The Role of Mentorship in Disrupting Ableism and Advancing STEM

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INTRODUCTION

The science, technology, engineering, and mathematics (STEM) workforce is large and expansive; opportunities for participation exist in the education, corporate, and government sectors. For decades, a robust STEM workforce has been seen as critical for an increase of living standards, economic growth, and global competitiveness (NSB-NSF, 2021). Unfortunately, this workforce has been facing a "persistent and dramatic shortage" of employees (New American Economy, 2017, para. 4). Confounding this challenge is the historical homogeneity of individuals in the STEM workforce. In the late 1990s, federal agencies increased their investment in broadening workforce participation from historically and systemically excluded groups including women, individuals from racially and ethnically minoritized groups, and individuals with disabilities. In recent years, leaders across industrial sectors and federal agencies have called for renewed attention and commitment to recruiting, retaining, and advancing individuals with disabilities in the STEM workforce (Mattison et al., 2022). In 2022, the White House urged an "increase access to labs, classrooms and workplaces through the use of universal, human-centered design practices" (OSTP, 2022). While the percentage of college students with disabilities in STEM fields is similar to that in the general population, a smaller percentage of these college students graduate compared with their peer group (Thurston et al., 2017; Dunn et al., 2021).

Three critical efforts were launched over the past 5 years by the National Academies of Sciences, Engineering, and Medicine. These included two reports: *Advancing Anti-Racism, Diversity, Equity, and Inclusion in STEMM Organizations* (2023) and *The Science of Effective Mentoring in STEMM* (2019), as well as the Disrupting Ableism and Advancing STEM

workshop series (2023). Each acknowledged the importance of drawing on the full pool of scientific talent to ensure this country's future economic and environmental sustainability. Each of these initiatives highlighted the deep and systemic and structural inequality that is at the root of many challenges to full participation of individuals from historically excluded groups and the important role that mentorship, and mentorship ecosystems, can play in addressing systemic disparities.

> Talent is equally distributed across all sociocultural groups; access and opportunity are not.
>
> – Dr. Angela Byars-Winston, Chair, Science of Effective Mentorship in STEMM (NASEM, 2019)

Limits to access and opportunity for individuals with disabilities are rooted in ableism. Individuals with disabilities are a heterogenous group and many experience their preparation, entrance to, and advancement in the STEM workforce at the intersection of systemic ableism and racism (Fuentes et al., 2023). Mentorship, in its most effective form, has the potential to disrupt ableism and racism and remedy access and opportunity gaps.

This paper intentionally uses the term *mentorship* (as opposed to *mentoring*) for a simple reason: to elevate the agency of the less experienced colleague in the relationship. Mentorship, according to the National Academies, refers to "a professional, working alliance in which individuals work together over time to support the personal and professional growth, development, and success of the relational partners through the provision of career and psychosocial support" (NASEM, 2019). According to the Office of Disability Employment Policy (ODEP) of the U.S. Department of Labor, mentoring relationships provide valuable

support to young people, especially those with disabilities, by offering not only academic and career guidance, but also effective role models for leadership, interpersonal and problem-solving skills (ODEP, n.d.-a 2023).

Mentorship can take many forms and extends beyond a traditional dyadic structure—a relationship, for example, between one faculty mentor (who is older and has more professional experience than a mentee) and student mentee working together in-person to achieve mutual goals. Mentoring relationships can take place virtually (e.g., e-mentoring) or involve peers—a person close in age to their mentee that may become the source of ideas and plans or provide guidance in an informal manner. The power of networks has been empirically demonstrated to influence the personal and professional outcomes of individuals with and without disabilities (Montgomery, 2017; Sorcinelli and Yun, 2007). Individuals in a variety of different institutional roles, for example, managers, research supervisors, advisors, can serve as mentors. However individuals holding those roles are not always mentors, and those who are do not necessarily engage in relationships that are effective.

An effective mentor can be an individual with or without a disability. Mentors who have similar disabilities are able to serve as role models and they can offer responses to questions mentees have about their own disabilities, securing accommodations, and career development in STEM. The power of such a relationship was articulated by Dr. Michele Cooke, professor of earth, geographic, and climate sciences at the University of Massachusetts Amherst, in her introduction of the "Fireside Chats" at the 2023 Disrupting Ableism and Advancing STEM workshop series:

> I had a very beneficial relationship with a mentor who was also disabled during my master's program. Up until that point I had never met a mentor who was

> disabled. And that definitely made a difference. Seeing someone who was deaf and hard of hearing so successful changed my perspective on professionalism and possibilities. For my professional career meeting that person made me elevate my goal. I think that is what a good mentor does (Cooke, 2023).

However, due to a limited number of mentors with disabilities in STEM (Sukhai and Mohler, 2017), more often than not, students and others with disabilities in STEM must engage proactively with scientists without disabilities. Scientists without disabilities can play an important role in removing stereotypes, connecting mentees to science professionals in their own networks, and serving as an advocate for accessibility and inclusion in their organizations (Sukhai and Mohler, 2017). Mentoring relationships have the power to extend access and opportunity not just on a person-by-person basis. Mondisa et al. (2021) call for robust STEM mentoring ecosystems that extend responsibility for robust mentoring relationships to the institutional and policy environments within which those relationships are embedded. In its most effective form, an ecological approach to mentorship can disrupt ableism—the "ideas, practices, institutions, and social relations that presume able-bodiedness, and by so doing, construct persons with disabilities as marginalized, oppressed, and largely invisible 'others'" (Chouinard, 1997, 380)—permeating our STEM institutional environments.

In the rest of this paper we will discuss (1) the benefits and challenges to mentorship for individuals with disabilities and their mentors; (2) the role that the STEM mentorship ecosystem (including governmental and nongovernmental employers, colleges and universities, and national professional and disciplinary societies) can play in disrupting ableism; and (3) practices that

individual mentors and mentees can implement to foster robust relationships that can bridge the aforementioned access and opportunity gaps.

BENEFITS OF MENTORSHIP FOR MENTEES WITH DISABILITIES AND THEIR MENTORS

Social science research has robustly documented the benefits of high-quality mentorship for both mentees with and without disabilities in STEM. In particular, mentorship has the potential to play a powerful role in supporting the persistence of individuals who have been historically and systematically excluded from STEM fields at all career stages (Byars-Winston et al., 2015; Byars-Winston et. al., 2016). Potential benefits of mentorship for mentees with disabilities include the following:

- *Identity affirmation.* Individuals with identities that have historically been institutionally marginalized can have those identities affirmed by mentors with or without disabilities. In the Kreider et al. (2018, 10) study at the University of Florida, students reported an enhanced view of their disability as a "difference in thinking and learning rather than a deficiency or disability." A student's identity as someone with a disability can also be affirmed through the exposure to role models who share their own lived experiences (Sukhai and Mohler, 2017).
- *Sense of belonging and connectivity.* Silverman and Bell (2020) recognized the power of mentors to support the building of a visually impaired mentee's network with other STEM professionals, allowing them to demonstrate competence that can serve to break down stereotypes and connect mentees to professional opportunities they may

not previously had access to. Mentees with disabilities can also benefit from being connected to others with disabilities who can answer questions about accommodations generally and/or within the context of working in a specific field of study (Sukhai and Mohler, 2017). The power of a mentee having access to a close relationship with positive adult role models cannot be understated (Stumbo et al., 2010/2011).

- *Increased self-efficacy.* Mentors can play a powerful role in building the self-efficacy (the belief that one can succeed in their chosen field) of mentees (Butz et al., 2018; Varghese and Finkelstein 2021). In their report of a study involving 170 blind adults, Silverman and Bell (2020) noted the role mentors can play in helping mentees overcome self-doubt through both support and high expectations.
- *Problem-solving assistance and productivity.* Educational institutions and employers have a great interest not just in the personal development of employees but also in their ability to problem-solve. Kreider et al. (2021) demonstrated the important role a mentor of individuals with learning disabilities can play in big-picture thinking, breaking tasks down, managing stress and time, developing organizational strategies, and providing any disability-specific coping strategies.

Beneficial outcomes also are experienced by *mentors*—both those with disabilities and those without disabilities—in these relationships. However, a smaller literature base exists about these experiences. For all sociocultural groups of mentors, beneficial subjective and objective outcomes have been identified and include job satisfaction, increased organizational commitment, enhanced meaning and purpose, as well as increased energy about their work (Eby

et al., 2006; Ghosh and Reio, 2013; Hillier et al., 2018). Some of these benefits to mentors were articulated by participants at the Fireside Chats held during the third virtual session of the Disrupting Ableism and Advancing STEM workshop. Dr. Dean Tantillo is advisor to Dr. Hoby Wedler and does not have a visual disability. He expressed how much fun he had addressing accessibility problems and found it very rewarding to get other members of the group excited about the solutions they came up with. He also mentioned how serving as a mentor to Dr. Wedler "got me thinking differently about scientific problems … and nonscientific problems … and you know, if you ask me what I want for my birthday, that's what I want" (Tantillo, 2023). In their in-depth qualitative study of deaf mentor/mentee dyads, Listman and Dingus-Eason (2018) found that being a mentor allowed them to serve as role models about what it means to be a deaf scientist, specifically making transparent the unwritten social norms of academia. They also discussed the enjoyment they got from helping mentees foster self-advocacy skills and network with a broader scientific community. In their article reporting on the experience of peer mentors without disabilities working with mentees who are neurodiverse, Hillier et al. (2018) found mentors reporting personal growth and the development and enhancement of skills (including patience, flexibility, knowing when to ask for help, and "thinking on their feet") as well as enhanced knowledge about disabilities and how stigma is experienced within the disability community. Additional empirical studies are needed to explore the mentorship outcomes for mentors.

CHALLENGES OF MENTORSHIP FOR MENTEES WITH DISABILITIES AND THEIR MENTORS

It is important to highlight challenges that prevent mentees with disabilities and their mentors from participating and enjoying the above-mentioned benefits of mentoring relationships. Specific challenges may vary by disability type, but shared challenges include the following:

- *Underrepresentation in education and work.* Individuals with disabilities are underrepresented in STEM educational programs and workplaces. Individuals with at least one disability make up 3 percent of the STEM workforce. Individuals with at least one disability earn 11 percent of science and engineering doctoral degrees (NCSES, 2023). This underrepresentation results in two realities in STEM education and the STEM workforce: (1) mentees who may be interested in being paired with mentors with disabilities may find it difficult to find one and enjoy the many unique benefits of those mentoring relationships; (2) mentors with disabilities experiencing work-related stress as a result of pressure to serve as mentors to this population.
- *Complexities of disclosure.* The process of disclosing a disability that needs to be addressed and/or accommodated in educational or professional settings can be challenging for mentors and mentees. Individuals with disabilities may choose (or not choose) to disclose a disability to their relational partner. Mentees with disabilities may choose to disclose a disability and request an accommodation from an accommodations specialist but not share this with a STEM mentor. There are many benefits to disclosure (facilitates accommodation, promotes openness and trust,

protects against discrimination). Many individuals with disabilities hesitate to disclose their disability due to the fear of stigma from a mentor or loss of privacy. Mentors (both those with disabilities and without disabilities) are often not educated in the policies for or unprepared to respond to an accommodation request from a mentee. A lack of disclosure makes it difficult for the employers and/or education programs to provide the reasonable accommodations needed for the students to enjoy both the benefits of mentoring and academic or professional success (Bower, 2023; Sukhai and Mohler, 2017; Grimes et al., 2020).

- *Access to networks.* Individuals with disabilities often have less access to navigational capital in institutions marked by ableism. Access to scientific social communities is critical for all individuals pursuing education and work in STEM (Listman and Dingus-Eason, 2018).
- *Inaccessible websites.* According to Greg et al. (2017, 205), "For students with disabilities specifically, use of virtual worlds may offer control over identity and representation, thus positively influencing persistence factors such as self-determination." Websites that are not accessible could prevent individuals with disabilities, especially those who are blind or have low vision, from participating in e-mentoring and other web-based programs. These websites are usually built without following the World Wide Web Consortium Accessibility standards and guidelines (https://www.w3.org/).
- *Mentors lacking disability- and accessibility-related information.* Mentorship education is a component of successful mentoring relationships (NASEM, 2019). All mentors and mentees in STEM (those with and without disabilities) can benefit from

evidence-based mentorship education. As mentioned previously, mentors without disabilities (or mentors with different disabilities than their mentees) often do not know how to handle issues such as boundaries, disclosure of disability-related information, or how to create accessible educational and/or research environments.

- *Low expectations.* Mentors who have low expectations for their mentees with disabilities will not encourage mentees to challenge themselves or step out of their comfort zones. This may result in mentees questioning their own skills and abilities (Fuentes et al., 2023).

Edmund Asiedu, current ADA coordinator and disability service facilitator at the New York City Department of Transportation and former campus coordinator for the Workforce Recruitment Program for students with disabilities at Columbia Mailman School of Public Health, also noted additional challenges (Asiedu, 2023):

- *Lack of inclusion of individuals with disabilities in mentoring programs*. Mentoring programs usually do not include people with disabilities because of extra funds needed to provide reasonable accommodations. This makes it difficult for individuals with disabilities to find mentoring programs that are tailored to their needs.
- *Access to career development resources.* Faculty members participating in mentoring programs may not be aware of the available career development resources specifically tailored to individuals with disabilities (e.g., the federal government's Workforce Recruitment Program that helps college graduates who have disabilities find their dream jobs). This could prevent the mentee with a disability from achieving their career goals.

Fortunately, employers and educational institutions, national mentorship organizations, and scientific disciplinary societies are critical components of the broader STEM mentoring ecosystem and can both mitigate some of these challenges and promote beneficial outcomes for mentees with disabilities and their mentors.

DISRUPTING ABLEISM REQUIRES CHANGE ACROSS THE STEM MENTORING ECOSYSTEM

According to Brown et al. (2010, 108), "Students with disabilities are provided with the best opportunity for mentoring success when a flexible, multi-layered system of support exists." Critical components of multilayered STEM ecosystems of support are employers and educational institutions, national mentorship organizations, and STEM disciplinary societies.

Employers and Educational Institutions

To attract more students and researchers with disabilities, STEM organizations should create workplaces or campuses that welcome and promote the success of all individuals regardless of disability status. This is a challenge for many STEM organizations (especially those in academia) that are marked by ableism and reflect "a system designed for fully fit and healthy people … does little to account for those who fall outside those parameters" (Byrne, 2021, para. 1).

In her remarks during the Creating Disability-Inclusive Workforces and Workplaces segment of the Disrupting Ableism and Advancing STEM workshop series, Amy Bower, Ph.D.,

emphasized how crucial it is for educational institutions and/or employers to push to transform their organizations to go beyond compliance and provision of accommodations to students and/or employees with disabilities (Bower, 2023). The following suggestions reflect some possible next steps for these institutions:

- *Assess how policies and practices of disclosure and provision of accommodations are enacted in the organization.* To go beyond compliance and the provision of accommodations, employers need to first ensure that policies are accessible, are understood, and are being enacted in the most effective and inclusive ways possible. If policies and the related implementation of those policies are effective, mentors and mentees should be able to develop creative ways of working together to achieve shared goals. An organizational assessment may include exploring answers to the following questions:
    - Are opportunities provided to allow people with disabilities to disclose their disability so accommodations can be provided in the application process, during onboarding, and in support of performing the essential functions of that job (ADA National Network, n.d.). The process of applying for and receiving reasonable accommodations should be transparent and barrier-free.
    - Do educational materials (e.g., documents) exist that will specifically let individuals with (invisible) disabilities know what their disclosure will mean for the university or organization?
    - Is the institution's disability inclusion policy visible on the organization's website and/or other electronic communication channels? Are website accessibility statements posted publicly to explicitly lay out efforts being made to make all

digital contents accessible and how people can provide feedback for enhancement?

- Are organizational leaders engaging in disclosure of disabilities? What barriers are they facing?
- Do educational resources exist to educate mentors and mentees about ableism, disability inclusion, and how to move beyond disclosure and accommodation to create robust working relationships and effective teams?

Once this assessment is done, organizations can appoint officers and cross-functional teams to ensure accountability and continuous quality improvement of these efforts.

- *Provide services that will provide individuals with disabilities access to networks*. This can be done in several ways, including strategic collecting and distribution (with permission) of names and contact information of alumni/ae with disabilities in the STEM workforce. A mentoring program may also use such a list of alumni with disabilities in mentor-mentee matching. The City University of New York (CUNY) established their CUNY LEADS program (CUNY School of Professional Studies, n.d.) to facilitate successful academic and career outcomes for students with disabilities. Programmatic activities include academic advising and career counseling, résumé and interview preparation, internship preparation, and job search and placement assistance. The development of a strategic communication plan will enable this information to make its way to mentor/mentee pairs.
- *Support student and/or employee resource groups to promote peer mentorship*. According to Hastings (2009), “Disability resource groups may provide a way for

employees with disabilities to support one another, but for many, the goal is business results." The existence of student or employee resource groups send a powerful message to prospective employees or students about an organization's commitment to raising awareness and addressing issues that affect mentors and mentees with disabilities. The presence of student disability organizations or employee resource groups can also serve as a way to promote mentor-mentee matches.

- *Consider the role of mentors and mentorship during critical transitions* such as admission/hiring, orientation/onboarding, advancement/evaluation, and graduation/next steps for employment. Leake et al. (2011) reported that their research participants mentioned mentors as their role models and key motivators for their success socially, academically, and professionally. For example, mentors can review résumés/CVs of mentees with disabilities and offer them access to their networks when job searching.
- *Publicize and create programming around National Disability Employment Awareness Month (NDEAM), Disability Mentoring Day (DMD), and Disability Pride Month.* NDEAM is celebrated every October by many organizations in the United States to recognize and honor important contributions by employees with disabilities and showcase workplace policies that benefit both employees and employers (EARN, n.d.-a). DMD is a national effort coordinated by the American Association of People with Disabilities (AAPD) to promote career development for students and jobseekers with disabilities through career exploration and ongoing mentoring relationships (AAPD, n.d.). DMD is celebrated during the third week of October. STEM organizations are also encouraged to celebrate Disability Pride Month in July. The

Americans with Disabilities Act (P.L. 101-336) was passed in July 1990, and it is celebrated each year in July. These celebrations, when coupled with real change to policies and practices, may serve to bring awareness of an organization's commitment to promoting and including individuals with disabilities and their disability mentorship programs. STEM organizations should not just celebrate NDEAM, but practically pursue an initiative that could be used to recruit, hire, and retain employees with disabilities, avoiding inauthentic or performative displays of support (Kutlaca and Radke, 2023).

- *Reward excellence in mentorship.* Supporting excellence in mentorship is critical and can be done through the creation of mentorship awards and revising criteria in annual review and promotion processes. STEM institutions should acknowledge and honor faculty members, managers, and administrators with or without disabilities who volunteer their precious time to mentor students or employees with disabilities at events held annually. Additionally, this may be helpful in attracting more faculty members to become mentors.
- *Use data and research for broader conversations about inclusive mentoring*. Collect data on students or employees with disabilities and mentors who participate in institutions' mentoring programs, which would be used to make informed decisions. Bonnielin Swenor, Ph.D., M.P.H., in response to a question posed by a WITH Foundation (https://withfoundation.org/vision-mission-values-history/) staff member emphasized the importance of using data to advance equity for individuals with disabilities: "Data is necessary for identifying disparities among people with

disabilities and developing strategies to address these inequities" (Swenor, n.d., para. 4).

- *Integrate disability etiquette into educational programming for mentors and mentees.* Making continuing education available to mentors and mentees is a critical intervention to support inclusive mentoring relationships (NASEM, 2019). Institutional efforts could involve training (and making resources available to) students, faculty members, and administrators, including senior staff members on topics such as the importance of using inclusive language and providing reasonable accommodations. Workshops and resources could support high-quality communication and writing about individuals with disabilities (disability etiquette), fulfillment of requirements of the American with Disabilities Act, increased digital inclusion, and implementation of disclosure and accommodation policies. All educational programs and resources can contribute to a larger institutional strategy to support increased empathy for students or employees with disability, leading (hopefully) to a reduction in stigmatization associated with disability disclosure.
- *Build information and communication infrastructure in support of accessibility initiatives.* Examine all information and communication technology infrastructure to ensure that individuals with disabilities are fully included across all phases of employment and education (EARN, n.d.-b).
- *Include disability in the organization's diversity, equity, and inclusion policy*. As STEM organizations make policies that would allow them to build more inclusive workplaces, disability should be included both in policy and in practice. The disability community constitutes the largest (with more than 50 million individuals)

and most diverse minority group in the United States (ODEP, n.d.-b), which makes their perspectives more intersectional. Cross-cutting topics, including mentoring, implicit bias, laws and policies, and communicating across differences, could serve as points of collaboration between those working in spaces to promote inclusivity across different sociocultural categories.

National Mentorship Organizations

Another component of a robust STEM mentoring ecosystem is *national mentorship organizations*. These are national organizations or professional associations that promote mentorship more broadly, and some, mentorship for individuals with disabilities more specifically. These organizations are formed by professional societies or advocacy organizations and can be resources to mentors and mentees for education and policy assistance. They can also be a source of support for individuals with disabilities pursuing careers in STEM to identify possible mentors. These organizations are established to:

- create mentoring opportunities for all people including individuals with disabilities;
- increase awareness of inclusive mentoring;
- recognize mentors and mentoring programs for their contributions to inclusive mentoring; and/or
- promote evidence-based best practices that increase the quality of mentoring relationships for all people, including individuals with disabilities.

Some examples of these national organizations are as follows:

- *National Disability Mentoring Coalition (NDMC).* Established in 2014, the NDMC aims to raise awareness about the importance and impact of mentoring in the lives of people with disabilities and to increase the number and quality of disability mentoring programs around the country (NDMC, n.d.-a). NDMC is a membership organization dedicated to increasing the awareness, quality, and impact of mentoring for individuals with disabilities. The network is made up of more than 500 individuals from more than 220 organizations such as the National Council on Independent Living, Association of University Centers on Disabilities, American Association of People with Disabilities, University of Wisconsin–Madison, Partners for Youth with Disabilities, Cornell University and Salesforce. NDMC organizes the Susan M. Daniels Hall of Fame every year to honor those who are making a significant difference in the lives of youth and adults with disabilities through mentoring and to raise awareness about the importance of mentoring for individuals with disabilities (NDMC, n.d.-b). It offers scholarships to undergraduate students with disabilities who are pursuing degrees in STEM and other business programs. NDMC has other programs geared toward professional advancement of people with disabilities.
- *National Research Mentoring Network (NRMN).* In FY 2014, the National Research Mentoring Network (www.nrmnet.net) was established with funding from the National Institute of Health's (NIH) Diversity Program Consortium. This initiative was in part a response to the findings from the Ginther et al. (2011) report that revealed great disparities in grant funding in NIH's R01 award programs. The mission of the NRMN is to "provide all trainees across the biomedical, behavioral,

clinical, and social sciences with evidence-based mentorship and professional development programming that emphasizes the benefits and challenges of diversity, inclusivity, and culture within mentoring relationships, and more broadly the research workforce" (Sorkness et al., 2017). Although not designed to specifically serve individuals with disabilities in STEM, the NRMN website is a platform for mentor-mentee matching, professional development, and networking.

- *MENTOR National.* MENTOR's mission is to fuel the quality and quantity of mentoring relationships for America's young people and to close the mentoring gap for the one in three young people growing up without this critical support (MENTOR National, n.d.). On July 21, 2021, MENTOR National, AAPD, and NDMC partnered to advance inclusive mentoring by engaging U.S. Congress members on Capitol Hill (Shield, 2021). The organization has resources dedicated to fostering inclusive mentoring for all young people with disabilities. MENTOR and Partners for Youth with Disabilities team up every year to offer Disability Mentoring Certification that allows youth mentoring programs to become members of the NDMC.

STEM Disciplinary/Professional Societies

The National Academies, in their consensus study on mentorship, identified the important role that disciplinary societies can play in the development of rich cultures for mentorship (NASEM, 2019). As best practice, disciplinary societies could do the following as recommended by the Employer Assistance and Resource Network on Disability Inclusion (2020).

- Conduct a needs assessment
- Lay the groundwork and set the program objectives

- Align the mentoring program with the organizational goals, strategies, and missions
- Develop the mentoring program
- Train the participants
- Develop a mentoring roadmap
- Gain senior leadership support
- Recruit a program manager
- Create a steering committee, or enlist an Employee Resource Group to lead the effort

The following disciplinary societies have a history of leadership in this area.

- *American Public Health Disability Section Mentoring Program*. The Disability Section Mentoring Program of the American Public Health Association aims to strengthen the public health workforce and improve representation of people with disabilities and our allies in leadership (APHA, n.d.). The program supports and guides early-career professionals interested in disability and public health to navigate school and work. It also advocates for an inclusive public health in the near future.
- *American Psychological Association (APA) Disability Mentoring Program*. The mentoring program supports psychology students with disabilities, disabled psychologists entering the field, and psychologists in the field who have acquired a disability (APA, n.d.). For more than two decades, young professionals or mentees who participate in this program attain an increased understanding of a discipline, receive guidance and advice, gain higher confidence levels, and acquire access to networks and other resources.

- *Association for Research in Otolaryngology (ARO) (Supports for Deaf and Hard-of-Hearing STEM Professionals).* The network was initially formed in 1992 at a professional society meeting for the ARO and has continued to grow based on shared experiences at those meetings and in other STEM environments (Huyck et al., 2021). The group has more than 110 deaf and hard-of-hearing engineers, scientists, and clinicians, most of whom are active in clinical practice and/or auditory research (Adler et al., 2017). The group has been successful in collaborating with other professional organizations to implement successful, practical strategies for improving accommodations, raising awareness, and promoting academic, research, and career development opportunities for diverse trainees (Huyck et al., 2021).
- *American Association for the Advancement of Science* (AAAS, n.d.). The AAAS has a signature program called Entry Point! that was created to increase diversity of the STEM workforce focusing on scientists with disabilities. This program engages STEM employers across industries to place individuals with disabilities into 10-week paid internships. In addition, the AAAS sponsors Mentor Awards to honor individuals who have gone above and beyond to provide students from minority groups, including individuals with disabilities, with career guidance in science and engineering.

STEM disciplinary and professional societies have the potential to be a critical part of the ecosystem that supports the creation and cultivation of inclusive mentoring relationships in STEM.

THE ROLES FOR INDIVIDUAL MENTORS AND MENTEES IN DISRUPTING ABLEISM IN STEM

We have used the term mentorship to suggest to the agency that both mentors and mentees—with and without disabilities—have to contribute to robust and effective mentoring relationships. Previous work published by the National Academies (NASEM, 2019) identified four factors critical to successful mentoring relationships: *expectations setting, trust building, self-reflection, and education/training*. This section discusses the roles that mentors and mentees can play in maximizing those four factors while adding a factor critical to mentoring relationships involving mentees with disabilities—the importance of creative exploration and initiative-taking by both relational partners.

Clarify and Align Expectations

One of the factors associated with success in mentoring relationships is a constant review of explicit and transparent expectations that each relational partner has of the mentoring relationship. It is critical for mentors to have the same high expectations for mentees with disabilities as they would for those without disabilities (EARN, n.d.-c; EARN, n.d.-d). When mentors challenge mentees with disabilities it boosts their morale and increases the level of their confidence. This allows mentees to move out of their comfort zone and think more broadly. Mentees should also have high expectations of mentors but realize that one mentor cannot meet all the needs of every mentee. By utilizing tools such as mentoring agreements and/or mentoring compacts (Diggs-Andrews et al., 2021), mentors and mentees can share expectations about the

role of the mentor in specific areas of a mentee's personal and professional development, including introductions to other STEM professionals, career guidance and resume review, or assistance solving workplace challenges. A written document can also include expectations about the regularity and locations of meetings and the modality (in-person or online) the mentor and mentee will use to connect with one another. One of the most important expectations that mentors and their mentees with disabilities can discuss are their shared expectations for anonymity and confidentiality. Aligning expectations should happen on a regular basis throughout the mentoring relationship. Mentors and mentees should meet regularly, reiterate and/or articulate changes to expectations, and seek feedback from the other relational partner.

Working to Proactively Build Trust

Building trust is critical for any relationship. Mayer et al. (1995, 712) offered this definition of trust: "the willingness of a party to be vulnerable to the actions of another party based upon the expectations that the other will perform a particular action." In the domain of mentoring, this "would include the skills, competencies and characteristics" (Leck and Orser, 2013, 416) that would indicate to the mentor or mentee that the other was committed to their relational work together. All relational partners in a mentoring relationship can contribute to trust building, but mentors and mentees can make great progress to that end by demonstrating a willingness to learn (Leck and Orser, 2013). Specifically, mentors without disabilities who are mentoring mentees with disabilities can begin to build trust by demonstrating a willingness to learn about the lived experiences of their mentees and learn how to be an advocate against ableism (Ostrove et al., 2019). A critical component of becoming an effective advocate is "an ongoing process grounded in self-reflection and engaged action" (Ostrove et al., 2019, 925).

Disclosure of disabilities by both the mentor and mentee, especially those with disabilities that are invisible, can communicate a willingness to be vulnerable and therefore a belief that the other relational partner is trustworthy.

A mentor's willingness to recognize the abilities of mentees with disabilities can also build trust in the mentoring relationship. It is important for someone mentoring individuals with disabilities to recognize and acknowledge that the person has abilities and capabilities that can enrich the mentoring process. Early recognition of the strengths and abilities of mentees with disabilities by the mentor communicates a degree of open-mindedness and respect that contributes to trust building in the relationship. Finally, a mentor and mentees' willingness to explore shared values can also contribute to building trust in the relationship. As stated previously, a mentor and mentee do not have to share all values. However, identifying points of shared purpose can be very helpful and can lead to a better working relationship between the mentors and mentees with disabilities.

Engage in Self-Reflection

Successful mentoring relationships are developed and expanded when all relational partners engage in self-reflection.

- Mentors and mentees willingness to learn about their own biases. The Harvard Implicit Association Test (https://implicit.harvard.edu/implicit/takeatest.html) is a free tool to use to examine one's own biases across a variety of dimensions of diversity. Mentors with and without disabilities would benefit from assessing their internalized ableism and other biases that they may not have been previously aware of.

- For both a mentor and a mentee, the willingness to acknowledge the very real effect that intersecting marginalized identities play in the other's experience of the STEM educational and/or work environment. Mireles and colleagues (2022) highlighted the racist ableism that Black and Brown students with disabilities navigate and emphasized that racist ableism "positions them as intellectually and academically inferior on the basis of racialized perceptions of ability, capability, and productivity" (19). Therefore, mentors and other institutional leaders (especially those that are White) must consider that the lived experiences of individuals of disabilities are not homogenous. The willingness of mentees with disabilities to reflect upon intersecting marginalized identities is also critical. For example, a White cisgender male mentee with a physical disability can demonstrate a willingness to learn about the lived experience of their Black nonbinary mentor without a disability. Willingness to reflect about the implications of intersectional identities on both parties can powerfully move partners forward toward establishing a relationship of mutual curiosity and engagement.
- Mentees should reflect upon the nature of their own career and professional development needs. A mentee might ask themselves questions such as: What areas are a priority right now in my academic and/or professional career? What areas of skill development are critical at this time? What areas do I need more confidence in?
- Mentors should consider their own affordances and constraints as a career or academic mentor. No one mentor can provide everything that a mentee needs. A mentor might ask: What areas of my discipline do I feel particularly positioned (e.g., theory, research, application) to mentor students? What areas do I have less

experience or confidence in? How can I make those areas of strength accessible to all regardless of physical or cognitive disability? What colleagues can be thought partners?

- Mentors should reflect upon their own identity as an individual with or without a disability. How will that affect their strengths and limitations as a mentor? How can you engage a larger network of support for your mentee and for yourself as a mentor engaging in ongoing professional development?

Seek Out Training and Educational Resources

Formal evidence-based mentorship education has been proven to be an effective way to improve the mentoring behaviors of both mentees and mentors in STEM environments. The National Academies' consensus study, *The Science of Effective Mentorship in STEM* (NASEM, 2019) highlighted a particularly effective approach developed by scientists at the University of Wisconsin–Madison called *Entering Mentoring*. This mentorship education curriculum is available on the portal of the Center for the Improvement of Mentored Experiences in Research (www.cimerproject.org) along with the curricula for mentees, Mentoring Up and Entering Research. All of these mentorship education approaches are competency driven and systematically provide participants with case studies and activities to help them develop critical mentoring competencies including maintaining effective communication, aligning expectations, promoting independence, reflecting on diversity and establishing a practice of inclusion, enhancing cultural awareness, promoting research self-efficacy, and others.

Occasionally a mentor and mentee will have the same disability. However, when a mentor and mentee do not share a disability and/or one of the individuals has a disability and the

other does not, it is critical that the partners increase their awareness about disability issues, become informed about disability etiquette (e.g., person-first, disability-first language), seek out accurate information about how to best support individuals with specific disabilities through accommodations, learn about the career development resources that exist locally and nationally for individuals with disabilities, and develop leadership skills to counter oppression by disrupting structural barriers and attitudes that reinforce ableism (Ostrove et al., 2019). In providing recommendations to individuals running mentoring programs for individuals with disabilities, Stumbo et al. (2010/2011) suggested that programs provide specific professional development to mentors to enable students to succeed in their pursuit of STEM-related careers, utilize various technologies as empowerment tools, and reinforce the importance of applying universal design to make STEM education and research more accessible.

Take Initiative, Innovate, and Explore

For mentors working with mentees with disabilities and the mentees themselves, it is critical that both parties energetically innovate, take initiative, and explore options to optimize their work together. Mentors and their mentees can play a critical role in disrupting ableism in STEM by questioning the status quo—the status quo about how science is learned and advanced. For example, Hoby Wedler, Ph.D., and Dean J. Tantillo, Ph.D., shared their experience during one of the sessions at the 2023 Disrupting Ableism and Advancing STEM workshop series as a mentee with disability and mentor, respectively, about how they worked together to remove roadblocks and engaged in collaborative problem-solving:

> It was an opportunity for us to sort of test out how computational chemistry would work for me and how we could make things accessible in the lab and really how we could make most of the processes we utilize to study organic chemistry from a computational perspective in mechanistic organic chemistry accessible to me.… I think a lot of what we discovered a lot of the sighted students in the lab found our techniques to be really useful and productive for them as well. For instance, making a 3D printout of a molecule that someone has been visualizing on the screen, [which] I had never visualized, of course, but someone has been utilizing a visual interface to look at, for sometimes years at a time, that now they can hold in their hands and manipulate. It is fun how that helps everybody (Wedler, 2023).

Having a mentor who is willing to work with a mentee (in this case Dean Tantillo) who has a disability is crucial, and mentees have repeatedly expressed the value of mentors who are hands-on and creative about accommodations (Sukhai and Mohler, 2017).

One of the benefits of inclusive mentoring is the opportunity to innovate, as both mentors and mentees with disabilities are looking for solutions to frequent issues they face during the mentoring relationship. Mentors and mentees with disabilities work together to remove barriers that could impede the progress of their relationship by troubleshooting and finding solutions to not only digital access issues but physical access issues as well. This allows mentors to be flexible and willing to work with the mentees even if they have to communicate through a sign language interpreter or a device. As STEM professionals, it is important for mentors and mentees with disabilities to work together to solve common issues that are encountered by the latter. A typical example is including the mentees with disabilities in how the research laboratory is set

up, focusing on height of tables or desks, lighting, and so forth. This could lead to everyone feeling comfortable moving around at the research laboratory. Mentees with disabilities should not hesitate to take initiative in the mentoring relationship, through setting meeting agendas, offering new ideas, and asking questions promptly when challenges arise. They should also be proactive in exploring alumni networks and employee resource groups that exist at their organizations.

CONCLUSION

In *The Science of Effective Mentorship in STEM*, the National Academies of Sciences, Engineering, and Medicine concluded that there is a robust "science of mentorship" in STEM and that both mentors and mentees can develop skills in mentorship through "intentional and reflective practice and cultural responsiveness" (NASEM, 2019, xi). The report explicitly recognized the reality that individuals with a wide variety of marginalized identities (including those with marginalized racial/ethnic, socioeconomic, educational, gender, and sexual orientation identities), including individuals with disabilities, are less likely to be integrated fully into STEM environments. However, the charge for the authoring committee was to focus broadly on the science of mentorship as it applied to systematically excluded groups more generally (as opposed to focusing on mentorship as it relates to individuals with disabilities). One goal of this paper was to amplify how the broader mentorship literature and the specific literature about the experiences of individuals with disabilities can expand, inform, and be integrated with one another.

This paper identified both the benefits and the challenges in mentorship experienced by individuals with disabilities and their mentors. Benefits to mentees with disabilities include

identity affirmation, increased self-efficacy, sense of belonging and productivity, and persistence and productivity. Mentors of individuals with disabilities experience enhanced meaning and purpose in their work.

Individuals with disabilities, both in roles as mentors and in roles as mentees, face several unique challenges in mentoring relationships compared with their peers without disabilities. Some of these challenges include access to mentors and/or mentees with a shared lived experience (caused by underrepresentation of individuals with disabilities in education and work), the complexities of disclosure, access to networks and electronic resources, mentors and mentees lacking disability- and accessibility-related information, low expectations that mentors and mentees without disabilities may have of their relational partner, and stress related to a heavy mentoring load that might be faced by mentors with disabilities. These challenges can sometimes prevent mentees with disabilities from achieving their academic and career goals and reduce job satisfaction and organizational commitment for mentors with disabilities. It is important that these challenges be explored and addressed at the beginning of any informal or formal mentoring relationship to ensure that mentors and mentees can fully participate in and benefit from these programs. Individuals with disabilities have multiple intersecting sociocultural identities that result in multiple oppressions for some. We argue that it is critical for both mentors without and mentees with disabilities to reflect upon intersecting identities and consider how a mentee's experience with ableism can be amplified when facing other systemic oppressions.

Robust STEM mentorship ecosystems are needed to reinforce and support effective mentoring relationships. STEM mentorship ecosystems include educational institutions and employers, national organizations with mentoring as a primary focus, and professional/disciplinary societies. Organizations that compose the STEM ecosystem are critical

in supporting mentees and mentors with disabilities who are facing academic, social, and economic challenges in the STEM ecosystem. All members of the STEM workforce—mentors and mentees and those with and without disabilities—have a part to play in transforming organizational cultures in support of inclusive excellence in STEM. It is critical that mentors and mentees work together to clarify and align expectations (of the content and process of their work together); work proactively to build trust; engage in self-reflection; seek out training and educational resources; and take initiative, innovate, and explore in their work together.

It is important that leaders factor disability into all elements of the process of starting a mentoring program and providing support for mentors and mentees to succeed in those relationships and thrive in their careers. Proactive and intentional investment in evidence-based mentoring practices and policies that are inclusive of all STEM professionals, including those with disabilities, is critical. We call on all STEM institutions to create programs, institute policies, and reinforce practices that empower students, researchers, and all employees with disabilities to reach their full potential and contribute to building a robust STEM infrastructure in the years and decades to come.

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