Making the Invisible Visible: Let's Discuss Invisible Disabilities

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Abstract

Despite the passage of laws aimed at increasing access and equitable opportunities for students with disabilities in postsecondary education, issues related to disability continue to be rarely discussed in topics related to diversity, inclusion, and educational reform. Disability represents not only an immensely diverse section of the general population, it is a term that is problematic to define, and a term embroiled in controversy, both historically and from a current day perspective. This short piece invites readers to consider the history of how disability has been defined, explores specific issues faced by those living with 'invisible disabilities', such as learning disabilities and attention deficit hyperactivity disorder (ADHD), increases awareness of how these issues may affect educational outcomes, and encourages educators to seek best teaching practices that can address the specific needs of particular students in their classes. https://doi.org/10.21692/haps.2020.101

Key words: Invisible disabilities, students with disabilities, equitable opportunities

Introduction

Access to higher education for individuals with disabilities has increased steadily since the 1970s, especially in recent decades. In 1995-96, nationally representative data found that students with self-reported disabilities represented approximately six percent of the overall undergraduate population in postsecondary education (Horn 1999), while in 2015-2016, the proportion of undergraduate students with any form of disability had risen to just under 20% (National Center for Education Statistics 2019). The significant increase in enrollment rates for students with disabilities at postsecondary institutions can be especially attributed to the passage of civil rights based federal laws, particularly Section 504 of the Rehabilitation Act of 1973, and the Americans with Disabilities Act (ADA) of 1990 (amended in 2008), which forbid discrimination against the inclusion and acceptance of students with disabilities at educational institutions that receive public funds. Furthermore, it ensures that students with disabilities have access to reasonable accommodations should appropriate documentation be provided, ensuring equitable access to learning opportunities, regardless of ability, or impairment (Burgstahler 2003; DaDeppo 2009; Oslund 2013; Cortiella and Horowitz 2014).

Nevertheless, while the passage of these laws has been instrumental in providing a means of equal access for students that was once impossible due to discrimination, students with disabilities continue to face challenges related to educational outcomes and support. Lennard Davis' (2011) article in the Chronicle of Higher Education notes that while discussions related to diversity should be commended, and higher education has improved its ability to provide accommodations and services to students with disabilities, disability as a topic is often missing from dialogues pertaining to inclusion, diversity,

and curriculum reform, instead being relegated to webpages dedicated to accommodations and services. Central to his argument, Davis (2011) notes that within his own field of literary theory and cultural studies, one publication contained only one essay dedicated to disability (which he authored) and found was subsequently removed from future editions.

This point has been echoed more recently by Trybus and colleagues (2019), who cited studies that found of the total number of educational development articles and presentations dedicated to inclusion, diversity, and social justice, published over a span of two decades, less than one percent mentioned disability. Within Davis' (2011) article, he also recalls an incident where after giving a presentation focused on disability and diversity, he was challenged on whether the oppression of people of color could ever be comparable to those living with disabilities. He replied that the notion that disability shares parallels with cultural differences and minority group status is not a new one and that other researchers have argued that framing disability as an aspect of human diversity, and as its own minority group, would be beneficial as a means of social justice and empowerment, rather than viewing one's impairments as a negative condition that requires charity or pity (Anastasiou and Kauffman 2012; Banks 2015).

However, concerns related to how disability is defined, and who chooses to identify as disabled within identity politics represents only a small part of concerns within disability studies and addressing the needs of people living with different kinds of disabilities. Disability remains a controversial, and vaguely defined aspect of human diversity. How the term is defined can have a profound impact on who chooses

to identify as disabled or not, and it remains a heavily under researched area, including studies investigating STEM fields. These factors make addressing the needs of students with different kinds of disabilities extremely difficult.

This article briefly examines the history of disability rights in education, how society's perception of the meaning of disability can affect the willingness of people with different types of disabilities to identify as such, and how this can subsequently affect postsecondary educational outcomes for students, their willingness to seek accommodations and other support services, faculty teaching practices, student-faculty relations, and future employment opportunities for students with disabilities. Given that little research has been conducted into understanding the needs of students in specific STEM fields such as anatomy and physiology, this article is deliberately broad, and will attempt to reference articles related to STEM fields and medical education where possible. Because disability studies within STEM fields remains an under researched topic however, this piece is not intended to offer definitive solutions, and instead hopes to encourage educators to reflect on their own teaching practices and any potential biases of how they view students with particular disabilities, and to seek professional development opportunities where possible.

A Brief History of Disability Rights, Access to Education, and Concerns Related to Diversity, and Identity

The etymology of the word disability roughly translates to 'loss of power', and although the concept of what it actually means to be disabled has been vigorously contested over the last century, it is irrefutable that people with disabilities have long suffered from negative connotations associated with their impairments, or being classified as disabled, even when holding positions of power. For example, President Franklin Delano Roosevelt suffered from partial paralysis from the waist down a result of being previously infected with polio at age 39, and this required him to use a wheelchair for much of his life including his entire time in office. However, Roosevelt took extraordinary steps to hide his condition from the public eye; he staged photographs to maintain the illusion that he was able bodied, and sought to suppress publication of photos from journalists when seen in a wheelchair, as he feared such exposure would show him in a "weak state" (Fleischer et al. 2012; Porter 2019).

Throughout history, people living with disabilities have had their abilities and opportunities to contribute to society censored or denigrated, encouraged to hide their conditions, or have had their status in society relegated to a passive recipient of care; a burden on society who must be cared for by the able bodied, or removed entirely from public view. Contemporary views of disability however are far more complex, and controversial. This next section briefly introduces the origins of two competing models of disability that continue to have a major impact on how disability is viewed by the members of the public, and from a legislative standpoint.

There is evidence as early as the period of Plato's Republic (around 427-347BC) that the ability to think and act rationally was viewed as the spirit of human embodiment. Individuals with physical and intellectual disabilities were actively excluded from being able to participate as full members of society and were often killed. Members of the Republic viewed the presence of a disability as a sign of dysfunction and injustice that should be purged from society (Kiefer 2014). Biblical interpretations of physical or intellectual abnormalities have at times also characterized such conditions negatively, from a sign of evil spirits being present, to an act punishment against an individual or their family for sinful behavior (Oslund 2013).

These early beliefs have had a lasting impact on how disabilities have been viewed over the last century, from popular culture representations to political discourse, although there have been some differences from a geographical standpoint. For example, Oslund (2013) noted that 19th century views of people with disabilities in the United Kingdom tended to view those with disabilities as 'idiots' to be left behind. At the same time, in the United States, some attempts were made to put those with disabilities to work, or to educate them to a point of self-sufficiency, albeit often at the expense of segregation and institutionalization, or exposure in the form of circus freak shows (Oslund 2013; DiNunzio et al. 2016).

Furthermore, it is important to appreciate that eugenic principles previously espoused during Plato's Republic have also affected the lives of those with disabilities as recently as the 20th century. Modern eugenics, most often associated with Nazi Germany war crimes, may have in part been influenced by medical procedures carried out in the United States at the time (Hansen and King 2013). One such example was the widespread implementation of forced sterilization laws aimed at people with disabilities, and other 'undesirable' traits; rhetoric largely founded on ethnic, and racial prejudices (Stern 2005; DiNunzio et al. 2016). A common premise shared by these examples is that early conceptions of disabilities were based on variations in structure and function that are outside of an expected or accepted norm. This fundamental attitude of disability as a state of difference that requires correction or remedy is commonly referred to as the 'medical model of disability' (Bickenbach et al. 1999; Shakespeare 2006; Wasserman et al. 2016; Trybus et al. 2019).

During the early-mid 20th century, issues regarding access to education for persons with disabilities began to emerge. In addition to the already limited opportunities to access education, people with disabilities who sought educational opportunities were not protected from being excluded because of their conditions. Universities and colleges could not only reject applications based on an individual's disability status; they also did not have to accommodate the needs of certain students into the architectural design of their learning spaces, such as the construction of ramps for wheelchair access (Madaus 2011; Oslund 2013).

Genuine access to education for persons with disabilities, along with the advent of disability support services and accommodations many of us may be familiar with today, were born out of the disability rights movement, which itself was a product of the civil rights movement during the 1960's. As Oslund (2013) noted, those participating in the disability rights movement were not just individuals with disabilities themselves. Many advocates were parents of individuals with disabilities, who rejected the long held notion that their child should be kept away from the public eye, or reduced to a minimal role in society (Shakespeare and Watson 2001; Oslund 2013).

Similar to other minority groups of the civil rights movement, people with disabilities protested against a lack of equality and systemic discrimination, and rejected the long held belief that medical professionals, and able-bodied individuals were the most reliable judges of what was best for their lives (Shakespeare 1998). The central argument of many disability advocates at the time was that disability was a condition imposed upon them on top of their impairments, rather than merely due to the impairments themselves. In other words, the main reason they were restricted from engaging in daily activities was because society had failed to incorporate their needs as a result of social prejudices and ignorance, a competing theory that became known as the 'social model of disability' (Shakespeare and Watson 2001; Oliver 2013; Oslund 2013; Foundation for People with Learning Disabilities 2019).

The social model of disability soon became and remains the dominant theory of what it means to be disabled. It directly competes with the older medical model of disability and advocates for the removal of social barriers. In its most extreme form, it rejects the existence of limitations on daily activities caused by bodily impairments, is dismissive of intervention measures such as special education and accommodations, and demands that those with disabilities advocate as a homogenous, unified group, rather than focusing on differences related to disability type and severity (Shakespeare and Watson 2001; Shakespeare 2006; Thornton and Downs 2010; Anastasiou and Kauffman 2012; Oliver 2013; Oslund 2013).

The disability rights movement proved to be a powerful force for change in the lives of those with disabilities. Aside from challenging the long-held doctrine that impairments were a wholly internal defect to be remedied, it challenged society to be aware of its privileges and implicit biases, and gave a voice, and positive identity to those with disabilities. In the United States, it led to the first federal laws dedicated to addressing the needs of students with disabilities, such as the Architectural Barriers Act of 1968, which focused on addressing the needs of those with physical disabilities, but later saw implementation of the Rehabilitation Act of 1973, and later the ADA of 1990, which together have expanded the rights granted to those with disabilities, by covering a broad range of conditions and impairments, including those with disabilities that are 'invisible' to the naked eye (Madaus 2011; Oslund 2013). Examples of 'invisible disabilities include specific learning disabilities such as dyslexia, dyscalculia, dysgraphia, and other conditions such as attention deficit hyperactivity disorder (ADHD) (Oslund 2013).

Since that time, the social model's influence on the concept of what it means to be disabled has been the subject of great debate and controversy; some people with learning disabilities for example refuse to use the word 'disabled' to describe their condition, preferring to instead refer to their condition as a learning 'difference' or 'difficulty' (Goodley 2001; Denhart 2008), while other scholars have argued for seeing disabilities as a cultural aspect of diversity, as mentioned at the beginning of this article (Shakespeare and Watson 2001; Bampi et al. 2010; Davis 2011; Anastasiou and Kauffman 2012).

Since the debate of whether disability is more of a medical versus a social phenomenon began, there are some important paradoxes that should be noted. Firstly, it is ironic that the laws designed to protect the rights of people with disabilities still define disability from an ableist, or medical model viewpoint. Within the ADA, disability is 'any physical or mental impairment that substantially limits one or more major life activities' (United States Department of Justice 2009), while access to special education, or accommodations as stipulated within the Rehabilitation Act of 1973, and Individuals with Disabilities Education Act (IDEA) of 2004, also go against the social model's conceptual framework (Anastasiou and Kauffman 2012; Mole 2013; Holt et al. 2019; Trybus et al. 2019).

Furthermore, some researchers have been critical of the inflexibility of the social model's focus on social barriers and framing disability as a form of human diversity, citing incongruencies. As Shakespeare (2006), and Davis (2011) point out, while the overarching goals of equality, and being seen as normal, may be shared between persons with disabilities and other minority groups, equating disability with diversity can be problematic. It seemingly goes against a central notion of diversity and inclusion that minority group identities such as gender, race and ethnicity, are not debilitating in

their own right, but only due to social prejudices. Arguably, this cannot be true for some with impairments that are debilitating in themselves, such as a neurodegenerative disease. Furthermore, Davis (2011) contends that this central idea within diversity dialogue of sameness within differences, leaves it unable to celebrate disability as an empowering identity, or a uniqueness we could imagine choosing for ourselves. This also leads to some people embracing one group identity, but rejecting the other; gay individuals, and those who identify as African American for example, are more likely to resist the label of disability (Shakespeare and Watson 2001; Wagner et al. 2005; Newman et al. 2009).

Anastasiou and Kauffman (2012), and Shakespeare and Watson (2010) are also critical of the attempts of social model proponents and multicultural theorists to categorize people with disabilities as a homogenous group, irrespective of the type of disability, or its severity; ironic given that diversity is synonymous with variety. As Shakespeare and Watson (2001) note that the Union of the Physically Impaired Against Segregation (UPIAS) granted membership to those with only physical disabilities. Disability is a term that represents a tremendously heterogenous group of conditions, some more obvious to the naked eye than others. For example, at Indiana University, disabilities are grouped around seven broad categories: visual, mobility, auditory, neurological, cognitive, medical, and psychological (Indiana University 2019). In addition to differences based on type, and severity, disability can also be considered a fluid term as opposed to a fixed aspect of one's life (Shakespeare and Watson 2001). While some conditions may impose limitations that affect an individual for large parts of their life, some conditions can present themselves at only certain points of life, such as in elderly individuals, or also be episodic in nature, such as multiple sclerosis.

The concept of disability is complex, controversial, and demands an understanding of the socio-historical contexts in which it is defined. The heterogeneity surrounding the vagueness of disability, and the many different types of barriers that exist, is compounded by the fact that both the medical, and social models fail to encompass the specific experiences of those living with particular disabilities.

It is my personal view, that an adequate lens for approaching and studying disability need not be focused on one perspective. I concur with the opinions expressed by Shakespeare & Watson (2001), and Anastasiou and Kauffman (2012), that a more holistic and interactional viewpoint is required to understand the lived experiences of those with disabilities, and these should encompass the variability of human experience related to aspects such as bodily, psychological, cultural, and social factors, rather than focusing on whether existing barriers are purely social or medical in nature. Nonetheless, the heated nature surrounding the term disability still resonates, and reconciliation between the social and medical models seems unlikely for now.

Competing Ideologies: The Impact of Classifying Disability on Disclosure Rates, Postsecondary Educational Outcomes and Employment Opportunities

Understanding the history behind why modern discourse surrounding the term disability is filled with controversy can help us better understand the lingering impacts that being labelled as disabled has on students with certain disabilities; particularly their willingness to identify as disabled, the effectiveness of laws designed to prevent discrimination, the impact of faculty knowledge of a student's disability, and the efficacy of solutions such as accommodations. Each aspect ultimately has a profound impact on the educational and employment outcomes of students with disabilities.

Before delving into what the literature suggests about educational outcomes for students with different kinds of disabilities, it is important to understand that the overall picture remains unclear. In addition to being an under-researched topic, low disclosure rates for those with non-physical conditions such as learning disabilities can negatively affect the representativeness of samples in disability studies conducted at postsecondary institutions, and privacy restrictions make it difficult for researchers to identify eligible participants. When data is readily available, disability is sometimes reported as a single category, rather than considering differences by disability type, and there remains a paucity of data available regarding outcomes for students with disabilities within specific STEM domains such as anatomy and physiology. Finally, although the term invisible disabilities can be used to refer to a range of conditions, most of the works I cite will focus on studies in students with learning disabilities and these statements should be interpreted with caution and are not necessarily representative of all invisible disabilities.

Enrollment rates, faculty knowledge and disability disclosure rates
Since the passage of laws such as the ADA, the proportion of students with learning disabilities enrolling at postsecondary institutions has increased substantially, with 34.5% enrolling at a postsecondary institution within four years of leaving high school in 2005, compared to just 11.4% in 1990 (Lightner et al. 2012). Furthermore, within eight years of leaving high school, students with learning disabilities enroll in some form of postsecondary education at approximately the same rate (67%) as the general population (Cortiella and Horowitz 2014).

However, students with learning disabilities are twice as likely to attend two-year colleges compared to four-year colleges, attend four-year institutions at approximately half the rate as the general population (Cortiella and Horowitz 2014),

and pursue postsecondary education at four-year colleges at a significantly less rate compared to students with other disability types, including speech/language impairments, hearing impairments, orthopedic impairments, autism, and deaf/blindness (Wagner et al. 2005, Newman et al. 2009). Despite these discrepancies, national data has shown that students with invisible disabilities, including learning disabilities, ADHD, and psychiatric conditions, are now the most common disability groups enrolled at postsecondary institutions (Raue and Lewis 2011).

With regard to enrollment rates of students with disabilities in STEM fields, recent data has shown that students with disabilities pursue STEM majors at a slightly higher rate than the general population, albeit at two-year colleges as opposed to four-year institutions (Lee 2011). One possible reason for the enrollment discrepancy between two-year and four-year colleges may relate to previous findings by Burgstahler and associates (2001), who reported that students with disabilities enrolled at two-year institutions experienced a greater number of personalized services and accommodations and more supportive faculty compared to students with disabilities at four-year institutions.

Negative stereotypes surrounding disability remain a significant life-long problem for people with learning disabilities. National data has shown that parents of young children with signs of a learning disability are more likely to wait and see if their child will grow out of it, rather than seeking a diagnosis early on, and approximately half the general public believe learning disabilities are the result of laziness (Cortiella and Horowitz 2014). Similar negative views have been found in faculty members in higher education settings (Thurston et al. 2017).

There has been a suggestion that faculty members in the basic sciences may be less accommodating and understanding of the needs of students with disabilities compared to faculty in other fields such as education, social sciences, and business (Burgstahler 2003). Previous studies of views held by postsecondary STEM educators have revealed that faculty members can hold negative stereotypes of and expectations of students with disabilities in STEM classes, show a lack of understanding and acceptance of students with disabilities, may be hesitant to cooperate with implementing accommodations, and display a lack of preparedness to teach students with disabilities (Love et al. 2014; Thurston et al. 2017; Banks 2019).

Other studies have found that postsecondary faculty educators who display a greater interest in knowledge about disabilities and a willingness to adapt their methods of instruction can have a positive impact on academic outcomes for students with learning disabilities (Hedrick et al. 2010; Thurston et al. 2017; Banks 2019). While those

who are more understanding of the needs of students with disabilities are also more likely to seek professional development opportunities, they also lament that it is harder to accommodate students with invisible disabilities, since they are difficult to identify and contact, due to privacy restrictions embedded within federal laws (Love et al. 2014; Thurston et al. 2017).

Given that there remains a broad and significant lack of understanding of the difficulties faced by students with invisible disabilities, it is perhaps not surprising that students with learning disabilities report experiencing stigma surrounding the nature of their condition, feel that they are viewed as lazy, and that are they trying to cheat the system by seeking accommodations (Denhart 2008; Lightner et al. 2012). Crucially, this can have a significant impact on how students in higher education view their condition as they transition from K-12 to postsecondary education, and their willingness to seek disability support services (Grasgreen 2014).

It is important to note that as a student enters postsecondary education, some laws and regulations that had granted them special education services and accommodations in K-12 education no longer apply and that the onus of disclosing a disability to the university and seeking accommodations is now the responsibility of the student rather than the school (Burgstahler 2003; DaDeppo 2009).

For students with learning disabilities, nationally representative data has found that of students who received special education services in high school, only 35.5% will disclose their disability to their postsecondary school, and an additional 7.8% who consider themselves to have a learning disability will not inform the school of their condition. (Wagner et al. 2005; Newman et al. 2009). Furthermore, the postsecondary rate of disclosure for students with invisible disabilities, including learning disabilities and emotional disturbances, is around 1.5-2 times less than disclosure rates reported for other disabilities, including hearing and visual impairments.

Reasons for why students may choose not to disclose their condition or wait to seek services vary. For those entering postsecondary education from high school who choose not to disclose, most do so because they do not consider themselves to have a disability and the likelihood of a student choosing not to disclose their disability for this reason is higher in African American and Hispanic student populations than for their Caucasian counterparts (Wagner et al. 2005; Newman et al. 2009).

For those with learning disabilities who delay seeking assistance until after enrolling at postsecondary institutions, reasons include a lack of knowledge and self-advocacy to seek disability services, a desire to forge an identity away from

their disability, cost concerns for testing related to obtaining appropriate documentation, a lack of support from faculty and staff members, and a perception of shame and cheating for seeking assistance (May and Stone 2010; Lightner et al. 2012; Grasgreen 2014).

A reluctance for individuals to disclose their disability is not just confined to educational settings. One study reported that a majority of people with learning disabilities choose to not disclose their condition to their employer, despite nearly three-quarters of respondents also mentioning that their disability impacts their work (Madaus 2006). Furthermore, Madaus (2006) found that approximately one-fifth of respondents feared repercussions for disclosing their disability, and one-third of those who requested accommodations were declined.

Graduation and Attrition Rates
Despite improved access, national statistics broadly show that students with disabilities remain much less likely to obtain a postsecondary degree compared to the general student population (U.S Bureau of Labor Statistics 2015). Understanding difficulties that specific groups of students with disabilities face completing a postsecondary degree, such as those with invisible disabilities, is extremely difficult, as little is known about how rates of graduation vary by disability type. Many studies will refer to students with disabilities as a general group rather than considering disability types. Furthermore, trying to understand graduation, and attrition rates for students with different types of disabilities in specific STEM fields is even more complicated due to a lack of available data.

Based on nationally representative data in 2016-2017, high school graduation rates for students with disabilities in general, are significantly less than the national average (67.1% vs. 84.6%) (National Center for Education Statistics 2018), while 2015 data from the U.S Bureau of Labor has reported that of surveyed households, 41.9% of those a disability had completed some form of postsecondary education, compared to 61.4% of those without disabilities. Furthermore, completion rates were even lower for colleges, with 16.4% of surveyed respondents with a reported disability completing a Bachelor's Degree, compared to 34.6% of those without disabilities (U.S Bureau of Labor Statistics 2015).

For those with learning disabilities, the dropout rate reported at colleges is near 70% (Lightner et al. 2012). While data concerning attrition rates by STEM sub-fields does exist for the general postsecondary student population, data related to graduation, or attrition rates by disability status in STEM fields does not readily exist (Hawley et al. 2013). While this lack of data is particularly true for undergraduate degrees, limited data from 2010 concerning research doctoral degree attainment has shown that students with disabilities in general were less likely to have completed their degree in a science or engineering field than those without a disability (60.2% vs. 69.8%) (Hawley et al. 2013).

Furthermore, it should also be noted that the rate of students with disabilities entering postgraduate school is lower than those with no disability status (2.1% vs. 3.5%) (Hawley et al. 2013). This is also true for students pursuing postgraduate degrees in medical education, with only 2.7% of the student cohort consisting of students with disabilities in general, although the majority (92%) of these are students with invisible disabilities (Meeks 2019 Jul 2).

Academic achievement, study skills, self-efficacy, and integration factors
Previous studies that have attempted to understand potential reasons why completion rates for those with disabilities are significantly lower than for the general population. Attempts to identify potential factors that predict success and persistence have yielded mixed findings. While a number of factors have been found to be important, their impact on academic success and persistence as single measures should be interpreted with caution. Sometimes the amount of variance explained for such measures may be quite large within single studies (Kirby et al. 2008); at other times it may account for only a small amount of total variance when controlling for other factors (DaDeppo 2009; Bergey et al. 2017). The role of multiple factors and possible interplay between each should be stressed, as well careful consideration of the quality of a sample containing students with disabilities given that disclosure rates at postsecondary institutions are extremely low.

Regarding the impact of GPA on academic success and persistence, studies have shown that high school GPA is correlated with college GPA for both students with learning disabilities, as well as the general population (Vogel and Adelman 1992; DaDeppo 2009; Marrs et al. 2009). Furthermore, college GPA has been linked with the likelihood to persist and graduate from postsecondary education (Vogel and Adelman 1992; Herbert et al. 2014).

However, college GPA has been shown in recent studies to not significantly differ between students with or without learning disabilities, or between students with learning disabilities that do or do not receive accommodations, with the exception of first year college GPA among students that do or do not receive accommodations, and between younger and older students with learning disabilities enrolled at postsecondary institutions (Hall and Webster 2008; Lightner et al. 2012; Hen and Goroshit 2014; McGregor et al. 2016). Given that graduation rates are much lower for students with disabilities, despite no apparent difference in college GPA, this raises questions about whether college GPA may be considered a reliable predictor of persistence and intent to graduate for these populations. To the best of my knowledge, no study has explored this question in greater depth.

A number of studies have attempted to compare differences in measures for study skills, self-efficacy, and metacognition as possible explanations for differences in academic success and GPA differences between students with or without learning disabilities, but with little consensus on what seems to work for students with specific disabilities. Compared to their non-disabled peers and despite no apparent differences in GPA, students with learning disabilities have been found to score lower on study skills survey measures related to emotional intelligence, self-efficacy, metacognition, selecting main ideas, and use of test taking strategies (Hall and Webster 2008; Kirby et al. 2008; Hen and Goroshit 2014) while scoring significantly higher for measures related to the use of time management strategies and study aids (Kirby et al. 2008). Kosine (2006) also noted that students with learning disabilities who scored lower for measures related to metacognition also tended to report a lack of self-awareness regarding the nature of their disability and were more likely to delay seeking assistance until signs of academic failure.

Other factors put forward as impacting college GPA and persistence in students with learning disabilities, including race/ethnicity, gender, disability type, and matriculation from the same campus versus transferring from a two-year college, have yielded conflicting results (Johnson et al. 2008; Mamiseishvili and Koch 2011; Herbert et al. 2014). Integration, and external factors external to GPA have also been found to uniquely impact a student's likelihood to persist, although their influence by disability type is still unclear.

Cortiella and Horowitz (2014) cited cost as one of the most prevalent reasons for why students with learning disabilities do not complete postsecondary education, while DaDeppo (2009) found that factors related to social, and academic integration at college were unique predictors of intention to persist in students with learning disabilities, including the role of informal contact with faculty on social integration. Another study by Feldman and colleagues (2016) found that integration factors related to hope could mediate feelings of loneliness and self-efficacy, although its impact on academic performance was not considered.

Other studies have found that while academic and social engagement for disabilities in general are associated with persistence, their role within this more general grouping has been shown to not hold significance when controlled for demographic variables, such as race, gender, and age, and other university characteristics such as GPA (Mamiseishvili and Koch 2011). Nevertheless, some studies have been critical of the limited predictive value associated between GPA and measures for cognitive achievement, study attitudes, and study habits (Murray and Wren 2003).

Qualitative studies, or the use of mixed methods approaches may provide an alternative method for understanding the specific experiences that affect student performance, and persistence. Previous qualitative research studies have demonstrated the positive and negative roles of faculty, peers, and family for students with likelihood to seek assistance, develop confidence and self-advocacy skills, and managing anxiety (Denhart 2008; Jenson et al. 2011; Lightner et al. 2012; Love et al. 2014).

Accommodations, compensatory strategies, and universal design
Despite their apparent shortcomings in skills related to self-efficacy, study habits, and metacognition, it is welcome news that students with some forms of invisible disabilities are still able to academically succeed at postsecondary institutions. Academic support for students with disabilities, such as learning disabilities, have included the use of academic accommodations, assistance from academic support centers, and universal design principles, but their efficacy is still not well understood.

The use of accommodations is probably the most well-known example of support granted to students with disabilities. Gaining access to accommodations however is not always easy for eligible students and there are concerns as to who is more likely to receive accommodations. Cortiella and Horowitz (2014) noted that the cost of obtaining appropriate documentation from diagnostic testing can be a potential barrier to students receiving accommodations, particularly those with learning disabilities who must prove their need for support (Lightner et al. 2012).

Students with learning disabilities receiving accommodations are much more likely to come from wealthy to upper middle class socioeconomic brackets (McGregor et al. 2016). A lack of uniformity between postsecondary institutions regarding support services available and mismatches between the appropriate documentation needed to access accommodations at postsecondary institutions compared to high schools are also potential barriers (Cortiella and Horowitz 2014). There is also a lack of definitive evidence that accommodations can be beneficial to student performance, particular in postsecondary settings.

One study conducted at a liberal arts college by Trammell (2003) found that students with learning disabilities received lower end of term grades when given accommodations related to extra time, taking exams in a separate room, and having access to recording of books and classes, while the reverse finding was true for students with ADHD, and students who were labelled as having both a learning disability, and ADHD reported minimal gains in end of term performance.

McGregor and colleagues (2016) also found that differences in GPA were non-significant between students with learning disabilities who did or did not receive accommodations. While this may suggest limited efficacy with use of accommodations, a lack of difference between those who do, or do not receive

accommodations may instead suggest that those who need accommodations the most are receiving appropriate support that brings them up to a comparable level of performance with their peers (Ricketts et al. 2010; McGregor et al. 2016; Meeks and Jain 2017).

Within the scope of anatomy, Meeks and Jains (2017) also noted that the use of extended time for laboratory examinations may not address the needs of certain students who may require other forms of accommodation such as the provision of assistive technology and visual aids. Even if the efficiency of particular accommodations granted to students with specific disabilities does hold some value, concerns remain for those students who do not disclose their disability to their postsecondary school.

While students with learning disabilities may score lower for measures related to study habits, and awareness of their learning difficulties, students with learning disabilities have been shown to score higher in some attitudinal, and self-regulatory measures, including initiative, resilience, and hope (Trainin and Swanson 2005; Hall and Webster 2008; Feldman et al. 2016). With the additional use of compensatory study strategies, the combination of these two factors may explain in part why students with some form of invisible disability are still able to succeed academically.

What specific methods tend to be beneficial are not well understood and sometimes demonstrate conflicting results, but some studies have suggested that teaching compensatory strategies at postsecondary institutions, and accessing academic support services on a regular basis can be beneficial to students with learning disabilities (Holzer et al. 2009; Troiano et al. 2010).

While the use of some compensation strategies has at times been negatively correlated with performance measures, such as GPA, or reading ability (Ruban et al. 2003, Kirby et al. 2008), a similar argument related to the use of accommodations may instead suggest that students who need the most support are using appropriate strategies in an attempt to earn a comparable grade (Ruban et al. 2003). A previous study by Reis and colleagues (2000) in high achieving students with learning disabilities included a comprehensive list of compensation strategies cited by students, including note taking, time management skills, memory strategies, and use of word processors, although the authors importantly note that the efficacy of such strategies may be more related to the individual needs of each student, as opposed to one-size-fits all solutions. Perhaps most important, the authors note that the use of such strategies were beneficial for students because they enabled them to focus on their strengths, as opposed to remediation of content-related deficits (Reis et al. 2000).

The incorporation of compensatory strategies into wider teaching practices, such as universal design, is not well understood. Furthermore, the use of compensatory strategies may lead to struggles later on for students when the pace of a curriculum overwhelms their ability to compensate, and even impact on their ability to secure accommodations (Rosebraugh 2000).

Universal design for learning (UDL) has been consistently touted as an appropriate framework for optimizing teaching practices to benefit all students, regardless of background, or ability. It represents using a range of approaches for assessment, expression, and strategic engagement (Izzo and Bauer 2015), although there is a lack of quantifiable evidence in postsecondary settings related to what UDL methods can provide beneficial outcomes for students with specific disabilities.

With regard to assessment, studies in medical schools have suggested that multiple choice exams provide the fairest means of testing for students with learning disabilities (Rosebraugh 2000). Engagement in STEM classes has been linked to the use of in class videos, animations, and access to lecture recordings (Izzo and Bauer 2015). Although quantitative measures regarding the efficacy of UDL are still lacking, studies have generally shown that both students and faculty support UDL implementation, although discrepancies in faculty attitudes compared to self-reported actions have been noted (Lombardi et al. 2011; Black et al. 2015), suggesting that there is a greater need for professional development workshops for faculty dedicated to understanding UDL principles and disabilities (Burgstahler 2003; Thurston et al. 2017; National Academies of Sciences, Engineering, and Medicine 2018; Meeks 2019 Jul 2).

UDL principles have been incorporated into disability support services frameworks at some universities, although this implementation is not widespread (Thornton and Downs 2010; Mole 2013). As an additional means to providing accommodations, this may be beneficial as a means of improving collaboration between disability services and faculty throughout campuses, as it may help faculty to consider implementing universal design principles while maintaining academic integrity (Black et al. 2015).

An overreliance on UDL principles to solve all issues related to disability is ill advised however by some researchers. Shakespeare and Watson (2001), stress that although the removal of social barriers (in this case a lack of faculty knowledge) is an important consideration, UDL cannot account for all the barriers and difficulties that people with disabilities face, suggesting that the idea of a barrier-free utopia with UDL could be considered an unsustainable myth.

Concluding Thoughts

Improved access to postsecondary educational opportunities for students with disabilities have proven beneficial for students with a range of conditions, and while improvements in access, and some measures of academic achievement are welcome news, lagging graduation rates, a lack of knowledge regarding outcomes for students with disabilities in STEM, a lack of appreciation for specific issues faced by students with particular disabilities, and persistent negative connotations associated with disability are troubling.

As instructors, we have a duty of care to understand who is in our classroom, and to be flexible with our teaching methods and assessment. Focusing solely on the effects of impairments at the expense of what we can do to improve as instructors is just as inadvisable as finding one-size fits all solutions that do not consider the needs of students with specific disabilities.

Utilizing techniques that can address the needs of all students, such as UDL, is an important strategy that has some merit. However, while it may be unrealistic to expect teachers to be aware of all the issues faced by people with different kinds of disabilities, understanding specific issues faced by students with particular types of disabilities is important. As Oslund (2013) noted, the social model's insistence on disabilities being addressed as a single group ignores complex nuances seen among individuals with physical disabilities, compared to those with invisible disabilities. On occasion, there are tensions between these two different groups. Those with physical disabilities are often fighting to prove their abilities, while those with invisible disabilities are often fighting to prove their disability (Oslund 2013).

As an able-bodied individual, I acknowledge that I may lack an understanding of the needs and concerns of students with specific disabilities. Furthermore, as a PhD student I do not pretend to understand the complexities that full-time faculty may face when trying to incorporate UDL solutions into their classrooms, when constraints related to the physical space of a classroom, time, and class size may impact the feasibility of incorporating the needs of all different kinds of students. Nonetheless, it is my opinion that faculty should be more cognizant of the language they use around people with disabilities, be challenged to consider the kinds of students that are in their classroom, including those with unseen disabilities, and, where possible, to seek professional development opportunities that can benefit students with disabilities in addition to the need for academic accommodations.

Given its link to persistence and graduation rates, future research in disability studies could perhaps consider whether there is a critical value, or range for college GPA that could be used as an early identification measure for students with different types of disabilities that may require additional support, whether or not they are receiving accommodations.

The role of specific study strategies that can prove beneficial as a compensatory technique for students in STEM classes could be explored further, and perhaps even be stressed as an avenue for universal design principles given that rates of disability disclosure in postsecondary institutions are generally low. Qualitative research methods could further probe the impacts on persistence related to a range of factors, including attitudinal factors, pre-postsecondary educational experiences, support from family, peer, and/or faculty, differences based on the age of diagnosis, stigma, workload, age etc.

The topic of disability in STEM fields such as anatomy and physiology remains a heavily under researched topic. While we do not yet have the answers to how we can improve postsecondary outcomes for students with some forms of invisible disabilities, nor how these outcomes differ within STEM fields, there is no doubt that the time has come for disability to demand a greater say in conversations regarding inclusion, diversity, and professional development.

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