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ARTICLE



Exploring student disability and professional identity: navigating sociocultural expectations in U.S. undergraduate civil engineering programs

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ABSTRACT

National agencies throughout Australia and the United States (U.S.) have called for broadened participation in engineering, including participation by individuals with disabilities. However, studies demonstrate that students with disabilities are not effectively supported by university systems and cultures. This lack of support can shape how students form professional identities as they move through school and into careers. To better understand these experiences and create a more inclusive environment in engineering, we conducted a constructivist grounded theory exploration of professional identity formation in students who identify as having a disability as they study civil engineering and experience their first year of work. We conducted semi-structured interviews with 24 undergraduate civil engineering students across the U.S. and analysed them using grounded theory techniques. Navigating sociocultural expectations of disability emerged as one key theme, consisting of three strategy types: (1) neutrally satisfying expectations, (2) challenging expectations, and (3) aligning with expectations. Regardless of strategy, all participants navigated sociocultural expectations related to their studies and their disabilities. This theme highlights the ways sociocultural influences impact students' navigation through their undergraduate civil engineering careers. These findings can be used to examine cultural barriers faced by students with disabilities to enhance their inclusion in engineering.

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Disability; grounded theory; identity; civil engineering

1. Introduction

Current reports show that approximately 6% of Australian college students and 19% of United States (U.S.) college students have identified as having a disability to their institution of higher education (Koshy and Seymour 2015; NCES 2019). While the number of students with disabilities matriculating into higher education is slowly increasing (Cunninghame, Costello, and Trinidad 2016; Vaccaro et al. 2015), this group still remains largely underrepresented within STEM in both the U.S. (Chubin, May, and Babco 2005) and Australia (Cunninghame, Costello, and Trinidad 2016). This lack of representation highlights deeper issues of access and inclusion within secondary education; students with disabilities often leave secondary school with lower college aspirations (Kimball et al. 2016). Moreover, of those who do pursue higher education, many do not choose to register with disability services offices at their university due to a number of reasons, including feelings of cheating, concerns about stigmas surrounding disability (Barnard-Brak et al. 2010; Cunninghame, Costello, and Trinidad 2016; Ganguly et al. 2015; Kent 2016), and the potential to jeopardize future career plans (e.g., the armed forces). Of particular concern within engineering education, students with disabilities are

often discouraged from taking engineering-related courses (Lee 2014). Those who do enrol in engineering and other STEM majors are often not supported effectively (Cunninghame, Costello, and Trinidad 2016; Lee 2014; Ryan 2007) and left to navigate university structures typically designed for those without disabilities on their own (Hadley 2011; Kimball et al. 2016).

This lack of support has been traced to broad definitions of disability within government agencies (Cunninghame, Costello, and Trinidad 2016) and a lack of attention from researchers to effectively address the needs of this population, particularly as they move into STEM fields (Forlin 2004; Kimball et al. 2016; Spingola 2018). To provide these students with the necessary resources for academic success, many institutions of higher education refer to definitions of disability established by governmental agenmedicalized derived from perspectives (Commwealth of Australia 2015; Cunninghame, Costello, and Trinidad 2016; Disabled World 2015; U.S. Department of Justice 2009). Researchers and equity groups criticize these broad, normative definitions as being too vague and failing to adequately describe disability, particularly when considering the range and combinations of differences, variabilities, or impairments an individual may experience across changing contexts (Adams, Reiss, and Serlin 2015;

Cunninghame, Costello, and Trinidad 2016). As a result, these definitions can make it more difficult for individuals to access necessary resources for success in school and work.

This issue is exacerbated due to the paucity of research that explores the needs of these individuals (Kimball et al. 2016; Lee 2014) and their experiences in higher education. Work that does exist has sparked debate regarding streamlining (Linton 1998) or normalising students with disabilities into general education contexts (Forlin 2004; Konza 2008; Linton 1998). While proponents of educational inclusion cite positive social, psychological, and cognitive outcomes for all students, opponents point to a lack of resources and support for students with disabilities and faculty (for an in-depth description of this debate in both the U.S. and Australian contexts, see Forlin 2004; Konza 2008; Linton 1998). At the same time, this debate turns the spotlight on the concept of normalisation, or what Bogart and Dunn (2019) identify as 'assimilation' (652), as it reflects medicalized paradigms (e.g. U.S. Americans with Disabilities Act, 1990; Australian Disability Discrimination Act, 1992) and ableist privilege that shape the societal, cultural, and educational norms to which individuals with disabilities are expected to adhere. To counteract this exclusionary frame, we need research that centres the voices and experiences of people with disabilities as informants of inclusive education.

Within engineering, many calls have implored educators and researchers to broaden participation (e.g. Engineers Australia 2017; Jamieson and Lohmann 2009); however, these conversations typically centre on race and gender with little to no work addressing students' experiences with disability (Lee 2014; Ryan 2007; Spingola 2018; Svyantek 2016). Reflective of the research in higher education broadly, scholars in engineering education have examined the systemic and personal barriers experienced by engineering students with disabilities (e.g. Butler et al. 2017; Pearson Weatherton, Mayes, and Villanueva-Perez 2017; Ryan 2007). However, little work has examined the ways students with disabilities experience, interpret, internalize, and engage in the field to become professional engineers. This gap is problematic, as research in higher education suggests that experiencing a disability can influence the ways students perceive and experience school, develop professional identities, and remain in their professions (Kimball et al. 2016; Lichtenstein et al. 2009; Tonso 2014).

Our study bridges this gap by exploring the experiences of students with disabilities as they move through their undergraduate careers and into the civil engineering workforce within the U.S. To contribute to conversations that move beyond mere tolerance and actively welcome a diverse range of students in engineering, this study seeks to

understand the ways undergraduate students experience disability as they form professional identities as civil engineers. We focus here on the emergent findings from a grounded theory examination of interviews with 24 undergraduate civil engineering students who identify as individuals with physical, learning, cognitive, and/or mental health disabilities. Given the similarities across U.S. and Australian contexts suggested by reported challenges in enrolment, retention, and climate for students with disabilities (Cunninghame, Costello, and Trinidad 2016; Gale and Parker 2013; Martin et al. 2011; Pearson Weatherton, Mayes, and Villanueva-Perez 2017), as well as parallels in the culture of engineering programs in Australia (e.g. Godfrey 2014; Godfrey and Parker 2010) and the U.S. (e.g. Downey 2014; Jorgenson 2002; Tonso 2006a), we hope our findings can contribute to an international dialogue focused on the inclusion of individuals with disabilities in engineering education.

2. A note on language

Throughout scholarly literature and daily discourse, an ongoing debate exists between the use of personfirst and identity-first language to describe disability (Brown 2011; Liebowitz 2015). While this debate may initially seem a superfluous disagreement, the use of these phrases are important and highlight significant implications for an individual and their identification with disability. Person-first language (e.g. a person with dyslexia) positions the person before the disability, theoretically underscoring the value and worth of an individual by recognizing the person before the condition (Brown 2011). Identity-first language (e.g. a dyslexic person), in contrast, positions the disability or condition before the person, thus communicating it as an inherent aspect of one's identity (Brown 2011; Liebowitz 2015). In this paper, we generally use person-first language, reflecting current disciplinary and higher education norms; this approach is seen in legislation such as the U.S. Americans with Disabilities Act (1990), Australia's Disability Discrimination Act (1992), and the United Nations' Convention on Rights of Persons with Disabilities (2008). However, we recognise that, among members of the disability community, preferences vary, and we value and affirm the ways in which activists like Stella Young have reframed disability through the social model and insisted on using 'disabled' as an identifying adjective in asserting themselves as disabled people (Young 2014). To remain true to participant voices and identities, then, we use the language choices of our participants where appropriate, which may be person-first (e.g. Sammie) or identity first (e.g. Shawn).



3. Sensitizing concepts

Three frameworks serve as sensitizing concepts for this study (Charmaz 2014): social identity theory (Spears 2011; Tajfel and Turner 1979), intersectionality (Collins 2015; Crenshaw 1989), and identity salience (Abes, Jones, and McEwen 2007). Social identity theory posits that individuals partially define who they are through intra- and inter-group comparisons and self-categorization, based on the values and regulatory influences to which particular groups ascribe (Abrams 2015; Tonso 2014). This theory is useful because it aligns with studies that situate disability as a social group (Kimball et al. 2016). Intersectionality was initially conceived by black women as a means to confront social inequities based on interactions of race and gender by describing the ways intersected identities shape all experience and cannot be reduced to one identity alone (e.g. that of being a woman or that of being African-American) (Collins 2015; Crenshaw 1989). It has evolved as a lens for examining the interrelations among various dimensions of a single individual's identity (Abes, Jones, and McEwen 2007). In this study, we use intersectionality to acknowledge the interrelated and integrated nature of students' various identity dimensions as they navigate their undergraduate careers. Lastly, multiple dimensions of identity and identity salience posit that one's sense of self is influenced by multiple factors that become more or less salient through various contexts and interactions as individuals interpret and make meaning of them (Abes, Jones, and McEwen 2007). Within the context of this study, we recognise disability as a powerful social construction that shapes the lives of our participants, as a social categorization to which individuals are socially assigned or ascribed (Kimball et al. 2016), and as a dimension of how a person chooses to identify themselves as well as how the world recognises (or fails to recognise) them.

4. Prior work

While *professional identity* is often used to capture the developmental aspects of an individual's identity as they prepare for careers, research also emphasizes the reciprocal influences of personal identity on professional formation (Capobianco 2006; Cech and Waidzunas 2011; Faulkner 2000; Foor, Walden, and Trytten 2007; McGee and Martin 2011; Steele 2011). Therefore, in addition to the three sensitizing concepts, this work is informed by research on the interactions and interrelations across personal and professional identities. The Advancing from Outsider to Insider Grounded Theory of Professional Identity Negotiation (the AOI Model), developed by Groen (2017) with McNair, Simmons, and Paretti, captured the complex, dynamic nature of professional identity

formation as civil engineering students advance from an outsider (i.e. an individual not belonging to the civil engineering profession) to an insider (i.e. an individual belonging to the civil engineering profession). The AOI Model posits that individuals iteratively undertake a variety of identity negotiations to balance their definitions of self and profession to maintain identification with civil engineering and achieve their career goals (Groen 2017; Groen et al. 2018b). This study expands the model to focus on the professional identity formation of civil engineering students with disabilities.

5. Positionality statement

Aligning with the mantra of 'nothing about us without us,' (Charlton 2000) used by many who identify with disability, the majority of our research team identifies as either a person with a disability or as a disabled person and vary in our use of person-first and identity-first language. With the aim of broadening participation in engineering, we use our work to inform inclusive educational systems that move beyond individual accommodation and toward universal access and the removal of barriers to access. As such, our work stems from social models of disability that focus on the social and political structures that produce a dynamic and fluid identity consisting of a variety of physical, cognitive, or developmental differences (Adams, Reiss, and Serlin 2015). That is, we do not conceptualize disability as a condition or 'sickness' to be 'treated' (DasGupta 2015; Davis 2015), but as a difference that is experienced while navigating systems constructed with an assumed sense of normality. This orientation toward disability studies research positions us to examine the accessibility of physical, bureaucratic, and social institutional structures while centring on participants' experiences within these systems. As such, we do not speak for the individuals participating in this study, but rather bring their voices to the forefront of this work.

6. Methods

Because actively creating space for students who identify with disability requires deepening our understanding of the ways these individuals experience disability as they form professional identities, we are conducting a longitudinal grounded theory study. Most commonly used to make sense of a process when a theory is not available, grounded theory is also useful for adapting existing theory to a specific sample population possessing characteristics of interest (Charmaz 2014; Creswell 2013). Given prior research examining the nuanced experiences and access requirements of students with disabilities in higher education - and particularly in engineering - this approach enables us

to develop a richer understanding of why and how these students form professional engineering identities as they move through their undergraduate programs and into the workforce. To bound our study, we focus on civil engineering, one of the oldest and most codified engineering professions (Groen et al. 2018a).

6.1. Cultural context

As a nationwide study exploring experiences of disability within civil engineering programs across the U.S., this research was highly influenced by the nation's cultural and political climates. Because they may differ from those outside the U.S., we provide context to orient readers and illuminate the significance of emergent findings discussed in later sections.

This study was intentionally designed so that participants were not required to disclose their disability to their academic institution for two reasons: (1) to be inclusive of students from all socio-economic statuses, and (2) to avoid coercing students into institutional disclosure. First, to receive necessary accommodations within the U.S. higher education system, students must submit medical documentation to their institution's disability services office. Due to the structure of the U.S. healthcare system, obtaining these diagnoses can be a time-intensive and financially draining process, especially for students coming from low-income families or putting themselves through school on a limited income. Second, as researchers, we strongly believe that disclosure to one's institution is a personal choice, and because disability is still highly stigmatized throughout U.S. culture, individuals with nonapparent disabilities may prefer to pass as nondisabled. For these reasons, many students choose to navigate school without requesting accommodations. However, despite having access to free healthcare in Australia, studies have reported similar trends in disclosure, positing that the number of students with disabilities in university contexts remains underrepresented due to associated stigma and lack of support (Cunninghame, Costello, and Trinidad 2016). By eliminating this requirement for institutional disclosure, we sought students from any socio-economic background and any disability identification to contribute to this work and share their experiences.

6.2. Recruitment, data collection, and analysis

Upon obtaining human subjects research approval, a participation invitation and recruitment survey were electronically distributed nationwide to students through institutional (e.g. civil engineering programs, disability services offices) and professional listservs (e.g. American Society of Civil Engineers, American Society for Engineering Education, etc.). Due to the limited number of students with disabilities in

undergraduate civil engineering programs, all students who expressed interest and satisfied our sampling criteria were contacted by a member of the research team. Eligible participants were those who experienced any form of cognitive, developmental, physical, or mental health disability. While participant recruitment remains open to date, a total of 24 participants (9 men, 14 women, 1 non-binary individual) from a total of 19 universities were recruited and interviewed at the time of this study.

Semi-structured interviews, each lasting between 60 and 90 minutes, were conducted using intensive interviewing approaches (Charmaz 2014) framed by constructive interviewing (Charmaz 2014) and critical incident techniques (e.g. Sattler, Turns, and Gygi 2009; Simmons 2012). Due to the exploratory nature of this study and the myriad of impacts that different disabilities may have on students' identity formation, combining these techniques enabled us to tailor each interview to participants' unique responses and achieve an in-depth exploration of individuals' experiences. To ensure accurate capture of individuals' identity preferences, participants were asked their preferences regarding the use of person-first or identity-first language. Interviews were audio-recorded and transcribed, and field notes were recorded to preserve the context and subtle implications of topics discussed by participants. To protect participants' identities, each participant chose their own pseudonym to represent them in the study; these pseudonyms are used to identify participant quotations and experiences throughout the manuscript.

Aligning with the coding procedures of grounded theory research (Charmaz 2014), initial and focused coding were conducted line-by-line and incident-byincident for each interview to identify critical incidents that related to professional identity formation and disability. Critical incidents were identified in interview transcripts as utterances (in the form or stories or discussion topics) that a participant used to enact or indicate identification or deidentification with their disability and professional identities. That is, rather than topically coding the content of what participants said, codes captured abstracted meaning of what participants were doing with what they said (Gee 2011). This iterative, constant comparative process continued across all transcripts until no new themes emerged. Researcher insights were captured in memos that served as a methodological audit trail as well as a data source during analysis and theory development.

7. Navigating sociocultural expectations of disability

Drawing from a larger grounded theory analysis, we focus here on a single emergent theme that appears salient across national boundaries: navigating sociocultural expectations of disability. This theme captures the ways participants navigate the development and enactment of their own conceptualizations of disability in relation to established assumptions and expectations in U.S. culture broadly as well as in civil engineering specifically. This theme identifies the ways participants position themselves or are positioned by others as 'disabled.' Given that this positionality is culturally constructed and enacted across individuals, we also drew from the social model of disability (DasGupta 2015) and research examining norms of U.S. engineering culture (Cech and Waidzunas 2011; Jorgenson 2002; Tonso 2006b). From this perspective, we conceptualized this positioning as an enactment of identity that is bound by the affordances and constraints of the culture in which it is created. In the following sections, we describe the ways participants neutrally satisfied, challenged, or aligned with cultural expectations and definitions of disability as they formed professional identities. To stay true to participants' voices (Charmaz 2014), we supplement our discussion using selected participant quotes that both articulate the observed themes and representative participants' of collective experiences.

7.1. Neutrally satisfying sociocultural expectations of disability

Within the U.S., estimates suggest that approximately six percent of college students with disabilities are enroled in engineering programs (NSCES 2016). However, due to the self-reported nature of disability status, the use of systemic procedures that rely on medical definitions and diagnoses of disability, and the stigmatization of disability in U.S. culture, disabilities studies scholars speculate that this number is likely higher (Adams, Reiss, and Serlin 2015). As a result, individuals - particularly those with nonapparent disabilities - may intentionally or unintentionally pass as non-disabled to blend in or align with sociocultural norms. For Sammie, a woman diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) before her final year of secondary school, the decision not to disclose her learning disability was rooted in a misalignment between perceptions of disability and perceptions of engineering, as well as in the stigmatization of disability within her engineering college:

[...] it's fine to say, 'Don't mind my [bad] attitude, I'm running on three hours of sleep.' Because you can fix that. You can get 10 hours of sleep once you're done with all your stuff, and say, "Okay, now I'm good to go.' But when you have a disability, you can't just solve [the disability]. And also, I think that engineers, we have this idea, we have this concept of we're solving problems. That's all really, most of what engineers do is we solve problems. And it's like, sometimes I feel like it's a problem that I can't solve, so I just don't talk about it. With my friends, I pretend that it doesn't exist, because it's something that I can't deal with or correct or solve. (Sammie)

In her description, Sammie identifies an identity conflict between engineering culture (i.e. solving problems) and her conceptualization of her disability (i.e. a problem that cannot be solved). She also depicts an engineering culture in which hard work and struggle are expected norms (e.g. not getting enough sleep due to completing course tasks), whereas disabilities are perceived as a failure:

Interviewer: [...] your shortcomings are more seen as a failure, then?

Sammie: Yeah, and that's where it goes into engineering, is that we all want to pretend like everything is okay, that everything is great, that we're reaching our highest potential, and that we're on top of everything. That's the biggest thing, is that everyone seems to have their [stuff] together but me, so I'm just not going to say anything.

To manage her disability in this environment, Sammie described using self-deprecating humour, saying, 'if you can laugh at yourself, that means no one can make fun of you, and you can't get hurt.' Hence, due to the stigma surrounding disability on her campus, and particularly within her engineering college, Sammie typically will not disclose or discuss her learning disability with those around her, allowing her to pass as a student without a disability.

Darren passes as a non-disabled student by not requesting accommodations in his courses. As a veteran who experienced a traumatic brain injury while deployed overseas, he describes instances in which his 'bad brain days' impact his performance on course tasks that require him to retain a lot of information in a short amount of time. When asked if he had any accommodations through the university, Darren responded:

I do not. I'm not really sure if I need an accommodation or if an accommodation will help me, and I'm not sure what they can do. I probably should actually talk to them about it. Because when I have the bad brain days, I don't know when it's going to happen. [...] I'll go [into the exam] and everything will just go out, like I can barely remember to write my own name on the test. I just sit there and stare at the words and I'm like, "I don't even understand any of this." So, I don't know what kind of an accommodation they could do for that, but I probably should find out. [...] That's the stubborn part of [...] like, they're not going to help me anyway, and they weren't going to help me, or I just didn't want to ask for help, I guess. (Darren)

As described by Sammie and Darren, these instances do not indicate an active challenge or alignment with larger cultural norms. Rather, they highlight a few of the many reasons why an individual may pass as nondisabled within their engineering programs contexts (e.g. for Sammie to avoid ridicule and for Darren being too 'stubborn' to seek accommodations - or too jaded by past experiences in which he was not helped) (Samuels 2015). Still, they highlight cultural features that frame civil engineering and engineering within the U.S. and Australia broadly as meritocracies that reward hard work and talent (Cech 2013; Godfrey 2014) and where disability, as described by participants in this study, is not openly discussed.

7.2. Challenging sociocultural expectations of disability

Other participants described instances of challenging normative expectations of disability, particularly in academic settings. Johnny, a recent graduate who was diagnosed with Attention Deficit Disorder (ADD) during primary school, spoke to this theme at length when describing how faculty reacted to his extended testing accommodations:

... except for three professors, everyone was really rude about it. They would always ask me more questions than were necessary. [...] When I first requested it, people were really, really rude. Like, "Really? Do you really want that?" They bring up a really, I don't know, micro-aggressive tone, I would say. [...] Sometimes they'd actually send me back to the resource center to get extra verification that I wasn't trying to cheat or something. It was really weird. (Johnny)

Although Johnny had requested accommodations through his university's student services office, he still experienced pushback from faculty and had to repetitively explain his disability to justify using accommodation. He experienced similar questions from his peers:

... more often than not, they are like, "Did you drop the class? Why weren't you in the exam? Why weren't you in the room taking the exam with us?" People would always question. I explained that to them, and then people wouldn't believe me in school. "I have a learning disability." "Johnny, you're right [on homework], why do you have to do that?" [...] The hard part was explaining it to my peers. A lot of my peers would never really accept that, really. (Johnny)

Despite Johnny's repeated disclosure of disability to faculty and peers, they struggled to comprehend and, in some instances, accept that one can have a learning disability and need accommodations while performing well in school. Because Johnny challenges normative expectations, his instructors and peers questioned whether his accommodations were necessary and implied that he might have been trying to cheat in his courses and exams.

Madison also described having to repeatedly justify why she has specific accommodations. Upon entering college, Madison was diagnosed with Lyme Disease, and she explained that its symptoms manifest in a variety of ways based on individuals' predispositions. Madison's symptoms included severe knee and general joint pain that sometimes significantly impacted her mobility to, from, and across campus:

There was this semester where I drove to class every single day because it hurt too much to walk the whole way. [...] I'd leave my house like 45 minutes before my class started so I could take my time [walking] there. Then eventually I was like, "No, I'm just driving. I can't do this every day." (Madison)

Because of her mobility impairment, Madison uses a placard to gain access to close parking spots on campus on 'bad days' when her mobility is impacted most. However, these symptoms are also intermittent; they do not consistently or continuously impact her mobility, which challenges the perception that anyone with a handicap parking pass must have a constant mobility impairment:

I have a handicap parking pass, and people are always like, "Why do you have a handicapped parking pass?" I'm like, "I don't use it every day. I use it when I have bad days," and stuff like that. Then I feel like I have to explain then too because I can't just be like, "Oh, I just have a handicap parking pass." They're like, "Why? That doesn't make sense," because those are kind of hard to get. [...] People are really bitter that I have it and they don't [...]. (Madison)

and Johnny Madison's experiences reveal a paradoxical relationship among disability, social expectation, and accommodation. Their accommodations are questioned as a necessity by non-disabled individuals precisely because they work; they allow Johnny to be successful in a course and Madison to quickly and efficiently navigate campus. This paradox further highlights the pervasiveness of ability privilege within our institutions, which assume that if an individual is not experiencing an apparent struggle, accommodations are providing unnecessary support. As a result, participants also discussed instances in which they would moderate or limit the use of accommodations to avoid perceptions of cheating or abusing institutional support.

7.3. Ascribing to sociocultural expectations of disability

While some participants neutrally satisfied or challenged normative expectations of disability, others aligned their behaviours with or defined their experiences using broader conceptualizations of disability in society. Alignment occurred as participants either learned the skills to enact accepted, normative behaviours or, drawing from sociocultural expectations, to define and conceptualize disability.

Shawn, a woman who identifies as autistic, described a realization that she was different from her peers at an early age. To enhance Shawn's communication skills, she was encouraged to participate in activities and sports, such as dance and cheerleading, to learn normative communication skills and other types of social interaction. Here, Shawn describes an instance in which she realized that communication was not only verbal, but also physical:

I would be at a concert with my mom [...] and I would be having the best time, but my face would just be like [makes a serious, non-expressive face on screen]. The entire time. My mom would just be like "Are you okay? Are you having fun?" I'm like "Yeah, I'm having a lot of fun." Straight monotone. That's something that I had to learn, that you don't do that. If you're happy, you smile. If you're sad, you need to frown. If you think something's funny, you need to laugh. That's become second nature to me now, just because I've done it so much, like a creature of habit, now. But way back when, growing up, that wasn't something I did. It was just basically all one emotion all the time. (Shawn)

Societal norms shape our expectations of how individuals should act in public. Shawn practiced these accepted behaviours so much that they have become second nature, which enables her to align with sociocultural expectations of interpersonal interaction and communicate with others. However, many autistic individuals have described such practices as exhausting and overwhelming, leaving them emotionally, mentally, and physically drained of energy when engaging with the general public.

Another emergent aspect of alignment included ways participants' perceptions and definitions were influenced by established sociocultural norms. For example, Angela was diagnosed with depression and anxiety during secondary school and, more recently, obsessive compulsive disorder (OCD). When asked if she considers herself to be disabled, Angela replied:

I usually don't ... I have depression, anxiety, and [obsessive compulsive disorder], which none of them are physical disabilities, and because they affect so many people, I don't normally think of them as a disability. But obviously, they do actually qualify as one and they do actually make things harder. I don't tend to think of them as a disability. (Angela)

Here, Angela aligns her mental health disabilities with general colloquial conceptualizations of disability in the U.S.: disabilities are physical in nature a conceptualization echoed in Cunninghame, Costello, and Trinidad's (2016) review of research funded by Australia's National Centre for Student Equity in Higher Education (NCSEHE). Despite Angela's acknowledgment that her mental health diagnoses qualify as disabilities and that they can significantly impact her life, she does not identify as disabled or having a disability. This de-identification reflects current debates in the U.S. that typically stigmatize mental health and question its status as a disability or medical condition.

7.4. Summary

Overall, the experiences described by study participants highlight the complex nature by which students with disabilities are required to navigate undergraduate engineering programs - and ultimately undergraduate engineering culture. Within engineering education, a plethora of work has been conducted examining a variety of cultural characteristics that are reflected in participants' accounts. For example, Dryburgh (1999) identified the 'work hard, play hard' culture (664), which is reflected in Sammie's interactions with her peers who commend one another for sleepless nights and lengthy study sessions. Stevens et al. (2007) similarly identified engineering as a 'meritocracy of difficulty' that positions one's ability to persevere through difficult content as a key marker of an engineer's worth. This theme is further highlighted in Johnny's experience where his faculty and peers often questioned his use of and, most importantly, his need for accommodations because of his high academic performance. While this list is not encompassing of all cultural characteristics identified in engineering, it provides benchmarks that students use to implicitly or explicitly indicate their belonging to engineering.

The U.S. participants in this study highlighted a number of national cultural and engineering cultural features that echo those identified in studies of Australian universities. Such examples of this alignment include hard work as an indicator of quality (Godfrey 2014) and efforts to broaden participation for women and other minoritized groups (Godfrey 2014; Goldfinch et al. 2016; Male and MacNish 2015; Mills et al. 2006; Waling and Roffee 2018). Specific to disability, aligning cultural characteristics include lower retention and success rates for students with disabilities (Kilpatrick et al. 2016; Richardson, Bennett, and Roberts 2016) and a lack of knowledge of support structures for students with disabilities among university administration, faculty, and staff (Ganguly et al. 2015; Owen et al. 2016). While these national and disciplinary cultural parallels do not necessarily mean that Australian engineering students with disabilities share the experiences of those in our study, our findings open an important dialogue that begins with responding to Cunninghame, Costello, and Trinidad's (2016) calls for additional research.



8. Implications and conclusions

As highlighted by debates of inclusive education (Forlin 2004; Konza 2008; Linton 1998) and the ableist structures that permeate our educational systems (Bogart and Dunn 2019; McLean, Heagney, and Gardner 2003), our academic contexts are imbued with sociocultural expectations and norms that influence how individuals navigate school, the workplace, and their lives (McLean, Heagney, and Gardner 2003). For many faculty and students, these navigational strategies go unnoticed, despite their significant influences on the ways students with disabilities experience school and form professional identities (Kimball et al. 2016).

By bringing these students' voices to the forefront of our work, we revealed nuanced insights into the ways students navigate sociocultural expectations of undergraduate engineering as they become engineers. Overall, this study identified three types of navigational strategies employed by students with disabilities during their undergraduate experiences: (1) neutrally satisfying expectations (i.e. passing as non-disabled), (2) challenging expectations (i.e. enacting characteristics of disability that do not conform to normative conceptions), or (3) aligning with expectations (i.e. utilizing broader societal norms to define, conceptualize, or enact one's own disability). We emphasize here that these strategies vary and one type is not better than another; it is up to the individual to determine what type of strategy they want to employ to meet their own needs and contexts.

While this study has been conducted within the context of civil engineering, implications of this study may be applied across disciplinary contexts and align with inclusion efforts identified by Cunninghame, Costello, and Trinidad (2016). To be more inclusive of individuals with disabilities within the U.S. and Australian contexts, we must culturally move beyond monolithic and medicalized conceptions of disability that position disability and engineering in opposition of one another. We must listen to our students and develop practices that promote universal accessibility rather than accommodation. To accomplish this, we must reconsider our course structures and curricula. For example, practices such as heavily weighted, timed exams can create unnecessary access barriers for students with a variety of disabilities, particularly as they manage accommodations in addition to studying content. As we begin to shift how we teach and assess engineering content, we can begin to construct a new and more inclusive culture that allow students with disabilities to flourish in engineering and beyond.

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