frontiers | Frontiers in Physics

TYPE Perspective
PUBLISHED 14 December 2022
DOI 10.3389/fphy.2022.1085789

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Space Physics, a section of the journal Frontiers in Physics

RECEIVED 31 October 2022
ACCEPTED 30 November 2022
PUBLISHED 14 December 2022

CITATION
Burt MA, Haacker R, Montaño P, Vara M and Sloan V (2022), The ethics of diversity, equity, inclusion, and justice in the earth system sciences. *Front. Phys.* 10:1085789. doi: 10.3389/fphy.2022.1085789

The ethics of diversity, equity, inclusion, and justice in the earth system sciences

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Institutions' motivations for pursuing diversity, equity, inclusion and justice (DEIJ) often center on the benefits to the organization, an argument known as the business case for diversity in which diverse teams are more creative, set high bars for research, and produce ideas that are more innovative than those produced by homogeneous groups. As the sole motivation for DEIJ efforts, the business case is flawed and does not address the harmful workplaces many marginalized scholars encounter. Institutions can make more progress towards diversifying the STEM workforce by acknowledging the ethical responsibilities for doing so and transitioning to an equity-centered approach. Emphasizing personal motivations to actively engage in DEIJ work resonates with individuals more, rather than engaging with DEIJ to benefit an institution's goals. Two recent studies support this argument. The first is an alumni survey and focus groups of postdoctoral fellows in the Advanced Studies Program at the National Center for Atmospheric Research to explore alumni efforts and motivations for engaging in DEIJ work. The second study surveyed attitudes towards DEIJ efforts among STEM graduate students at Colorado State University who took a course on social responsibility in science. Both studies show the motivations for scientists to support and get involved in these efforts and indicate that the business case is misaligned with the motivations of students and professionals in STEM. Understanding the attitudes and motivations that individuals have for DEIJ in STEM presents an opportunity for how institutions can best learn from and support these motivations for systemic change.

KEYWORDS

stem, workforce, diversity, equity, inclusion, justice

Introduction

The science, technology, engineering, and mathematics (STEM) fields continue to struggle with improving diversity, equity, inclusion and justice (DEIJ) in its community. Challenges range from attracting and retaining diverse talent in schools and the workforce, to making progress on changing how we do science in more inclusive and equitable ways so everyone can bring their full self. Although there has been an increase in

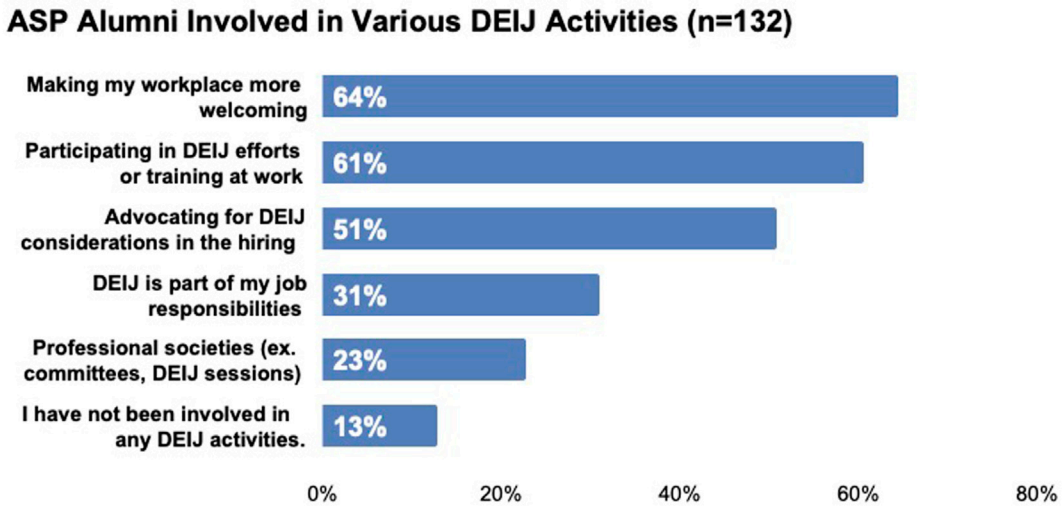

FIGURE 1
Results from the survey question, "Please indicate if you have been involved in efforts to make the workspace/science community more diverse, equitable and inclusive. Please select any of the activities that you have been involved in." *n* = 132 respondents. Respondents were able to select as many response categories as applied to them.

racial and ethnic diversity at the undergraduate level in STEM [1,2], little progress has been made in terms of increasing the numbers of professionals from diverse backgrounds [2,3]. People from marginalized communities face multiple obstacles when pursuing STEM degrees and careers, such as hostile environments and being made to feel that they do not belong in science [4]. In addition, they face persistent barriers presented in the forms of lack of representation and poor mentorship [5]. Efforts to diversify the STEM community and workforce have largely focused on recruitment of individuals who identify as Black, Latinx/e, Indigenous, women, and people from marginalized communities, often referred to as the pipeline model [6]. Augmenting the numbers of marginalized scholars represents a passive process with the hopes and intentions of leading to a diverse workforce [7,8]. In reality, this passive approach fails to illuminate the barriers, exclusionary practices, and hostile environments that individuals from marginalized communities often experience [4].

While the challenges for marginalized scholars remain, efforts to accelerate DEIJ in STEM in meaningful and persistent ways have gained support in recent years. The discourse about the urgency and necessity has expanded beyond being a topic for those only involved in human resources or STEM education. Ways to broaden participation and make opportunities in STEM more equitable are discussed in academic and research circles, the private sector, and professional societies. Discussions have progressed from the lack of DEIJ constituting a problem, to efforts and actions on what to do. While interest to invest efforts in DEIJ has increased, motivated by social movements like Black Lives Matter and heightened awareness of racial injustices and systemic inequalities, it is not clear yet if interest will be sustained and lead to meaningful efforts, or if efforts will remain ineffective.

The business case for diversity is flawed

One of the reasons why DEIJ efforts are often seen as performative is that institutions' motivations for recruitment and retention center around what is known as the business case for diversity, motivations which are often misaligned with the motivations of their own staff and students. The business case makes the argument that diverse teams are more creative and set high bars for research and scholarly excellence and produce ideas that are both more innovative and more feasible than those produced by homogeneous groups [9] and also help private industry connect to more diverse consumer groups. These benefits have often driven private sector companies and academic institutions to invest in diversifying the workforce or their student and faculty body. Private sector interest in DEIJ is driven by the potential to increase profits, and academic institution interest in diversifying the STEM workforce is driven by a desire for scholarly prestige.

While this rationale has been previously supported, recent papers have highlighted the shortcomings of this argument [10]

and the potential harm to Black, Latinx/e, Indigenous, women, and people from marginalized communities [11,12]. Specifically, the argument that diversifying the workforce will lead to better science and outcomes can inadvertently place heightened and unrealistic expectations on the few marginalized scholars brought onto a team and create an unwelcoming work environment for them where they will experience self-doubt and identity threat [13]. Black, Latinx/e, Indigenous, women and marginalized professionals should not have to overperform to be valued and evaluated positively by their peers.

A study of diversity statements of private sector and public institutions found that public sector institutions have a better employment image if they used moral arguments for DEIJ efforts over business reasons [14]. Specifically, they found that *"public sector organizations are expected to be more concerned with serving societal interest than self-interest."* [14] and that institutions that express moral reasons for diversity efforts are perceived as having higher morality and competence than public institutions that espouse a business case for diversity [14]. Concluded that moral arguments for diversity can lead to higher attractiveness of an institution for prospective employers. [12] found that for multiple marginalized groups (including women in STEM and African Americans in higher education) the business case for diversity undermined a sense of belonging to an organization and increased social identity threat, concluding that the business case deters rather than attracts diverse talent. [12] state that *"the most prevalent organizational diversity case works against organizations' stated diversity goals, by paradoxically warding off the very groups they need to attract to become more diverse."*

Understanding motivations to engage in diversity, equity, inclusion and justice

To truly transform STEM institutions and make progress on DEIJ, institutions need to examine and change their motivations for broadening participation. To do so, STEM institutions can learn from their own students, staff and STEM professionals and ask why community members get involved with DEIJ efforts.

For example, a study of alumni of a postdoctoral training program at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado revealed perceptions about today's scientific workforce, training needs in DEIJ, as well as individual motivations of STEM professionals for getting involved in DEIJ activities and mentoring. The training program, known as the Advanced Study Program (ASP), began in 1964 and has supported over 600 postdocs. The alumni study of 2021 and 2022 included 140 former postdocs from the past 40 years.

The study found that the majority (87%) of alumni surveyed are involved in DEIJ efforts, and many (61%) are involved in more than one type of DEIJ effort (Figure 1). These results indicate interest and motivation to transform STEM work cultures and the composition of faculty and staff at institutions by making workplaces more welcoming, advocating for DEIJ issues in the hiring processes, and participating in DEIJ efforts through professional societies. From the study, 33% of participants consider DEIJ as part of their job responsibilities today which shows that DEIJ has become an important part of institutional practices.

The ratio of men to women among survey respondents on questions about participation in DEIJ was 90 men to 38 women or 2.4:1.0. Responses indicated that men and women were similarly motivated to engage in DEIJ efforts to make their workplace feel more welcoming (about 66% of their respective pools) or because DEIJ is part of their job responsibilities (about 33% of their respective pools). Women were about twice (1.75 x) as likely as men to engage in committee work or DEIJ sessions with professional societies, and 1.42 times as likely as men to participate in DEIJ efforts or training at work. In terms of making structural changes in the workplace, women were much more likely than men to advocate for DEIJ considerations in the hiring process (68%: 44% or 1.55 times).

On average, those who participated in DEIJ activities were 1.4x as likely to report that their employers consistently supported their professional development compared to those who indicated that their employers "occasionally" supported their professional development. Those who participated, on average, were 1.2–3.2 times as likely to recommend that future postdocs engage in professional development focused on management, data analysis, and interpersonal skills, and DEI. There were 13% of respondents who reported that they do not participate in DEIJ activities and do not recommend it as a needed skill. This suggests that engagement in DEIJ activities in the workplace leads to an increased value placed on DEIJ training.

"In just five years, the expectations have dramatically changed in terms of my faculty roles. For example, there's now a DEIJ section in our faculty activity reports, so we report on [it] annually. It also features prominently now on the tenure and promotion materials. . ."

In addition, some of the DEIJ activities in and outside of work included serving as a mentor to colleagues from marginalized communities, initiating DEIJ training at work, creating DEIJ courses at their institution, and founding a DEI-focused non-profit.

An analysis of respondent comments and career experiences that were shared in the study found experiences of alienation, gender discrimination, and workplace harassment. In the words of one alum, *"During my 40 years career I never found a workplace where I felt completely accepted, supported and at home. There was always too much competition for grants and power."* Similar themes were found for some alumni who described how their career advancement was obstructed due

to sexual harassment, gender discrimination, and hostility from supervisors. Despite the challenges that some alumni faced, the study found that 76% of alumni mentored due to a sense of social responsibility, 70% as a way to give back, and 30% because they wanted to be a role model. Reasons for getting involved in mentoring differed by gender, with more women than men mentoring to be a role model to others (47% Women; 31% Men, $n = 125$). Responses for individuals who identify as non-binary/transgender/non-conforming/prefer not to answer were too small ($n = 5$) to include in the analysis. Close to half of all alumni in the study recommended training in DEIJ as important for today's workforce. The study showed that mentoring students and others, and participating in DEIJ efforts are driven by values and personal motivations.

Further evidence of the importance of personal motivations for engagement in DEIJ work comes from a study of student participants in a new course on "Social Responsibility in Atmospheric Science" at Colorado State University. The course piloted in 2021 and offered again in 2022, provided students an introduction and practical training on DEIJ issues in geosciences. Students expanded their personal and professional growth through readings, video lectures, guest speakers and other activities, and gained a critical understanding of intersectionality, gender, social identity, systems of oppression, and historical perspectives on social change movements. When asked why students decided to take the course, one student shared that they wanted to *"learn about the biases that exist in the field I am entering and to confront the biases that I hold. I want to be a part of the solution moving forward, but to do that I need to understand the problem."* Another student noted that *"because my research area (climate intervention) raises a range of ethical questions and has a particularly poor history with respect to equity and inclusion*." Faculty in the department have encouraged students to take the course because it sets the tone and culture to engage in discussions on DEIJ in their research and lab environments, and for future cohorts of graduate students. Involving students in understanding DEIJ challenges and becoming part of the solution is an important step towards changing STEM workplace cultures.

The two studies show that motivations for engaging in DEIJ efforts are deeply personal, and less connected to current priorities that benefit STEM institutions. Institutions can make more progress towards diversifying the STEM workforce by acknowledging the moral and ethical responsibilities for doing so and transitioning to an equity-centered approach. Emphasizing personal motivations to actively engage in DEIJ work resonates with individuals in the field and institutions can learn from their staff and students in articulating new rationales that include the moral, ethical, and value-driven motivations that a) reflect the motivations of community members, b) reflect the values of marginalized communities in STEM, and c) better speak to the populations being recruited and retained in STEM.

A call to transform our STEM institutions

The STEM field can achieve its goals in DEIJ if institutions incorporate the perspectives, ideas, and hope that motivate students, scientists, and staff to bring meaningful change to STEM. Institutions that use the business case to prioritize the benefits of diversity to the institution can potentially alienate DEIJ supporters and even harm the populations being engaged. From our surveys we have found the business case for DEIJ work is misaligned with the motivations of those in STEM. Understanding the attitudes, opinions, and motivations that individuals have for DEIJ in STEM presents an opportunity for how institutions can best support these motivations to bring forward systemic change. STEM organizations will be able to make more progress when espousing moral and ethical responsibilities for diversifying its workforce and by moving to what we call an equity-centered approach.

A move towards a value-driven and equity-centered approach will transform institutions to become safe and welcoming spaces *versus* being institutions focused solely on increasing numbers within diversity categories. The social and equity benefits of diversity advocated for do not depend only on the contributions of current Black, Latinx/e, Indigenous, women and other marginalized scholars or by only increasing the number of scholars with these identities but will arise from our collective actions to create inclusive and equitable spaces that allow STEM scholars to be valued and recognized fairly.

In implementing DEIJ goals, institutions need to be cognizant that diversifying the workforce and student body at any organization must be paired with systematically creating equitable and inclusive spaces that enable everyone to bring their full self, where persons can be valued unequivocally for who they are, and where performance is equitably evaluated. Organizations can take first steps towards an equity-centered approach by reflecting on their motivations for recruitment and retention of a more diverse workforce and student body and acknowledging the ethical and societal responsibilities they have in their communities as centers of learning and creativity. We invite institutions to review their DEIJ statements and goals and update them to include moral and ethical rationales, and include these considerations into DEIJ training for staff and students. We call for institutions to thoughtfully and intentionally co-create inclusive environments in STEM with students, staff, and scholars, and use moral, ethical and valued-based foundations to transform our field.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the UCAR Human Subjects Committee (HSC) under Memo #2021-17 Colorado State University Institutional Review Board. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors contributed to the conception and design of the study. MV and VS led surveys and focus groups of the ASP study and MV, VS, and PM performed the data analysis. MB led the CSU study and analysis. All authors wrote the manuscript and contributed to manuscript revision, read, and approved the submitted version.

Funding

The National Center for Atmospheric Research receives its major funding from the National Science Foundation under Cooperative Agreement Number 1755088. The research at Colorado State University has been supported by the National Science Foundation DCL 2039480.

Acknowledgments

The authors would like to thank Chris Davis, Scott Briggs and Scott Landolt at National Center for Atmospheric Research for their contributions to the ASP alumni study which provided some of the data for this paper. We also thank Katie Beem from the CSU STEM Center at Colorado State University for their work on assessing motivations for DEIJ work among CSU graduate students. We thank Lorena Medina Luna for the careful review and valuable input to the manuscript.

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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