey responses were reviewed by recruited STEM educators and education researchers who served as panelists at the opening SABER West 2021 town hall. These panelists live across the United States, vary in academic role (graduate students and faculty), work at a variety of institution types (community college, primarily undergraduate institutions, and research-intensive universities), and represent a diversity of communities (various ethnic and racial backgrounds, different gender identities and sexualities, persons with disability, and immigrants). Panelists reviewed the survey responses to identify themes in participant experiences ranging from marginalization or racist episodes to common barriers preventing STEM education conference participation. After survey distribution but prior to the town hall, panelists analyzed survey responses and were subsequently convened synchronously to discuss multiple relevant themes that they had identified. Through multiple discussions, each panelist selected a particular theme of the many identified that they would then present at the town hall, ensuring that distinct, although potentially overlapping, concerns among conference attendees were presented. It is important to note that survey respondent feedback was diverse and rich such that only a subset of the themes identified were presented. During the town hall, panelists importantly acknowledged that the purpose of the event was to center minoritized voices and broaden awareness about barriers and discrimination faced at conferences. Below are the major themes and challenges that the panelists discussed during the opening town hall.

Intentional inclusivity at STEM and STEM education conferences: Paloma Vargas, San Diego Mesa College

Paloma Vargas noted a lack of intentional efforts by conferences to create inclusive and equitable spaces, highlighting that 84% of survey participants had observed or experienced discriminatory behavior at STEM education conferences. She also highlighted the need for greater cultural awareness and antibias practices by conference participants, the lack of dedicated safe or brave spaces for minoritized communities to come together, and a lack of accessible spaces for people with disabilities.

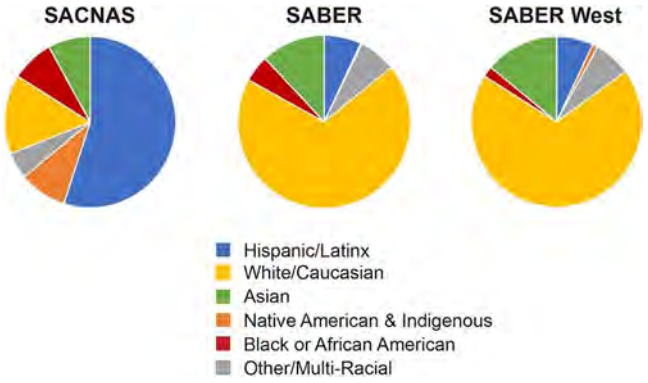

FIG 1. Racial demographics of SACNAS 2020, SABER 2020, and SABER West 2021 conference attendees.

These points were made in contrast with events hosted by organizations such as the Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS), that strives to "achieve true diversity in STEM" which are nonwhite spaces where BIPOC support is available (https://www.sacnas.org/who-we-are/). Vargas noted that in 2020, SACNAS attendees identified as 8% African American or Black, 8% Asian or Asian American, 56% Hispanic or Latina/o/x, 9% Native American and Indigenous, 5% other or multiracial, 15% White or Caucasian (https://www.sacnas.org/hubfs/Document%20Files%20(pdf,%20doc,%20xslx)/SACNAS_2020.pdf). A postmeeting analysis highlighted the contrast with the SABER 2020 annual conference and SABER West 2021 conference attendee demographics (Fig. 1) (http://saberbio.wildapricot.org/resources/Documents/2020%20meeting/SABER%202020%20Post%20Meeting%20Report.pdf).

The importance of fostering conference participant diversity is particularly relevant as demographics of students in higher education have shifted in recent years. In 2018, 39.8% of all STEM degrees and certificates were awarded to minoritized students (Black, Latinx, Asian or Pacific Islander, or two or more races), a 10% increase from 2008 (20). With projected growth of these populations and the increase in federally recognized minority-serving institutions (>700) such as Hispanic-serving institutions (HSIs; 559 designated, 393 emerging), 102 historically Black colleges and universities (HBCUs), and 35 tribal colleges and universities (TCUs), it is clear that 2- and 4-year institutions will continue to diversify (21, 22). The changes in demographics provide the perfect opportunity for STEM education organizations, conferences, and spaces to become more deliberately inclusive of the incoming wave of young scientists, educators, and researchers from minoritized communities.

Vargas highlighted particular survey responses to the prompt asking what factors are necessary to create an inclusive STEM education conference environment:

> "There needs to be an inclusion (not simply representation) of researchers and practitioners of color to ensure that their research, informed by their lived experiences, can be part of

the conversation in the STEM Ed field. This means that people of color are present and their ideas heard at every level of the conference (posters, paper presentation, plenary speakers, etc.). There also needs to be an inclusion of ideas at conferences. Diversity of methods, theory, and the embrace of criticality, particularly critical theories of identity (race, gender, sexuality, etc.). Openness to drawing on existing research from other disciplines will help with this process."

Lack of institutional inclusion at conferences: Luanna Prevost, University of South Florida

The next town hall panelist, Luanna Prevost, spoke of the lack of inclusion of faculty, researchers, and instructors from 2-year colleges at STEM education conferences. While less frequently mentioned, many of the concerns brought forward apply to a diversity of institutions, including 4-year primarily undergraduate institutions, HBCUs, HSIs, and TCUs. She reported how respondents identified a lack of representation of individuals from 2-year institutions at conferences and that only 16% of respondents to the SABER West surveys were from 2-year institutions, compared to the 77% of meeting attendees from 4-year institutions. Prevost highlighted a relevant quote from a survey respondent:

"There have been situations where it seems like community college education research has been given a token nod or as an accessory to R1 university education research instead of being put in the same spotlight as education research from a university."

This and other comments revealed to Prevost that STEM education conferences reflect and reinforce hierarchies that are systematic in academia, and she stressed that the knowledge and experiences from faculty at 2-year institutions need to be valued and included in STEM education research for this work to be broadly applicable.

Barriers to STEM education conference attendance: James Cooke, University of California, San Diego

The theme that James Cooke highlighted was barriers, in particular the logistical barriers to conference attendance, including cost and timing. One of the most common refrains from the survey responses was cost, including cost of registration (mentioned by 67% of respondents) and cost of travel (74% of respondents), as being influential in determining whether one could attend a STEM education conference. This was summarized by the following statement:

"Cost of conferences can be an enormous barrier for those of us coming from less well-funded schools, so paying for people to come might be beneficial."

Cooke recommended reducing the cost barrier by having a university host a conference in lieu of a large conference center, providing scholarships or travel awards to cover meeting costs, and allowing for portions of the conference to be held remotely.

Another barrier discussed by Cooke was that of time, in that many respondents reported an inability to attend conferences that occur during normal academic semesters (including the summer). The duration of the conference was also mentioned as being a factor, with respondents suggesting that they cannot be away from home for extended periods of time because of the associated costs: substitutes to teach courses, colleagues to handle research and other campus duties, and caregivers for children or pets, among other concerns. A final consideration he discussed was the timing of conference announcements and deadlines for registration and abstract submission. Respondents mentioned that if deadlines are too close to the conference itself, it prohibits them from being able to secure permission (or funding) to get time away:

"The timing of when conferences are announced and papers/presentations accepted; if it's too close to the conference, I typically can't get everything approved to go (time off and [substitute instructors] in my courses)."

Accessibility of conference venues: Logan Gin, Arizona State University

"All sessions should be fully accessible to persons with disabilities—closed captioning, signing, enough room to navigate between sessions, posters at heights visible for all."

A theme that Logan Gin recognized was the lack of accessibility for attendees with disabilities at conference venues. He noted that the traditional academic conference space has not been designed with individuals with disabilities in mind, and the logistics of conference programming has the potential to introduce barriers to attendees with disabilities. Reinforcing this idea, over 5% of survey participants highlighted issues with the lack of transition time between talks and presentations that often cover multiple floors within a conference venue. Explicitly, respondents mentioned instances where there was inadequate signage for the location of elevators, the elevator route being too far away from the rest of the other sessions, or even conference organizers specifically instructing conference attendees not to use the elevators, only reinforcing ableist structures and stigmatizing those with both apparent and nonapparent disabilities. Gin recommended providing more transition time between talks and sessions as a simple solution for allowing everyone to attend the events of their choosing. Another example he highlighted from survey respondents was the accessibility challenges of attending a poster session, happy hour, or a banquet dinner. These often occur in places where the rooms are crowded with many people engaged in conversation in close proximity. He also highlighted responses noting very little time or space at a conference for downtime, quiet time, or resting. By creating more time and space for attendees' accessibility needs, this could allow for an attendee with a disability to engage as they wish at a given conference.

TABLE 1
Themes and suggestions to promote more diverse and welcoming STEM education conferences

Theme	Suggestions
1. Adopt and adapt approaches that promote inclusion while continuing to collect data	• Learn from other societies that have demonstrable success in promoting inclusion and diversity, e.g., SACNAS has deliberately and consistently hosted BIPOC individuals as keynote speakers, conducted outreach to local indigenous communities where conferences are held, intentionally cultivated spaces for indigenous and LGBTQ+ communities (such as receptions and affinity rooms), and selected panels and professional development speakers and sessions that focus on uplifting the voices of and supporting BIPOC individuals. • Improving conference climates will be an iterative process with both successes and failures. Continue to collect feedback from your attendees to identify steps that still need to be taken, and be honest with them that while you are working towards an end goal, there may be bumps in the road.
2. Provide access to virtual audiences	• Offer online conference options to broaden participation; 70% of SABER West attendees strongly agreed with the statement, "I believe that remote conferences are more inclusive than in-person STEM education conferences." • Virtual participation provides a means for individuals who cannot attend a conference for a variety of reasons to still gain from the experience. While a hybrid conference presents a number of financial and logistical challenges, there are small steps that can be taken including recording talks and uploading posters or live streaming main sessions and allowing for virtual attendees to ask questions through a chat function.
3. Prioritize structures that lower attendee financial and personal costs for conference attendance	• The timing of the conference can be a key factor in whether an individual can attend. For example, those with a heavy teaching load may only be able to attend conferences on weekends or between academic terms. Scheduling a conference over two full days vs one full day and a half day on either end could reduce the hotel stay by 1 day. • Minimize costs where possible. Meals set up for the conference are often less expensive as opposed to asking individuals to purchase their food individually. Identify where your attendees are likely to come from, and make sure the meeting space is convenient to them (and not just you as the organizer) to minimize transportation costs.
4. Consider accessibility for attendees with disabilities	• In terms of physical layout of the conference space, it is important that rooms are near each other (or there are transportation arrangements if this is not possible), are accessible (elevator access, wheelchair ramps), and that there is sufficient time to travel to spaces in between activities. • Organizers can remind presenters to use a microphone and format their slides with color schemes that are accessible for color blind audience members. It is also the responsibility of organizers to incorporate American Sign Language interpreters or closed captioning, at minimum for the larger sessions.
5. Accommodate for mental health	• Recognize that conferences are very demanding experiences, especially for those hailing from minoritized backgrounds. Consider limiting the number of events that are back-to-back, enabling the incorporation of down time into the schedule, have available a "quiet room" for attendees to decompress at their leisure, and strive to create a welcoming environment

Deficit thinking at STEM education conferences: Sumitra Tatapudy, University of California San Francisco

A theme noted by doctoral candidate Sumitra Tatapudy in 13% of the attendees' survey responses was the need for a shift from deficit-minded approaches to a more strengths and assets-minded approach during presentations and discussions. She began her portion of the town hall discussion by defining deficit thinking, as referring to the implicit and explicit assumptions made about a student's motivation, ability, or aptitude, which results in

an emphasis on "fixing" students and perpetuates a culture of assimilation in learning (23, 24). She noted that a deficit-focused approach holds individuals from historically minoritized populations responsible for the challenges and inequities faced, rather than emphasizing the systemic, institutional, or socio-economic inequities responsible for the challenges encountered. Consistent with this idea, one of the survey respondents shared the following:

> "[Conference research] presentations seemed to talk about underrepresented minorities in a deficit/assimilation mode (e.g., assessing how students can better learn the right way to talk about mitosis versus do students see themselves in the scientific community and feel like they belong)."

Tatapudy reported that multiple survey respondents noted the use of a deficit-focused approach in science education research presentations and the use of deficit-language during postpresentation questions and remarks. Another survey respondent witnessed: "subtle discriminatory/microaggressive comments about presenters of color describing their presentations as 'not well thought out' or 'not as good as. . .' in comparison to a similar presentation by a white colleague." Tatapudy noted that deficit and discriminatory language used as part of "constructive criticism" and normative comparisons to predominantly white standards of conceptualization and articulation in education and training promoted deficit-mindedness.

Mental health of conference attendees and community: Mays Imad, Pima Community College

Mays Imad closed the town hall discussion by highlighting survey responses related to mental health, psychological traumas, and hidden disability explicitly mentioned by 5.5% of survey respondents. Importantly, 26% of respondents identified as being impacted by mental health disability, including anxiety and depression. While often unspoken, she noted that these issues have become particularly prevalent during the COVID-19 pandemic, with more reports emerging that paint a consistent picture about faculty members' mental health and well-being. Imad highlighted a recent report from Boston University's School of Public Health, the Mary Christie Foundation, and the Healthy Minds Network which revealed three important findings (22). First, students are increasingly relying on their instructors for mental health support. Second, faculty are feeling the heaviness of such responsibility, especially when they do not have the proper training. Third, faculty members themselves reported suffering from mental health illness.

This is not surprising, considering that the culture of academia has perpetuated a constant experience of an "uneasy feeling that there is always something left to do" (25, 26).

Imad highlighted that BIPOC faculty and staff are particularly vulnerable to race-based traumatic stress that existed before and has become more exacerbated by the pandemic. Imad aligned the conference attendee responses with data gathered from across academic institutions. A recent survey conducted by The Chronicle of Higher Education of 1,122 faculty members at 4-year and 2-year institutions around the nation showed that faculty are overwhelmingly experiencing increased frustration, anxiety, and stress. Over 66% of those who participated in the survey are struggling with increased workloads and a deterioration of work-life balance—particularly female faculty members (https://connect.chronicle.com/rs/931-EKA-218/images/Covid%26FacultyCareerPaths_Fidelity_ResearchBrief_v3%20%281%29.pdf).

TAKEAWAYS FROM SABER WEST 2021

Overall, the SABER West 2021 conference, as addressed by the town hall panelists and attendees, highlighted important aspects of STEM education conferences that we must consider and reckon with as we move forward as a professional society and community. We also acknowledge that the themes discussed do not represent an exhaustive list of all possible challenges and solutions to DEI problems related to STEM education conferences.

We end this report by considering the themes highlighted by the panelists in the context of future SABER West conferences and next steps that meeting organizers intend to take as presented in Table 1. While some of these suggestions are easier to implement than others, we believe it is the responsibility of conference organizers to ensure that conference access is prioritized if inclusion is a meeting goal. It is essential that STEM professionals prioritize inclusivity beyond the classroom if we truly support a diverse and vibrant community.

SUPPLEMENTAL MATERIAL

Supplemental material is available online only.

SUPPLEMENTAL FILE 1, PDF file, 0.3 MB.

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