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1 **Moving Towards More Diverse and Welcoming Conference Spaces: Data-Driven**
2 **Perspectives from Biology Education Research Scholars**

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5
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48
49
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51
52 **Abstract**

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

63

64 **Perspective**

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

73

74 The disciplinary-specific Society for the Advancement of Biology Education Research (SABER) was founded in 2010
75 with the mission to improve post-secondary biology education. In 2017, a group of SABER members established a
76 regional meeting, SABER West, to be hosted annually at the University of California, Irvine. While sharing similar
77 aims with the broader research-focused society, the SABER West conference was created with both discipline-
78 based education researchers and biology educators in mind. The meeting goals include:

79

80 1. Increasing interactions among science, technology, engineering, and mathematics (STEM) educators and
81 education researchers.

82 2. Fostering collaborations between two-year and four-year institutions.

83 3. Providing professional development enabling participants to conduct education research and implement
84 evidence-based instructional practices.

85

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

90

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

96

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

99

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

105

106 **The Need for Diversity and Inclusion at STEM Conferences**

107

108 DEI topics have been surging in conversations within STEM fields over the last three decades (6). Organizations and
109 educational institutions have focused energies and finances on the recruitment and retention of students of color
110 at both the undergraduate and graduate levels (7), yet we still see that white professionals are overrepresented in
111 STEM fields. According to a recent NSF 2019¹, minoritized (which we define as Latinx, Black, and Indigenous
112 populations) students represented only 21.6% of all bachelor's degrees, 13.2% of all master's degrees and 8.8% of
113 all doctoral degrees attained in 2016². In contrast, according to the 2016 census, minoritized people made up
114 nearly 48% of the US population.

115

116 Considerable evidence has highlighted institutional barriers and “chilly” STEM climates as causes for the attrition of
117 individuals from the professional realm, including a wide array of racist, sexist, homophobic, and ableist policies as
118 well as cultural norms that create STEM spaces unwelcoming to minoritized groups (8-10). These policies and
119 norms keep BIPOC people, people with disabilities, LGBTQ+ people, and people with intersectional identities (11)
120 out of academic spaces. Out of all full-time faculty in degree-granting institutions, when data are disaggregated by
121 race and gender only, Black or Latinx males and females each comprise 3% of the professoriate, Asian or Pacific
122 Islander faculty represent 7% male and 5% of female faculty, and American Indian or those who identify with two
123 or more races make up less than 1% of full-time faculty, while 40% and 35% of faculty identify as white males and
124 females, respectively (12). Not surprisingly, this is mirrored at STEM education conferences where we see an
125 overrepresentation of white participants and underrepresentation of all other demographics. Prior work has
126 identified issues that are prevalent in STEM academic conferences broadly, including a lack of diversity in the
127 conference speaker and conference organizer populations, issues with conference accessibility, a lack of
128 programming aimed at creating more inclusivity in that particular science field, among other barriers to conference

¹<https://nces.nsf.gov/pubs/nsf19304/digest/field-of-degree-women-men-and-racial-and-ethnic-groups>

²<https://data.census.gov/cedsci/table?d=ACS%205-Year%20Estimates%20Data%20Profiles&tid=ACSDP5Y2016.DP0>

129 inclusion¹³⁻¹⁵. Our work aims to add to the existing literature by focusing specifically on the STEM education
130 conference experience through the lens of the attendees of such events.

131

132 **SABER West 2021**

133

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

140

141 To inform the town-hall discussion, SABER West 2021 registrants were asked to complete a climate survey that
142 incorporated Likert scale and free-response items from published instruments, centered on interrogating
143 conference attendee experience. The pre-conference survey emphasized participants' general thoughts on STEM
144 education conferences and included items about travel and family logistics or cost barriers, as well as participant
145 experiences of disrespect, bias, discrimination, or racism while attending conferences (17-19; survey instrument
146 included in Supplemental Materials). The survey was completed by 198 of the 482 SABER West 2021 registrants.
147 There was broad representation of students, staff, and faculty from two-year, four-year primarily undergraduate,
148 and research institutions. The majority of respondents are biologists (76%), identify as female (79%), and are white
149 (69%), with approximately 20% of individuals identifying as part of the LGBTQ+ community. Because we did not
150 collect demographic information from all conference attendees, it is not possible to determine whether our survey
151 respondent sample was representative of conference attendees as a whole. As such, our review of survey
152 responses and corresponding recommendations may not reflect all attendees' perspectives broadly.

153

154 **Town Hall**

155

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

172

173 *Intentional Inclusivity at STEM and STEM Education Conferences -- Paloma Vargas, San Diego Mesa College*

174

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

180

181 These points were made in contrast to events hosted by organizations such as the Society for Advancement of
182 Chicanos/Hispanics and Native Americans in Science (SACNAS) that strive to “achieve true diversity in STEM”³
183 which are non-white spaces where BIPOC support is available. Dr. Vargas noted that in 2020, SACNAS attendees
184 identified as 8% African American or Black, 8% Asian or Asian American, 56% Hispanic or Latina/o/x, 9% Native
185 American and Indigenous, 5% other or multiracial, 15% White or Caucasian.⁴ A post-meeting analysis highlighted
186 the contrast with the SABER 2020 annual conference and SABER West 2021 conference attendee demographics
187 (Figure 1).⁵

188
189 The importance of fostering conference participant diversity is particularly relevant as demographics of students in
190 higher education have shifted in recent years. In 2018, 39.8% of all STEM degrees and certificates were awarded
191 to minoritized students (Black, Latinx, Asian or Pacific Islander, or two or more races), a 10% increase from 2008
192 (20). With projected growth of these populations and the increase in federally recognized Minority-Serving
193 Institutions (>700) such as Hispanic-Serving Institutions (HSIs, 559 designated, 393 emerging), 102 Historically
194 Black Colleges and Universities (HBCUs), and 35 Tribal Colleges and Universities (TCUs), it is clear that two- and
195 four-years institutions will continue to diversify (21-22). The changes in demographics provide the perfect
196 opportunity for STEM education organizations, conferences, and spaces to become more deliberately inclusive of
197 the incoming wave of young scientists, educators, and researchers from minoritized communities.

198
199 Dr. Vargas highlighted particular survey responses to the prompt asking what factors are necessary to create an
200 inclusive STEM education conference environment:

201
202 “There needs to be an inclusion (not simply representation) of researchers and practitioners of color to
203 ensure that their research, informed by their lived experiences, can be part of the conversation in the

³ <https://www.sacnas.org/who-we-are/>

⁴ https://www.sacnas.org/wp-content/uploads/2021/03/SACNAS2020annualreport_FINAL321.pdf

⁵ <https://saberbio.wildapricot.org/resources/Documents/2020%20meeting/SABER%202020%20Post%20Meeting%20Report.pdf>

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

209

210 *Lack of Institutional Inclusion at Conferences -- Luanna Prevost, University of South Florida*

211

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

219

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

223

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

228

229 *Barriers to STEM Education Conference Attendance -- James Cooke, University of California, San Diego*

230

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

236

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

239

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

243

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

252

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

255

256 Accessibility of Conference Venues -- Logan Gin, Arizona State University

257

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

260

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

276

277

278 Deficit Thinking at STEM Education Conferences -- Sumitra Tatapudy, University of California San Francisco

279

280 A theme noted by doctoral candidate Sumitra Tatapudy in 13% of the attendees' survey responses was the need
281 for a shift from deficit-minded approaches to a more strengths/assets-minded approach during presentations and

282 discussions. She began her portion of the town-hall discussion by defining deficit thinking, as referring to the
283 implicit and explicit assumptions made about a student’s motivation, ability, or aptitude, which results in an
284 emphasis on “fixing” students and perpetuates a culture of assimilation in learning (23-24). She noted that a
285 deficit-focused approach holds individuals from historically minoritized populations responsible for the challenges
286 and inequities faced, rather than emphasizing the systemic, institutional or socio-economic inequities responsible
287 for the challenges encountered. Consistent with this idea, one of the survey respondents shared that:

288
289 “[Conference research] presentations seemed to talk about underrepresented minorities in a
290 deficit/assimilation mode (e.g. assessing how students can better learn the right way to talk about mitosis
291 versus do students see themselves in the scientific community and feel like they belong).”

292
293 She reported that multiple survey respondents noted the use of a deficit-focused approach in science education
294 research presentations and the use of deficit-language during post-presentation questions and remarks. Another
295 survey respondent witnessed: “subtle discriminatory/microaggressive comments about presenters of color
296 describing their presentations as ‘not well thought out’ or ‘not as good as...’ in comparison to a similar
297 presentation by a white colleague.” Tatapudy noted that deficit and discriminatory language used as part of
298 “constructive criticism” and normative comparisons to predominantly white standards of conceptualization and
299 articulation in education and training, promoted deficit-mindedness.

300
301
302 *Mental Health of Conference Attendees and Community -- Mays Imad, Pima Community College*

303
304 Dr. Mays Imad closed the town-hall discussion by highlighting survey responses related to mental health,
305 psychological traumas, and hidden disability explicitly mentioned by 5.5% of survey respondents. Importantly, 26%
306 of respondents identified as being impacted by mental health disability, including anxiety and depression. While
307 often unspoken, she noted that these issues have become particularly prevalent during the COVID-19 pandemic

308 with more reports emerging that paint a consistent picture about faculty members' mental health and wellbeing.
309 Dr. Imad highlighted a recent report from Boston University's School of Public Health, the Mary Christie
310 Foundation, and the Healthy Minds Network which revealed three important findings (22). First, students are
311 increasingly relying on their instructors for mental health support. Second, faculty are feeling the heaviness of such
312 responsibility especially when they do not have the proper training. Third, faculty members themselves reported
313 suffering from mental health illness.

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

316
317 Dr. Imad highlighted that BIPOC faculty and staff are particularly vulnerable to race-based traumatic stress that
318 existed before and has become more exacerbated by the pandemic. Dr. Imad aligned the conference attendee
319 responses with data gathered from across academic institutions. A recent survey conducted by The Chronicle of
320 Higher Education of 1,122 faculty members at four-year and two-year institutions around the nation showed that
321 faculty are overwhelmingly experiencing increased frustration, anxiety, and stress. Over 66% of those who
322 participated in the survey are struggling with increased workloads and a deterioration of work-life balance—
323 particularly female faculty members⁶.

324

325 **Takeaways from SABER West 2021**

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

330

⁶ https://connect.chronicle.com/rs/931-EKA-218/images/Covid%26FacultyCareerPaths_Fidelity_ResearchBrief_v3%20%281%29.pdf

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

336

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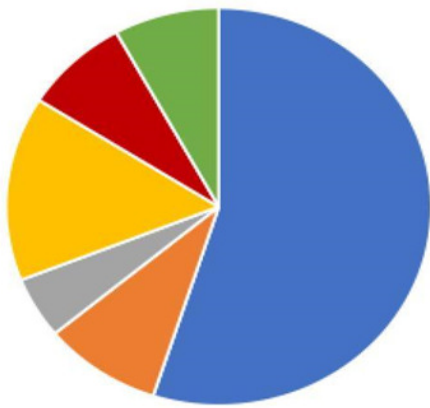
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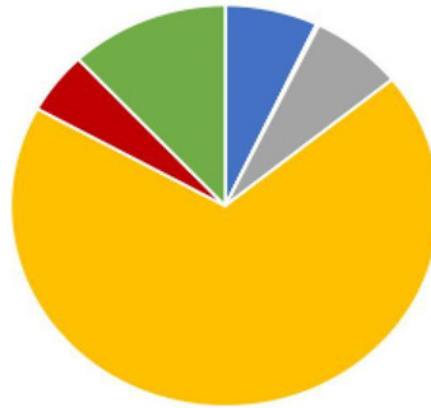
423 **Figure Caption**

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

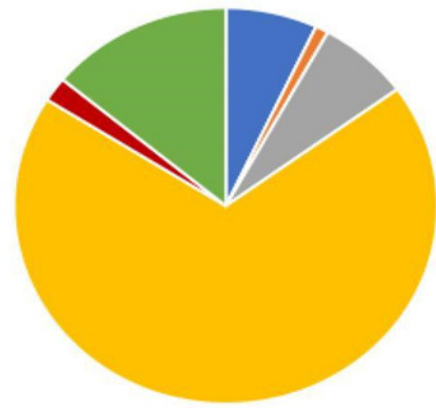
SACNAS



SABER



SABER West



- Hispanic/Latinx
- White/Caucasian
- Asian
- Native American & Indigenous
- Black or African American
- Other/Multi-Racial

Table 1. Themes and suggestions to promote more diverse and welcoming STEM Education Conferences.

Theme	Suggestions
1. Adopt/adapt approaches that promote inclusion while continuing to collect data	<ul style="list-style-type: none"> ● 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	<ul style="list-style-type: none"> ● 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.	<ul style="list-style-type: none"> ● 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 versus 1 full day and a half day on either end could reduce the hotel stay by one 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.	<ul style="list-style-type: none"> ● 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	<ul style="list-style-type: none"> ● Recognize that conferences are very demanding experiences, especially for

for mental health

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.