Synthesizing disabled physics students' pathways to access: a call for more access talk

Jacquelyn J. Chini (she/her)

Department of Physics, University of Central Florida, 4111 Libra Drive, Orlando, Florida, 32816

Erin M. Scanlon (she/her)

Department of Physics, University of Connecticut - Avery Point, 1084 Shennecossett Rd., Groton, CT 06340

We draw on methods from lines-of-argument analysis in Critical Interpretive Synthesis to synthesize and critique pathways through which disabled students access supports in postsecondary STEM. Integrating recent literature about pathways to access in postsecondary education as well as our ongoing research, we describe various mechanisms through which disabled students are currently provided (or not provided) access in postsecondary STEM and identify strengths and weaknesses with these various pathways. Specifically, we describe and problematize the typical accommodations process, which requires students to register with a Disability Resource Center which then negotiates accommodations with the disabled student and their instructors. Next, we describe alternatives to the traditional accommodations model, such as normalizing discussion of access needs (a tenant of disability justice), allowing individual instructors to validate students' needs and appropriate accommodations, and access through interdependence (another tenant of disability justice). We describe dimensions along which these pathways vary, such as process, disclosure, requirements for validity, and burden. We suggest instructors and mentors pull from all these models to create a transparent ecosystem of supports.

I. INTRODUCTION

In the United States, the Americans with Disabilities Act and Section 504 of the Rehabilitation Act provide legal obligations for postsecondary institutions to provide equal access and full participation for disabled students. Analyzing similar laws in a Canadian context, Prema and Dhand (2019) found that such laws do not create a "positive obligation" for institutions or instructors to include students. Rather, they state, "the onus of asserting rights or identifying Code breaches rests with students… As a result, those students who lack the will, endurance, means or ability to lodge a formal complaint may continue to be victims of discrimination" [1, pg. 8]. Writing in a British context, Stonehouse calls for physics departments to move beyond satisfying "the letter of the law" to "work with the student to open up opportunities, solve problems, and remove barriers" as well as promote "positive attitudes towards disabled people" [2]. In this paper, we synthesize and critique pathways through which disabled students access supports in postsecondary STEM, drawing both from the extant literature and our own ongoing research projects.

II. METHODOLOGY

A. Critical Interpretive Synthesis

We review extant literature and draw on methods from Critical Interpretive Synthesis to integrate "evidence from across the studies in the review into a coherent theoretical framework comprising a network of constructs and the relationships between them" [3, pg. 5]. Critical Interpretive Synthesis may require creation of synthetic constructs, constructed from the researcher's interpretation of the existing evidence. and may result in "disparate aspects of a phenomenon being unified in a more useful or explanatory way" [3, pg. 5]. Here, we aim to tease out the role of social power across pathways to access in postsecondary STEM education by making comparisons across disparate studies in the extant literature and our own research. Critical Interpretive Synthesis explicitly aims to be *Critical,* by questioning how the extant literature constructs the problem, the assumptions made, and influences on proposed solutions.

B. Data sources

In our broader work, we reviewed science education literature for articles about disability and STEM teaching and identified several recent articles in physics and biology education research that specifically described pathways for including disabled students in postsecondary STEM education. We analyzed two articles by Pfeifer, Stanton and colleagues about modeling self-advocacy for STEM undergraduate students with attention-deficit/hyperactivity disorder (ADHD) and specific learning disabilities (SLD) [4,

5]. These articles emphasize the legally mandated accommodations pathway through a disability resource center (DRC). Scanlon et al. (2021) describe challenges expressed by undergraduate physics students with accessing legally mandated accommodations during the Fall 2020 semester, when many students were taking classes via emergency remote teaching [6]. While modifying the Inclusive Teaching Strategies Inventory for use with postsecondary STEM faculty, Scanlon and Chini (2019) describe faculty's attention to student needs that extend beyond legally mandated accommodations; many faculty described using inclusive practices for "students who need it," and only vaguely defined what qualifies as "needing it" [7]. In an essay, Reinholz and Ridgway (2021) describe an alternative pathway through normalizing the sharing of access needs, which is rooted in disability justice and, the authors claim, would require disrupting ableist norms in STEM [8]. We are currently conducting interviews with disabled students and physics instructors/mentors and leverage their reasoning to explore advantages and disadvantages of each of these pathways to access.

C. Positionality

Both authors identify as white, cis-gender women with disabilities, including anxiety, depression, and migraines. Both authors are physics instructors, have conducted research and professional development about Universal Design for Learning, and have implemented inclusive practices and accommodations in their teaching. However, neither author used formal accommodations during her education.

III. ACCOMMODATION THROUGH AN OFFICE OF STUDENT DISABILITY SERVICES

A. The accommodation process

Pfeifer, Reiter, Hendrickson, and Stanton (2020) model the typical accommodation process for disabled college students [4]. First, the student submits documentation to the DRC, who approves (or denies) the student's documentation. Next, the student meets with a DRC coordinator to agree on initial accommodations. The DRC coordinator sends an accommodations letter to the instructor, and the instructor acknowledges the letter. This establishes the accommodation(s) for the semester.

In our experiences as researchers, mentors, and instructors, we have observed some variation in this model. The first step assumes that students already have documentation for their disability, which is not always the case. For example, in a national survey of students taking physics courses in Fall 2020, one participant responded that their accommodations didn't meet their needs because, "*My accommodations were provisional, as I just got the test*

results this week. Most of the semester I struggled to do my work, and the accommodations were too little too late" [6]. Thus, the step of submitting and having documentation approved is not simple or instantaneous for all students. Second, the model does not describe the process for setting up initial accommodations; we have experienced that some students feel that they were not treated fairly by the DRC coordinator and did not receive their needed accommodations. For example, in an interview we conducted with a disabled physics student about their experiences in physics learning and research environments, the student shared that a barrier in the physics community was professors and the DRC "*thinking they know more than I do about my own experiences*" [9].

Next, at some institutions the DRC sends a draft accommodation letter to the faculty, who can suggest alterations to specific accommodations if they are deemed unreasonable or inappropriate for the given course. In the authors' experience, this can lead to a dispute between the instructor, student, and DRC coordinator. Finally, the model ends at establishing accommodations and does not describe how they are implemented or that instructors may sometimes fail to implement the accommodations, either intentionally or unintentionally. For example, Pfeifer et al. (2020) describe a student who had an extra testing time accommodation, but whose instructor denied them extra time on pop quizzes [4]. Students who need additional time for timed exams likely also need additional time for unannounced quizzes, yet the instructor only agreed to put the students' quiz down first and pick it up last, which amounted to about 45 seconds of extra time.

B. Self-advocacy for accommodations

Pfeifer et al. (2020) interviewed 25 STEM undergraduate students who used accommodations related to ADHD and SLD to explore the applicability of Test's conceptual framework for self-advocacy of disabled individuals in a STEM undergraduate setting [4]. Pfeifer et al. focus on self-advocacy because of the shift in responsibility for seeking and managing accommodations from the school at the pre-college level to the student at the college level. The authors claim that "successful navigation of the accommodation process requires self-advocacy" [4, pg. 2], which has been defined in the literature as the "ability to assertively state wants, needs, and rights, and determine and pursue needed supports, and conduct your own affairs" [10, pg. 6]. Pfeifer et al. investigated how disabled students practice self-advocacy in STEM courses.

There are four components to Test's framework for self-advocacy: 1) knowledge of self, which focuses on the person's self-awareness of their own strengths and weaknesses as a student and disabled person; 2) knowledge of rights, which focuses on awareness of laws and policies; 3) communication, which includes use of assertive, non-aggressive communication; and 4) leadership, which is considered non-essential. Pfeifer et al. also state that they are guided by the social model of disability, which separates biological differences from disability, because "it calls individuals with impairments to take action to improve their own conditions within society," which requires self-advocacy [4, pg. 4].

Based on interview analysis, Pfeifer et al. found evidence for all four components of Test's original framework as well as emergent components not included in the original framework [4]. They group self-advocacy components into three types: knowledge, behaviors, and beliefs. In addition to knowledge of self and rights, Pfeifer et al. found students' self-advocacy also depended on knowledge of STEM learning contexts and accommodations. Communication had to occur both with the STEM instructor and the DRC coordinator, and some students engaged in the self-advocacy behavior "filling gaps" (discussed further in section VI). Additionally, students' self-advocacy was impacted by their beliefs, including their view of disability and agency.

C. Critiques of the accommodations model

A possible strength of the accommodations model is that it is ostensibly transparent, meaning all students will know how to access accommodations, and it is impartial, meaning all students will be treated equally. We argue that since accommodations require self-advocacy, accommodations are *neither transparent nor impartial*. In Pfeifer et al.'s study, some students explained that they did not think accommodations were available in certain class settings, like community colleges and lab courses, indicating the accommodations process is not transparent [4]. Pfeifer et al. highlight the importance of "assertive, non-aggressive communication;" yet, the interpretation of communication depends not just on what a student says and how they say it, but also how the recipient of the communication perceives the student. A Black woman in Ong, Smith, and Ko's (2017) investigation of counterspaces in postsecondary STEM described the need to weigh "defending herself against the risks to her professional reputation" because "once you got the 'angry Black woman' reputation, that was kind of it for you" [11, pg. 218; 12]. Communication is interpreted differently across identities and can include attributing lower intelligence to individuals with speech differences [13].

In fact, the accommodations model can be seen as a way to maintain the status quo of ableism in higher education. Nieminen and Peronen (2021) write, "such approaches have been claimed ableist as they frame disabled students as the problem to be fixed, not the inaccessible design itself" [14]. In our work, we have seen physics instructors rely on this framing to place the blame for struggling in a course on the disabled student. For example, a physics professor participating in an interview about supporting students with executive function disorders stated, "*they have some recourse if you have, you know, a documented illness or whatever, you can take these exams over at the [DRC] where*

they have more time and a quiet environment and other things. So um, whether or not those things seriously affect their test performance, a lot of times just depends on whether they've gone through the trouble of uh of getting diagnosed and then actually taking their test over at [DRC]" [9]. Here, we see that the accommodations model allows the instructor to shift the blame for students struggling with an exam from the exam format, which is shaped by the discipline and instructor, to the student. Challenging processes such as receiving an official diagnosis, establishing accommodations, and risking disability disclosure to peers is described by the above instructor as "*just depends on whether they've gone through the trouble.*" We argue *not* that the instructor is intentionally exclusionary, but rather that the standard accommodations process reinforces academic ableism by absolving individual disciplines and instructors from exclusionary practices by requiring the disabled student to identify themselves as "professionally assessed as different" and employing different ways to engage in the course and assessment.

IV. NORMALIZING ACCESS NEEDS

Reinholz and Ridgway describe the ideas of accessibility and access needs, core issues of disability justice, for STEM learning and research environments [8]. While the notion of "accessibility" often brings to mind resources like American Sign Language (ASL) interpreters and elevators, individuals require many things to fully participate in a space or activity. For example, "other access needs might include an opportunity to stand up and stretch (rather than stay seated for hours at a time), access to gender-neutral restrooms, eating during a meeting, accessible language, breaks between meetings, having participants raise their hands before speaking, or adequate childcare support" [8, pg. 3].

Reinholz and Ridgway describe tensions in creating spaces that are accessible for a variety of individuals. Frameworks such as Universal Design for Learning (UDL) can be applied to proactively "meet varied access needs even without accommodations" [8, pg. 6]. At the same time, Reinholz and Ridgway point out "access needs cannot simply be assumed" [8, pg. 3]. Thus, while proactive accessible design "lowers barriers that may prevent others from self-advocating for their own access needs," [8, pg 6] individual access needs will remain. Thus, it is important to create a culture of stating access needs. This can be done during introductions, just as the culture has shifted to including pronouns. In such an introduction, individuals should be supported to recognize and state that "My access needs are currently being met" rather than "I have no access needs." Yet, Reinholz and Ridgway explain "not all people will feel comfortable or will want to discuss their access needs," thus "it can be helpful to allow for private ways to request certain types of access" [8, pg. 6].

We share the goal of disability justice described by Reinholz and Ridgway. At the same time, we are skeptical of the potential for broad uptake of "access talk" in physics learning and research experiences as well as how a safe place to disclose one's access needs can be created within the physics community at scale. First, we question whether many physics instructors would be interested in implementing access talk in their courses. For example, we have found that even when instructors voluntarily participate in professional development about supporting disabled students, they can still make comments such as "*students who have attention issues a lot of times they'll be taking the test, they'll be okay for the first 20 minutes and then they'll, they'll just be screwing around or something like that*" [9]. While this instructor is interested in supporting disabled students in class, he may not be ready to lead an access check in discussion. Additionally, if students are sharing access needs in front of peers, there is also a risk of a peer disclosing that information to an unsafe person, such as an ableist professor of another course.

We suggest access talk as the topic of intentional culture change through social modeling. As Kattari (2015) explains, "social learning theory has the potential to be used as a framework to improve or reform ableist culture… Peer groups that model acknowledgement of privilege create a desired outcome of being privilege aware" [15, pg. 380]. The culture "at the top" has to change for the practice of sharing access needs "on the ground" to be productive. If a student shares an access need of taking breaks during a three-hour lab course or while working in the lab, colleagues may wonder how they will thrive in a lab in the "real world." Thus, a well-known physics institutional structure could support culture change by implementing and publicizing steps taken to meet individuals' access needs. As Reinhart and Ridgway acknowledge, "normalizing access talk is a necessary and insufficient first step" [8, pg. 7].

V. ACCESS THROUGH INSTRUCTOR JUDGMENT

Scanlon and Chini (2019) modified a survey about inclusive teaching practices in postsecondary education for use with postsecondary STEM faculty [7]. The most substantial change they made was the inclusion of the prompt "I would do this for" with response choices: no students, only students with disabilities, students who need it, and all students. Follow up prompts were included to investigate how physics instructors conceptualized these categories. Across the small pilot sample, there was variation in how physics instructors conceptualized "only students with disabilities." While most participants included students registered with the DRC, several participants also included students who did not register with the DRC but had a diagnosed disability and/or students who identified with a disability but did not have a diagnosis. Thus, students are likely to find that their access to inclusive practices and accommodations varies across instructors. For example, in the national survey of students taking physics courses in Fall 2020, one student shared: "*I didn't activate that*

accommodation for this class for this quarter because I can get the same results just by asking and not having our [DRC] strong-arm the instructor" [6]. This quote suggests the student may first try to have their access needs met by the instructor and only involve the DRC if needed.

Participants responded that they would provide the majority of inclusive teaching practices for "students who need it" [7]. Scanlon and Chini probed how participants defined this group with an open-ended prompt. Six (of 13) participants described "students who need it" as students who engaged in self-advocacy communication with the instructor, such as expressing "that they want the thing" (which can be thought of as sharing an access need) or self-identifying to the instructor. Scanlon and Chini explain, "This can be particularly problematic because not all students want to disclose their needs and/or disability due to stigmatization they experience" [7]. Participants also included a range of needs beyond disability, such as "extenuating circumstances"; "temporary times of hardship"; and "life circumstances (family needs, work, athletics, student activity groups)." Similarly, in interviews with physicists who had mentored disabled students, we found some participants explained that disability was just one type of challenge they would support students through. For example, one physicist who leads a research group shared "*every student has very unique challenges that they run into during grad school, and then I just feel like that any disability along this line is basically the same as those challenges*" [9]. This perhaps matches the broad range of access needs described by Reinholz and Ridgway [8]. However, Scanlon and Chini found that some participants specified that students needed to provide a "valid" reason, with one participant explaining, "*'Valid' is subject to my interpretation, which is why I generally reserve the large accommodations for those registered with disability services*" [7]. When individual instructors are the judge of students' needs, their interpretations will necessarily be influenced by their own experiences.

VI. INTERDEPENDENCE

In their analysis of self-advocacy among STEM undergraduate students, Pfeifer et al. (2020) identified a novel self-advocacy behavior they called "filling gaps," or "participant actions taken to overcome limitations in formal accommodations or instructional supports to ensure success as a learner with ADHD/SLD in undergraduate STEM courses" [4, pg. 14]. Examples of filling gaps demonstrated by interviewees included creating a shared Google Doc with classmates to ensure access to high-quality notes after experiencing low-quality notes through the DRC notetaking accommodation and identifying personal tutors when instructors did not seem approachable and appropriate tutors were not available through university-funded sources. Pfeifer et al. share a quote from a student who explained: "*I do my own accommodating by having another support*

system that is not the DRC that I can fall back on" [4]. We interpret "filling gaps" as an example of *interdependence*, one principle of disability justice. Sins Invalid describe interdependence in disability justice as: "we work to meet each other's needs as we build toward liberation, without always reaching for state solutions that inevitably extend state control further into our lives" [16]. Filling gaps may also be connected to collective access, another tenant of disability justice which Sins Invalid explains means "…We can share responsibility for our access needs, we can ask that our needs be met without compromising our integrity, we can balance autonomy while being in community…" [16].

While we recognize potential connections between "filling gaps" and disability justice tenants, we sense a tension between empowering individuals to create solutions for their own needs and *requiring them to do so*. Interdependence and collective access rely on one's social network [17]. The connections to meet one's needs through filling gaps will vary across individuals and may vary systematically across identity markers. For example, Rosa and Mensah (2016) found Black women physics students were often excluded from study groups [18]. We agree that instructors and research mentors should value interdependent solutions to access needs, yet we argue that they should not *expect* students to put in all the effort to change an inaccessible learning or research environment.

VII. TAKEAWAYS

We have identified a range of mechanisms through which postsecondary STEM instructors and mentors respond to unmet access needs in courses and research groups. These mechanisms range in process (legal accommodations through the DRC, ad hoc adjustments within the class or lab environment), require a range of disclosures (to the DRC, instructor, or whole course), vary in what counts as valid (an official medical diagnosis, convincing the instructor, self-identified), and vary in who needs to do the work to change the inaccessible environment (university, instructor, student). We suggest instructors and mentors pull from all these models to create an ecosystem of supports with a specific focus on transparency by explicitly sharing the resources available through each route in a publicly accessible space, such as a course website or shared group document. For example, an instructor could post that students who need an extended test time accommodation should use the DRC; students who have note-taking needs can access the instructor's notes and a shared class Google Doc; and students can expect breaks every 30 minutes and are welcome to take care of bodily needs that arise, such as stretching or using the restroom. Overall, we argue for transparent access in as many ways possible.

ACKNOWLEDGMENTS

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