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Refining an Assessment Tool to Optimize Gender Equity in Professional STEM Societies

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Abstract

Professional societies (ProSs) are instrumental in shaping science, technology, engineering, and mathematics (STEM) cultural norms. Existing legacy structures designed to serve majority groups and constructed in service of dominant norms and values present a clear obstacle to attracting, retaining, and serving minoritized STEM professionals, such as women, particularly women with additional intersecting marginalized statuses (Solebello et al., 2016). In this perspective article, we in the Amplifying the Alliance to Catalyze Change for Equity in STEM Success project, known as ACCESS+, explain our development of an adapted diversity, equity, and inclusion assessment tool. ACCESS+ is an NSF ADVANCE Partnership that is adapting a pre-existing tool known as the Diversity and Inclusion Progression Framework, which was developed in the United Kingdom jointly by the Royal Academy of Engineering and the Science Council (2021). As with the original version, the purpose of the U.S. adaptation—the Equity Environmental Scanning Tool, or EEST—is to provide STEM ProSs with a way to benchmark their diversity, equity, and inclusion efforts, discern areas of organizational strength, and identify foci for organizational remediation. In this piece, we share background information for EEST refinement, including content adaptations and structural changes.

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Introduction

Professional societies (ProSs) shape disciplinary norms and values. They exert significant power and influence over the career trajectories of their members through networking, opportunities for early leadership, and exposure to emerging technologies and trends, particularly for members historically excluded from a field. Participating in such societies has been linked with the retention of historically excluded people in science, technology, engineering, and mathematics (STEM) fields (Smith et al., 2021). It is widely recognized that these fields are better able to address global concerns when they welcome, support, and retain diverse talent (Borman et al., 2010; Page, 2007; Page, 2019), and numerous mandates exist for incorporating diversity, equity, and inclusion (DEI) into STEM (Nardi, 2021). Like the fields in which they are embedded, STEM ProSs often exemplify a general commitment to the ideologies of meritocracy, neoliberalism, and empirical/apolitical stances (McGee, 2020). Yet, for most of STEM history, such ideologies have presented systemic obstacles to women and professionals from other marginalized groups (National Academies, 2018). For example, ideologies in professional engineering culture that can produce inequities include schemas of excellence that focus on characteristics and skills that can be gendered, racialized, and heteronormative, such as the differential emphasis placed on technical skills compared with socially focused, communication-based activities (Faulkner, 2009; Campbell-Montalvo et al., in press); the belief that STEM is politically and culturally neutral (McGee, 2020); and the notion that if you work hard and long enough you will succeed—that a meritocracy prevails. These myths are at odds with structural approaches that recognize that despite the effort exerted by individuals, structural biases and inequities block them from achieving the same recognition and/or reward as their peers from majority backgrounds.

The history of STEM ProSs reflects the traditional exclusion of women in STEM fields. For example, at the beginning of the last century in the United Kingdom (UK), women engineers were routinely blocked from disseminating their work. They formed the Women's Engineering Society in 1919, in part to be able to publish technical articles. There has been some social progress in STEM ProSs in the UK and the United States; however, activities and efforts aimed at increasing DEI have generally been weak—perhaps because ProSs are often small, poorly funded, and have little time to reach out beyond their discipline. Several ProSs have taken a visible leadership role by advancing the inclusion and understanding of barriers for systemically marginalized groups; incorporating DEI within their business plans; and adopting more strategic approaches than they did in the past (McNelly, 2021). Referring to its own efforts, the American Geophysical Union noted in 2016 that “any professional society has not only a role but a unique opportunity and obligation to help address and establish the culture they want” (National Academies, 2018, p. 6).

STEM ProSs influence STEM workplaces and disciplinary practices through processes such as accreditation, licensure, and professional development, among other areas. At the same time, ProSs are plagued with DEI issues. For instance, a study by Cech and colleagues (2018) of over 16,000 STEM professionals across 14 ProSs provided insights into the cumulative disadvantages faced by women, Latinx, Asian, and African American people, LGBTQ+ members, and people with disabilities. In comparison to white participants, such marginalized groups were reported as being required to work harder, being harassed verbally or in writing, and having their work devalued and disrespected in the workplace. Yet, few peer-reviewed studies explore ProSs' capacity and ability to effect change in what has been referred to as the “chilly climate” for women and systematically marginalized groups (see for example Valian [1998] and Cech and colleagues [2018]). National Academies (2018) found that ProSs valued such research into disadvantages experienced by marginalized STEM professionals. The research highlighted tangible problems and suggested that one reason for inactivity was “because people don't see what they can do to make the change.” That study also reported a desire for change, “We can't solve the problems in a vacuum.... We want to identify what kinds of challenges our members are facing and what [we] can do to be a partner and an educator in helping to create actionable steps toward solutions” (p. 5).

In addition to a need for data-informed efforts for change, prior research identified several factors that support successful academic STEM institutional transformation, including 1) senior administrative involvement, 2) widespread collaborative research and synergistic partnerships, 3) clear vision, flexible path, and milestones, and 4) visibility of actions and outcomes (Bilimoria et al., 2008). External factors included a cohort of peer universities (best practice sharing) (Bilimoria et al., 2008). In our work—the work of the Amplifying the Alliance to Catalyze Change for Equity in STEM Success project (ACCESS+)—we apply Bilimoria and colleagues' (2008) conclusions. We aim to locate change leaders in ProS cohorts who can co-create a community of practice to share resources, best practices, and experience of what has worked and not worked to retain and support diverse STEM academic professionals (Segarra et al., 2019). Thus, the ACCESS+ NSF ADVANCE Partnership scaffolds strategic and systemic change based on information ascertained through a self-assessment and reporting tool, the Equity Environmental Scanning Tool (EEST). In this paper, we describe the tool for the first time.

Adapting the EEST: Domains and Frames

ACCESS+ is helping establish a structural approach for ProSs to improve DEI within their organizational functions and culture. Such efforts require the ability to ascertain DEI-related needs and progress. We reviewed several existing DEI self-assessment tools for potential use in our efforts, and ultimately selected a tool from the UK, developed through a collaboration between the Royal Academy of Engineering and the Science Council (2021). The resulting Diversity and Inclusion Progression Framework was developed and used across ProSs in the UK in 2017, with a revised version implemented in 2021.

In reviewing the Diversity and Inclusion Progression Framework for possible use with ProSs in the United States, we determined that two main types of changes were needed for the U.S.

context: *content* changes related to differences in the functions of UK and U.S. ProSs, and *structural* changes that would permit the assessment to be used more for measurement than as a device for discussion or elicitation. Content changes were related to differences in 1) how professional licenses work and are awarded; 2) how study programs in universities are accredited; 3) the important role of ProS student chapters in the early stage of the career ladder; and 4) the role of ProS advocacy for the discipline in providing comment and contribution on issues of national importance. Structural changes dealt with standardizing item wording across frames to allow for comparison between frames and other changes, such as revisions to avoid double-barreled items.

The development of the EEST was informed further by studies such as Solebello and colleagues' (2016), who analyzed ProS diversity programs and their aims, and Smith et al. (2021) who explored the functions of student ProS chapters in keeping underrepresented students in STEM. We also consulted dozens of subject matter experts and ProS DEI leaders. We will describe the revision process in a future paper. The EEST is currently undergoing piloting with the first ACCESS+ cohort of ProSs, from its parent project (Alliance to Catalyze Change for Equity in STEM Success, or ACCESS), a meta-organization that brings together the diversity committees of five ProSs, mostly in biology (Segarra et al., 2019). We are using interviews, think-alouds, and feedback workshops to trial and refine the EEST.

Domains

Three overarching domains related to DEI inform our measurement in the EEST: *leadership and strategy*, relating to the articulated goals of the ProS that shape all other efforts of the society; *policies and practices*, the day-to-day operations of the ProS; and *insights and evaluation*, relating to the extent to which a ProS gathers and uses data on ProS members and outcomes of activities to support change. Previous research shows that *leadership* is key to cultural change within an organization (i.e., Bilimoria et al., 2008; Bilimoria & Liang, 2012a; Bilimoria & Liang, 2012b; Kezar & Eckel, 2002). Specifically, organizational change is facilitated by leaders' attitudes and approaches, assistance in developing new ways of thinking, and responsiveness to stakeholders (Eckel et al., 2001)—all evidenced through ProSs' *policies and practice*, in which they construct norms, expectations, and programming aligned with their goals. We focus on *insights and evaluation* because progress can be measured through tracking key indicators of representation and equity; evaluating programmatic interventions and strengthening the institutional research infrastructure to improve data collection, analysis, and use (Bilimoria et al., 2008).

Frames

The structure of the EEST represents the main functions of ProSs and areas for DEI focus. These functions include:

1. governance and leadership
2. membership
3. programs and events

4. professionalization
5. student chapters
6. prizes, awards, and grants
7. marketing and communication
8. outreach and engagement
9. employment
10. advocacy
11. publishing

Each frame contains 20–30 items, many drawing on content from the Diversity and Inclusion Progression Framework. All have been aligned to a “skeleton” of standard phrasing to reduce cognitive burden on the participant and to allow for cross-frame comparison. We explain the focus and rationale of each of the frames below.

Frame 1: Governance and Leadership. Senior leaders shape the vision, strategies, and organizational infrastructure and culture within a ProS. This frame encapsulates a blend of words and actions by ProS leaders, proposed by Martins (2020). This focus is important, given that, compared with other types of organizations, the blend of ProS members, staff, and elected officers can compromise performance, particularly as elected leaders change frequently, sometimes annually. By systematizing the approach, we can support conscious consideration of DEI throughout a range of functions of the ProS and embed this consideration within its policies and practices. We also can support the reporting of outcomes to inform future actions.

Frame 2: Membership. ProSs spend considerable effort and money on recruiting, supporting, and retaining their membership. Membership dues provide an important source of income for many ProSs. The efforts of ProSs to address the diversity of membership has not been the subject of much academic study until recent times, as noted by Solebello and colleagues (2016). In the UK for example, ProSs are commissioning more research on membership and publishing it as “grey” literature (e.g., Institute of Physics, 2021). The Royal Society of Chemistry (2020) publishes a detailed analysis of its membership every 2 years, providing intersectional demographic analysis.

Frame 3: Programs and Events. Conferences, meetings, and events form the main programming of a ProS for both academic and industry-based members; these events also serve to introduce students to the society and the discipline it represents. Frame 3 addresses important components of ProS programs and events, such as promotional materials, speakers and panels, event chairs, participant diversity, codes of conduct, and meeting atmosphere. For many, diversity in STEM means increasing the participation of women. However, racially/ethnically minoritized women often experience a double burden, for example by being made to feel unwelcome when ProS conference staff use microaggressions (Morris & Washington, 2017). Addressing this type of exclusionary atmosphere requires education and training that focuses on a range of dimensions across events and meetings; allocating resources for formal support and recognition of the experiences of marginalized participants; and creating a welcoming atmosphere at events (Campbell-Montalvo et al., 2020).

Frame 4: Professionalization. As a core activity in STEM ProSs, professional development includes the development of skills for leadership, management, and networking, and technical certifications and preparation for licensure (e.g., through mentoring). ProSs also offer members leadership roles on committees or chairing conferences. Historically, these roles can be prestigious and have been passed on without due process or transparency. The opportunities to build career and professional confidence need to be inclusive, supportive, and aimed at marginalized members. See Morris and Washington (2017), Cech and colleagues (2018), and Moore and colleagues (2020) for strategies to grow the presence, power, and influence of diverse members within the society and the profession.

Frame 5: Student Chapters. Students, parents, universities, and industry invest heavily in training and educating the workforce of the future and are directly responsible for helping students cultivate the social capital they need to persist in STEM (Puccia et al., 2021; Skvoretz et al., 2020; Campbell-Montalvo et al., in press). The student chapters of U.S. ProSs directly support the participation of diverse groups, from education into relevant employment. Chapters are supported in various ways, from ProS central headquarters, through state-run activities, and by institutions/universities themselves. The ProS role cannot be underestimated in supporting efforts to grow the diversity of the student population and provide opportunities for rewarding careers for people from diverse backgrounds (Smith et al., 2021), especially given the stereotypes and microaggressions that women and people of color, particularly Black students, experience (Campbell-Montalvo et al., in press). ProSs can provide support to chapters as well as members who volunteer to support the chapters.

Frame 6: Prizes, Awards, and Grants. Recognizing, rewarding, and celebrating the achievements of disciplinary professionals have long been important functions of ProSs. Traditionally, awards are named after prominent past figures in the field—and historically in STEM, they were named after individuals who were white men. This frame focuses on how the ProS goes about marketing, nominating, reviewing applications, and awarding money or accolades, with special focus on efforts to obtain diversity among applicants, reviewers, and awardees.

Frame 7: Marketing and Communication. Organizational artifacts, such as websites, magazines, artwork, publications, and member “swag” such as ties, scarves, and cufflinks, embody the culture and image of the ProS and its members. A study of 11 natural resources-related ProSs showed that images on website landing pages were more diverse in terms of gender and race/ethnicity, but less diverse within subsections (Bal, 2019). As with other studies, women and marginalized people are less likely to be portrayed in active or field locations and are often represented in passive, indoor poses. This frame examines how ProSs engage in marketing and communication that are culturally relevant and representative of their membership.

Frame 8: Outreach and Engagement. A function of the outreach and engagement sections of ProSs includes finding new ways to inspire the next generation. This can include strategies for collaborating on schemes to avoid duplicating or “reinventing the wheel,” building on good practice, and undertaking research to improve STEM or ProS access to young people and the wider public. Increasingly, colleges lead such outreach activities in an effort to diversify their

student cohorts. Frame 8 focuses on how a ProS shares knowledge, articulates standards of behavior of participants, and considers how its material and content are relevant to a diverse audience.

Frame 9: Employment. Many ProSs have several fulltime employees in a range of roles to support the ProS's efforts. Frame 9 focuses on the recruitment and promotion of staff, as well as explores diversity and promotion amongst staff members. This frame also examines how ProSs may explore current employment practices, possibly aligned with models for small businesses, and how ProSs address equity across the workforce.

Frame 10: Advocacy. ProSs are composed of practitioners, often from a specific field or discipline, thereby positioning the ProSs to provide comments, advice, and evidence on public policy and issues of national importance. Frame 10 ascertains how the ProSs engage in advocacy—for example, by focusing on requirements about taskforce diversity and examining how science or technology may disproportionately negatively affect subsections of the population.

Frame 11: Publishing. A significant number of ProSs generate income through publishing journals and other media. Frame 11 explores the progress that is being made by ProSs to address subtle but career-changing biases that occur through in publishing—biases that place women and STEM professionals from other minoritized groups at a disadvantage. Major publishing houses, including Elsevier, Wiley, and Taylor and Francis, have explored how women and people of color have been discriminated against in publishing. To advance DEI, publishers have made changes, and continue to implement them, to support the provision of demographic data by authors; a need still exists for such data on reviewers. For example, IOP Publishing recently announced it will move to double-blind peer review based on the results of pilot tests (IOPP, 2020).

Conclusion

We cannot overestimate the challenge of creating and implementing a systematic approach to DEI in a ProS that has limited resources. To inform a strategic approach to improved DEI, ACCESS+ aims to build a practical and useful tool that will measure DEI status, introduce ideas for how to address DEI, and stimulate discussion. In concert with ACCESS+'s community of practice, ProS changemakers are offered support, knowledge sharing, and skill development. Pilot efforts so far support the EEST's potential efficacy in ACCESS+'s programming to improve the climate for systemically marginalized groups and create professional development opportunities for the ProS changemakers (Leibnitz et al., 2021). These opportunities include potentially developing a high-level dashboard that will offer demographic information on membership across frames and time as well as supporting ProSs in their strategic action planning to support gender equity in STEM.

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