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Online First Publication

CITATION

Cawthon, S.W., Garberoglio, C. L., Palmer, J.L., Davidson, S., Ryan, C., & Johnson, P. (2020). Measuring accessibility of postsecondary education and training for deaf individuals: A proposed conceptual framework. *Future Review: International Journal of Transition, College, and Career Success*, 3(1).

Measuring Accessibility of Postsecondary Education and Training for Deaf Individuals: A Proposed Conceptual Framework

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Postsecondary institutions serve as a vehicle for equal access to education and training for a diverse and wide-ranging student population. Deaf individuals, the focus of this paper, are enrolling in postsecondary education and training programs at increasing rates across the nation. These individuals face daily challenges in gaining access to institutional and program resources, requiring constant self-advocacy and the use of a multitude of strategies to navigate these complex systems. This paper first reviews the context of accessibility for deaf individuals in postsecondary settings under current research frameworks. We then offer a new framework for understanding accessibility that incorporates factors that are known to predict postsecondary success. We present a confirmatory factor analysis of a new measure aligned with this framework. The use of this measure is discussed within the context of possible considerations for institutional design to improve equity and success.

Keywords: Accessibility, deaf, postsecondary settings

If you look closely at many college degree diplomas, or listen carefully at a commencement ceremony, you may notice the following phrase: that this degree has been granted *with all the rights, privileges, and responsibilities appertaining thereto*. What rights, privileges, and responsibilities does this phrase refer to? Degree holders are eligible to apply for positions, access associated privileges such as higher pay or professional networks, and bear professional responsibilities such as commitment to sound and ethical practices. The majority of postsecondary training and education occurs at institutions or within programs that include formal learning opportunities, either through direct instruction or through hands-on experience (or both). These programs and institutions are wide ranging in where they are housed and how they are funded. But for each, students and participants enroll with a specific knowledge and skill goal in mind and upon completion, receive certification and the “rights, privileges and responsibilities” associated with it.

Yet not all individuals have an equal opportunity to access those rights, privileges, and responsibilities. Codified into civil rights legislation across public entities are strategies to reduce the denial of access to responsibilities and benefits on the basis of one’s gender, race, sexuality, social class, language,

religion, or disability. These policies support the notion that lack of access to the benefits of a democratic society for a small group, if done in a discriminatory manner, compromises access for the whole. For students with disabilities, the majority of institutions and programs were not originally built and designed with the diversity of disability in mind. What does it mean for education and training to be accessible and how do we achieve this goal? Once in place, how do identify needed changes, improvements, or areas for further work?

Purpose of Paper

When situated within a larger context of equity, how do we define and conceptualize accessibility so as to improve equality in opportunity to reach education and career goals? Measuring access for diverse populations poses unique challenges. Because access both lies on a continuum and is embedded within an ecosystem, the degree of access can vary by individual, within a specific learning environment, at a specific period of time. For the remainder of this paper, discussion will center on access for deaf¹ individuals to postsecondary education and training opportunities. Although deaf individuals share many characteristics with other historically and/or systematically excluded populations, there

¹ In this report, we use the term ‘deaf’ in an all-encompassing manner, including individuals who may identify as Deaf; hard of hearing; hearing impaired; late deafened; or deaf/disabled. Terminology from specific research studies is maintained where known. We also use “deaf” preceding adjacent nouns (e.g., individual, student) to reflect an identity first orientation to language use.

are some unique ways in which access is conceptualized and applied to this group, including experiences with early language deprivation, negative perceptions on the capacities of deaf individuals to succeed in school and at work, and multiple language and communication modalities. While experiences of other marginalized groups have been applied to deaf education (e.g., Antia, Reed, & Kreimeyer, 2005), the experiences of deaf individuals are less commonly used to generate models of access. These experiences can also inform and strengthen models of access that apply more generally and thus warrant specific analysis and exploration. In this paper we propose a model of accessibility that addresses this construct across six domains: technology, attitudes, information and communication, physical environment, services, and social capital. This paper then presents psychometric qualities a measure designed to capture these domains via a confirmatory factor analysis (CFA), concluding with examples to support accessibility across each domain in postsecondary settings.

Postsecondary Education and Training Outcomes for Deaf Individuals

Data on postsecondary enrollment for deaf individuals can be challenging to locate and analyze. There are several reasons for this. First, deaf individuals make up a relatively low incidence disability group -- with fewer than one percent of the K-12 student population receiving direct services under this category -- finding needles in the proverbial haystack is much harder than it is for measurement of outcomes for high incidence groups with more visible presence on campus and in data systems (Mitchell, 2017). A second reason that there are not always reliable statistics on postsecondary education and training experiences for deaf individuals is that students are not required to disclose their status upon application or enrollment. Deaf students become known to campuses and programs only if they seek accommodations or visibly demonstrate their deaf identity. Rarely is such information connected to larger institutional level tracking of student retention and completion outcomes.

Beyond institutional level analyses, US Census data, via the American Community Survey, allows for a national snapshot of postsecondary attainment among people between the ages of 25 and 64 (Garberoglio, Cawthon, & Sales, 2017). The sample in this analysis included more than 38,000 deaf individuals, defined by the US Census as those who “experienced hearing difficulties.” Nationally, the bachelor’s degree completion rate for hearing individuals has hovered at around 30-33%, whereas the same rate for deaf individuals has been around 16 -18%, a significant gap. In 2015, 27% of deaf individuals between the ages of 18 and 25 were enrolled in

some kind of postsecondary education or training program, compared with 39% of hearing individuals. There was significant variation in the data by race, gender, and ethnicity. For example, deaf women aged 18-25 had a higher enrollment rate in postsecondary institutions (45%) than deaf men (32%), nearly twice as large (13%) as the difference between hearing women and men (7%).

Currently, there are few large scale datasets that allow aggregation of a sufficient sample of deaf students to note what factors lead to trends in higher education and training. Understanding the context and predictors of postsecondary attainment is an important first step in conceptualizing what accessibility needs to look like for a diverse student population. One robust resource is the National Longitudinal Transition Study 2 (NLTS2), a study that followed students with disabilities from secondary grades to their school, work, and home lives through a ten-year period (Newman et al., 2011). The initial sample of deaf students within this study was approximately 1,000 students, providing a sufficient basis for identifying significant trends. A few key findings stand out from these analyses as relevant to how postsecondary institutions think about their approaches to accessible and inclusive education. First, the majority of deaf individuals attend two-year technical training and community college programs vs. four-year college degree programs, and that this proportion is higher than hearing students (Newman, et al., 2011). Second, deaf individuals use very different types of accommodations in high school than in postsecondary settings (Cawthon, Leppo, Ge, & Bond, 2015). Student experiences related to gaining access to information in postsecondary settings can vary radically from their experiences in high school. Third, self beliefs and parental expectations are significant predictors of postsecondary success, suggesting the power of supportive psychological environments in postsecondary educational attainment (Cawthon, Garberoglio, Caemmerer, Bond, and Wendel, 2015; Garberoglio, Schoffstall, Cawthon, Bond, & Ge, 2014). While findings from the NLTS2 are far from all encompassing, they suggest the need for a multidimensional approach to understanding accessibility at the postsecondary level.

Current Accessibility Frameworks

Accessibility through Accommodations

In the United States, equal access to postsecondary education is a basic legal right protected by the Americans with Disabilities Act (1990) and the ADA Amendments Act of 2008. ADA provides legal safeguards against unequal access to the information that students receive, either through the instructional materials in the classroom or the overall

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curriculum of an educational program. At a basic level, ADA focuses on equal access to the delivery of information. Deaf individuals often have reduced access to auditory information; ADA posits that delivery of information through auditory means should be available in some visual format in order to be accessible to deaf individuals (e.g., interpreted into sign language and/or transliterated into written English captions). ADA sets the legal expectation that a disability should not reduce a student's access to the resources that they need to pursue educational and employment goals.

Data on postsecondary enrollment for deaf individuals can be challenging to locate and analyze. There are several reasons for this. First, deaf individuals make up a relatively low incidence disability group -- with fewer than one percent of the K-12 student population receiving direct services under this category -- finding needles in the proverbial haystack is much harder than it is for measurement of outcomes for high incidence groups with more visible presence on campus and in data systems (Mitchell, 2017). A second reason that there are not always reliable statistics on postsecondary education and training experiences for deaf individuals is that students are not required to disclose their status upon application or enrollment. Deaf students become known to campuses and programs only if they seek accommodations or visibly demonstrate their deaf identity. Rarely is such information connected to larger institutional level tracking of student retention and completion outcomes.

This legal framework has been important for deaf individuals as they navigate how to gain access to educational opportunities, and for institutions as they seek to both comply with ADA and to support the success of a diverse student body. The fruits of ADA are seen most visibly in the degree to which accommodations are available across different learning environments. Accommodations refer to a range of tools, technologies, adaptations, and other resources that make it possible to deaf individuals and all those who qualify under ADA to access information that is key to education and training. Under ADA, the cost of these accommodations must be borne by the institution; while this is not a blank check for receiving supports and services, students and trainees have many rights that are exercised through this legal framework.

Effectively meeting the accessibility needs of deaf individuals in postsecondary settings is complicated and depends on a number of factors. Deaf individuals' personal characteristics and accommodation preferences can change over time and vary depending on content area and instruction delivery format. For example, a deaf student might request real time captioning in a physics class where complex content, and associated terminology, is delivered in lecture format. This

same student might then request an interpreter in a small group format writing class. Many contemporary learning environments value student interactions and incorporate these at a high degree while also delivering content in a lecture format, which can necessitate dual accommodations (e.g., interpreter and captioning) in order to facilitate equitable access both to peer interactions and course terminology (Cawthon, 2017).

Currently, there are few large scale datasets that allow aggregation of a sufficient sample of deaf students to note what factors lead to trends in higher education and training. Understanding the context and predictors of postsecondary attainment is an important first step in conceptualizing what accessibility needs to look like for a diverse student population. One robust resource is the National Longitudinal Transition Study 2 (NLTS2), a study that followed students with disabilities from secondary grades to their school, work, and home lives through a ten-year period (Newman et al., 2011). The initial sample of deaf students within this study was approximately 1,000 students, providing a sufficient basis for identifying significant trends. A few key findings stand out from these analyses as relevant to how postsecondary institutions think about their approaches to accessible and inclusive education. First, the majority of deaf individuals attend two-year technical training and community college programs vs. four-year college degree programs, and that this proportion is higher than hearing students (Newman, et al., 2011). Second, deaf individuals use very different types of accommodations in high school than in postsecondary settings (Cawthon, Leppo, Ge, & Bond, 2015). Student experiences related to gaining access to information in postsecondary settings can vary radically from their experiences in high school. Third, self beliefs and parental expectations are significant predictors of postsecondary success, suggesting the power of supportive psychological environments in postsecondary educational attainment (Cawthon, Garberoglio, Caemmerer, Bond, and Wendel, 2015; Garberoglio, Schoffstall, Cawthon, Bond, & Ge, 2014). While findings from the NLTS2 are far from all encompassing, they suggest the need for a multidimensional approach to understanding accessibility at the postsecondary level.

Accommodations are necessary for accessibility but do not always enable full access or ensure positive learning outcomes or active involvement in learning (Foster et al., 2004; Long & Beil, 2005; Marschark et al., 2005). Delivery of information is only a starting point. One misconception is that deaf students have the same access to instruction as hearing students when an interpreter is present. Even if they have top-quality interpreters, which quite often they do not (Schick,

Williams, & Kupermintz, 2006), deaf students do not always comprehend 100% of the information interpreted in educational settings (Marschark et al., 2005; Napier & Barker, 2004). The quality of accommodations may also impact student engagement. In studies comparing accommodated vs. direct communication, deaf students were less likely to interact with their teachers (Saur et al., 1987), asked fewer questions, felt less confident about their understanding, and felt less included in class (Long & Beil, 2005). Delivery of information alone is not sufficient for equitable access to the benefits of instruction, engagement with peers, and developing the critical thinking skills that come with wrestling through multiple perspectives on a topic or problem. Accessibility in postsecondary learning environment for deaf students depends upon more than simply the presence of auditory information in a visual form.

Accessibility as Learning Design

One of the great challenges of an accommodations approach to accessibility described above is the need to “retrofit” access onto an inaccessible system. Universal Design for Learning (UDL) is a pedagogical framework that responds to the challenge of accessible learning environments not through accommodations for individual students in their individual educational journeys, but through changes to the learning context as a whole. UDL framework differs from an accommodations-based approach in several ways. First, it comes from a mission of accessibility for a diverse population, not rooted in a legal requirement. Second, proactive rather than reactive learning environments integrate accessible tools and approaches in initial development curricula, instructional activities and context, and assessment and evaluation of student progress. Within a UDL framework, individual requests for accommodations would only be needed if there were additional access needs that were not already met within the initial design of the learning experience.

UDL is similar to ADA in that it prioritizes the different ways in which students might access information delivery in educational learning settings. Expanding on the ADA approach by emphasizing variability and choice in how students engage with material, UDL requires instructors and curriculum designers to think about providing multiple modes by which students can access the material, both in terms of information delivery and student response (Perez, 2015). Ideally, all students have the option to use different features of a learning environment. For example, videos would be captioned at all times, with or without a specific request for accommodations. Instructors using UDL consider multimodal representation of information during the construction of the course as well as its implementation. UDL is designed to

benefit not only students with disabilities, but students with or without disabilities. Offering options, both in the delivery and in the ways that students demonstrate their learning, is integrated into the design of the course. Despite factors pointing to UDL as a promising new field of research in a larger context, the effectiveness of UDL for deaf students has yet to be fully explored.

UDL challenges instructors to think about the ways in which their content delivery assume all students are hearing. There are nuances that are often uncovered when thinking about ways to equalize the language modality of learning and engagement. For example, instructors might think about providing ways for students to visually represent their contributions through written post it notes, online chat features, and images instead of relying solely upon oral large group discussions. UDL changes the paradigm of access from one of accommodation after the fact to inclusion from the start. While UDL is not a replacement for ADA, nor does it hold institutions legally or financially responsible for its utilization, UDL as an instructional framework does broaden the concept of access.

Accessibility as Engagement

ADA has resulted in sea changes in providing equal access for deaf individuals in learning setting. UDL frameworks have encouraged institutions to consider how providing access to post-high school training opportunities extends far beyond and more deeply than simply enrolling in a program, learning the information, and obtaining a degree or credential and encourages proactive approaches to instructional design that can minimize the need to kludge accommodations together after-the-fact. Yet neither of these two approaches examine accessibility of the learning experience as a psychological construct. In terms of impact on an individual’s successful acquisition of information and skills afforded in postsecondary education, accessibility has physical, cognitive, and psychological dimensions. Learning is a social act, an exchange of ideas, not just a one-way transaction. Although the training method can vary widely -- from an internship in a mechanic shop, to a lecture hall with 300 students, to an online training video -- the opportunity to *meaningfully engage with and respond* to information provided at a level that is equitable to one’s peers is a foundational concept in learning that is needed to fully understand accessibility in learning environments. This expansion of our understanding of equitable access requires consideration not just of how deaf individuals receive information, but also how they exchange information with their peers. The next section of this paper explores the ways in which accessibility is also a pedagogical approach.

Discussions about access for deaf learners often neglect a rigorous analysis of the role of engagement in the learning environment. The *psychological* component of access is less apparent but significantly impacts whether a deaf individual persists through access challenges and receives the same level of training as their hearing peers. Accessible learning for deaf students goes beyond simply making auditory information visible. Effective learning environments include other important aspects of access, including how students use and relate to instructional content. The classroom is a complex, dynamic, and interactive space. Dialog about concepts, conversations with peers, hands-on examples, and student projects are a few examples of how students engage with information. Effective learning for students includes having the opportunity to share their ideas and experiences and connect to course material. The role of engagement in learning ecologies is a growing area of inquiry in educational psychology research, which in the last decade has moved toward understanding learning as a process, rather than a product. Classroom engagement is a challenging but important component of an accessible learning environment, above and beyond access to the literal access to information itself (Finnis, Howell, & Gorrie, 2014).

Dialogue between members of a learning environment requires open communication, both literally through accommodations that allow for two-way exchanges of information, but also in the attitudes and feelings of acceptance within the learning environment. The feeling of exclusion and frustration can be a powerful demotivator. For deaf individuals, opting out is often an understandable response to repeated experiences of negative attitudes from faculty and staff, low expectations for performance, stigma from one's peers when using accommodations, and generally the high burden of needing to self-advocate to obtain access. These frustrations all occur on top of the energy required for the learning experience itself. To be an accessible learning environment is thus more than a physical state and extends to the mindset and attitudes of the institution and its members.

A Proposed Expanded Conceptual Framework of Accessibility

These three foundational conceptualizations of access—through accommodations, through learning design, and through engagement-- have been instrumental in raising important questions about how we build equitable learning environments for diverse populations, yet they are not sufficient to ensure that deaf individuals, or individuals with disabilities more generally, have access to the networks, resources, and opportunities that are integral to how postsecondary education and training prepares students for

future success. The following proposed model of accessibility expands the access construct to include six domains: (a) access services; (b) physical environment; (c) technology; (d) attitudes and biases; (e) information and communication, and (f) social capital. Further description of these domains and rationale for inclusion in this proposed framework is provided, below.

Domain 1. Access Services

Access services, or the system that provides accommodations, are one of the more visible indicators of access at an institution. For deaf students, visible indicators of access services may include interpreters or CART in the classroom, tutors, and dedicated advising hours. Beyond availability of resources, effective use of accommodations can depend on a variety of personal and institutional factors. For example, accommodations quality is often defined within the lens of the certification, skills, and experience of the access provider (e.g., interpreter or captionist) or the availability of technology (e.g., an FM system). Yet there are many elements to successful and high-quality services that are not as visible, such as departmental budgets for access, user-friendly request systems, service provider fit with learning environment, student feedback loops, and ways of evaluating the quality of service providers. The degree to which an institution considers these additional elements and establishes effective policies determines how successfully access services are implemented.

Domain 2. Physical Environment

ADA has been instrumental in providing access to the physical environment in ways that can be seen in our everyday lives. Anyone with a bicycle, baby stroller, or shopping cart uses accessibility features such as ramps, automatic doors, and curb cuts to easily maneuver streets and building entrances. Yet the characteristics of the physical environment that affect deaf learners are not always as obvious to the untrained eye. These elements include sight lines in public venues, dorm rooms with accessible doorbells, and visual alarms and notification systems. Facilities with barriers can prevent the attendance of individuals with diverse and changing abilities (Afacan & Erbug, 2009; Hope, 2017). ADA, and certainly UDL, are still relatively recent in relation to construction of many postsecondary facilities.

For deaf individuals, creating a campus that is conducive to visual learning and living, utilizing elements of “deaf space,” can be considered part of institutional accessibility. The DeafSpace project was created in 2005 and has developed guidelines over time for creating environments that allow for maximal use of visual information and, in some cases, include architectural elements that are rooted in Deaf cultural identity

(Edwards & Harold, 2014). The elements of DeafSpace consider how people move through space, the proximity of people and architectural features to each other, light, saturation of color, and acoustics. For example, a design using this approach would be mindful of the space needed for sign language users to communicate efficiently (Edwards & Harold, 2014). DeafSpace has the ability to potentially build upon UDL because it offers a wholistic approach to learning design, pushing it further into thinking about physical spaces that reflect how information is utilized by users of different language modalities.

Domain 3. Technology

Technology is an evolving and important mechanism for accessibility for deaf individuals in many learning environments, above and beyond the use of technology as assistive listening devices (e.g., hearing aids, cochlear implants, FM systems, and the like) (Buisson, 2007; Luetke, 2009; Slike et al., 2008). For example, technology allows for video remote interpreting and real-time captioning to be used in more settings, regardless of geographical location. Access to appropriate services and accommodations has historically been limited by proximity, such as in the case of reduced access to qualified interpreters in rural settings (Belcastro, 2004). Speech-to-text services will also be important as the number of students with cochlear implants, who may not be primary users of sign language, continues to increase (National Institute on Deafness and Other Communication Disorders, 2017). The advent of video remote services, as well as remote speech-to-text services, extend the current landscape of access services beyond those traditionally provided only face-to face. The degree to which technology is available and used to support learning may have an impact on the overall accessibility of an institution or campus.

Domain 4. Attitudes

Each campus or institution has its own culture which includes who is valued, where resources are allocated, and what kinds of expectations people have about each other and their potential for success. This ways in which attitudes relate to accessibility can be subtle—far less transparent than the availability of access services—but attitudes have a strong impact on the degree to which students have equal opportunities to capitalize on the resources of their certificate or degree program. For deaf individuals, negative attitudes from deaf and hearing individuals can serve as a barrier to academic and career success (Noonan, et al. 2004). Deaf individuals' beliefs about their capacity to succeed are shaped by parents, teachers and professionals (Cawthon et al., 2015; Crowe, McLeod, McKinnon, & Ching, 2015; Smith, 2013).

Under an accommodations framework, deaf students may be very aware of when requests for accommodations are seen as a burden. In fact, “undue burden” is a critical aspect of ADA legislation. However, when accessibility is viewed through the lens of engagement, institutions instead place value on every student’s full participation in the learning environment. On a more global level, positive attitudes about the equal rights of deaf students on campus and their contribution to the diversity and life of the community can be seen in the ways that students are accepted by their peers, encouraged by their faculty, and supported by institutional policies.

Domain 5. Information and Communication

Constructivist learning theories recognize that sharing information is at the core of how a learning environment supports and interacts with its students (originally forwarded by Vygotsky, 1962). In the hearing world, information and guidance is provided across many different domains, including direct instruction in the classroom, support in office hours or smaller settings, discussions with peers, “water cooler” conversations, study groups, and tutoring programs. While there is great value in the face-to-face direct instruction found in postsecondary education and training, information and insight gained from *incidental learning opportunities* is critical for academic success. Incidental learning opportunities describes knowledge drawn from natural occurrence –i.e., the give-and-take between members of the learning environment. For example, students may be chatting in the hallway about strategies for completing a difficult assignment, or faculty may have knowledge about internship placements that are publicly posted but shared during an office hour visit. Because accommodations are typically provided for the formal, but not informal learning opportunities, deaf individuals often lose out on those incidental learning opportunities, resulting in a reduced knowledge base compared with their hearing peers (Brackenbury et al., 2005; Lederberg et al., 2000; Hopper, 2011). This category therefore focuses on how information is shared with the student body, the extent to which communications outside of formal instructional contexts are accessible to all students, and the norms for communication across different institutional contexts.

Domain 6. Social Capital

Throughout this paper we discuss the accessibility of information as a critical component of an equitable learning environment for deaf individuals. Yet sharing information does not stand alone; it is critically embedded in relationships between people. Social capital is the sharing of values and norms, creating alliances, and making connections or places where resources can be exchanged (Bimper, 2016; Portes,

1988). Social capital can be shared between individuals at different levels of the educational system, such as a faculty member and a student in an advising meeting, or among colleagues, such as at a career networking event. Social capital building may occur at formal events, but more often this information is shared informally, in conjunction with but outside of structured settings. Social capital can help individuals solve problems, find hidden resources, build networks for postsecondary opportunities, and generally build a community of resilience and support.

For individuals from a minority group, being a part of a networked community can not only build towards opportunities, but also help cushion discrimination and provide strategies for navigating inaccessible settings (Campbell & Lavalley, 1993; Covell, 2006; Crocker & Major, 1989; Hintermair, 2008, Yosso, 2005). Scholarship on examining social capital development has also been paired with an exploration of critical race theory and the need to center our understanding of social capital networks on the experiences of marginalized populations with a specific examination of the role of race (Yosso, 2005). For deaf individuals, strengthening community connections contributes significantly to psychosocial well-being (Bat-Chava, 1993; Hintermair, 2008; Jambor & Elliot, 2005; Listman, Rogers, & Hauser, 2011) and persistence toward degree completion (Danermark, 1995; Stinson et al., 1987). Deaf role models and mentors of the same cultural or ethnic background can build upon this by providing guidance and support for language, communication, social, and career development skills within work and academic environments (Cawthon, Johnson, Garberoglio, & Schoffstall, 2016; Hauser, 2017; Koberg, Boss, & Goodman, 1998; Ragins, 2010). Making social capital building opportunities accessible to deaf individuals, from both hearing and deaf mentors, are a crucial part of how we conceptualize campus accessibility as a whole.

Methods

Measure Development

The accessibility survey (Project Open Doors) was developed through a continual process, which included various stages of refinement and ongoing pilot data collection. Our first step in pursuit of equitable postsecondary attainment for deaf individuals consisted of a targeted literature review to identify the root causes of education, employment, and quality of life outcome disparities. Utilizing an upstream approach allowed us to devise strategies that are not limited to the symptoms, but instead target underlying mechanisms and systemic structures. The root cause analysis identified five key impact areas that address the root causes of challenges to deaf individuals'

postsecondary attainment. These areas include: designing accessible environments, promoting high expectations for success, collecting and using data for decision making, leveraging community resources, and developing collaborative and integrated systems. A general review of the literature was conducted in order to analyze and borrow content from other validated measures of access currently being used in the field, categorize various themes, and identify areas that could be pertinent but missing. Along with the three foundational conceptualizations of access—accommodations, learning design, and engagement, one important finding from the literature indicated a shift in focus to include other essential factors of accessibility, such as relationships between individuals and the impact of deaf role models. The proposed questions in the current survey attempt to expand the construct of access by integrating new areas discussed in studies (i.e., social capital).

Cognitive labs with students who are currently at a university and have previous experience asking for accommodations were conducted. The goal was to walk through the draft survey items and determine whether these specifically targeted post secondary deaf individuals experiences and if respondents explicitly understood the content. Cognitive lab participants were shown the items and asked (1) What do you think this item is asking? (2) How would you answer this item? (3) Are the items clear? (4) Are we missing anything? Open discussion was encouraged and items were revised based on feedback. All cognitive lab interviews were video recorded with participants consent. Additionally, staff from the National Deaf Center on Postsecondary Outcomes at the University of Texas at Austin, and other experts in the field were asked for feedback as well. This allowed us to identify problems with item wording before survey distribution. After incorporating various feedback, the revised survey includes 38 items focused on one of the six categories discussed above. Another area of discussion included the description of scale options. Initially, respondents were asked to answer the questions based on a scale that ranged from completely agree to completely disagree. However, during the measure translation process to American Sign Language, it was brought to our attention using language that included how likely instead of a binary choice (i.e., agree/disagree) would be a more valuable representation. Therefore, the questions are based off a four-level Likert Scale ("Not Likely," "Somewhat Likely," "Likely," "Extremely Likely"). One example is, "How likely are you to see deaf faculty on your campus?"

Participants

This study consisted of a self-report online survey from deaf

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students about the accessibility of their postsecondary education environments. Participants were undergraduate students from multiple institutions across the United States large, federally funded center focused on providing technical assistance to both deaf individuals and institutions across the country. Data for the measure validation was collected from 234 deaf students currently attending small, medium, and large institutions across thirty-nine states. Eligibility requirements included: 18 years of age or older (b) currently enrolled in a postsecondary education or training program (c) identified as deaf (inclusively defined). Majority of the sample identified as female (74%) and were between the ages of 19-29 (61%). Additionally, 60% of participants were White, and 54% reported their preferred language as ASL for classroom lectures.

Data in this paper were collected for CFA purposes and measure validation; the data collection for the overall project is ongoing. Initial drafts of the survey were piloted both online and in focus groups with deaf youth. A final version of the survey was sent out via social media channels with ongoing recruitment starting in fall 2018. Students were able to take the survey via Qualtrics either in English or in American Sign Language. The survey is included in appendix A.

Statistical Analysis

We used second-order confirmatory factor analysis (Rindskopf & Rose 1988) for binary indicators to model the data. CFA is appropriate because it offers specific hypothesis testing for a theory that includes a strong rationale concerning which factors should be in the data and which variables explain each factor (Henson & Roberts, 2006). Multiple researchers encourage that the determination of model-data fit should be based on multiple fit indices (Fan, Thompson, & Wang, 1999; Schumacker & Lomax, 1996). Each survey item loaded onto a latent factor corresponding to the appropriate the accessibility aspect (as listed above), and those six latent factors loaded onto a general factor. Residual correlations between survey items and between latent factors were all assumed to be zero. The model was fit using Mplus version 7.4 (Muthen & Muthen, 2015), using the “Weighted Least Square Mean and VarianceAdjusted Estimator” (WLSMV) and results were analyzed in R, via the MplusAutomation package (R Core Team, 2018; Hallquist & Wiley, 2018).

The factor analysis model was fit to survey responses to 38 questions about six different aspects of campus accessibility described above. For the purpose of the CFA, we excluded data from 24 students who reported attending one of the “big 3” universities, i.e., Gallaudet University, Rochester Institute of Technology, and California State University, Northridge, leaving a total sample size of 234. Survey

questions were on a four-level Likert scale (“Not Likely,” “Somewhat Likely,” “Likely,” “Extremely Likely”). For the CFA analysis, we dichotomized responses, so that a zero corresponds to a response of “Not Likely” or “Somewhat Likely” and a 1 corresponds to “Likely” or “Extremely Likely”.

Results

Model fit measures indicated good, if not perfect, fit: $\chi^2_{659} = 804$ ($p < 0.001$); RMSEA=0.031 (90% CI: 0.022-0.038); CFI = 0.974. Every survey item loaded substantially and significantly onto its appropriate accessibility construct, suggesting that the items all relate appropriately to the underlying constructs of interest. Loadings for survey items on the factors representing aspects of accessibility ranged from 0.53 to 1.41, and the corresponding p-values were all less than 0.001.

The latent factors representing the six aspects of accessibility measured by the survey all loaded significantly onto the general factor, suggesting that each modeled aspect identifies an independent dimension of overall accessibility. These loadings are displayed in Table 1. Differences among the six loadings in Table 1 are not statistically significant; that is, there is no evidence at the $\alpha = 0.05$ level that any of the six factors contributes more or less than the others to overall accessibility.

Table 1. Latent Factor Loading

Factor	Loading	SE	p-value
Technology	1.000		
Attitudes	1.358	0.177	0
Communication	1.298	0.187	0
Physical	1.337	0.190	0
Access Service	0.988	0.174	0
Social Capital	1.517	0.199	0

Discussion

Just as siloed services are inefficient and often ineffective in achieving equitable learning experiences for deaf students, and students with disabilities as a whole, so are siloed frameworks for what accessibility means and how to improve it at the postsecondary level. The ADA and UDL approaches to accessibility help establish a research framework for

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defining access and shared responsibility. The proposed conceptual framework for accessibility in this paper has six domains that cut across both formal and informal interactions within a campus or institutional setting. Below we provide an acronym to represent the six dimensions of ACCESS in an easy-to-remember fashion, definitions of each construct, and offer some example strategies for implementation. While actions and behaviors of these domains of accessibility may not always be directly observable, the developed measure provides possible indicators that align with this overall framework. [Much of the following content is adapted from Palmer, Cawthon, Garberoglio, and Ivanko (2019) report at the National Deaf Center on Postsecondary Outcomes on how to apply these concepts in the field.]

Attitudes: A campus climate that welcomes and integrates deaf students in all aspects of campus life.

- Provide faculty members, staff members, and students with ongoing training and information about engaging, interacting, and partnering with deaf students.
- Establish inclusive classroom communication protocols with students to facilitate meaningful interactions and learning opportunities.
- Seek opportunities to include deaf role models on campus; consider partnering with campus clubs and organizations to bring deaf presenters to campus.

Campus Technology: Flexible technologies that are readily available in all campus settings—from classrooms to locker rooms—for deaf students to fully access and experience the college environment.

- Provide faculty members, staff members, and students with ongoing training and information about engaging, interacting, and partnering with deaf students.
- Establish inclusive classroom communication protocols with students to facilitate meaningful interactions and learning opportunities.
- Seek opportunities to include deaf role models on campus; consider partnering with campus clubs and organizations to bring deaf presenters to campus.

Communications: Efficient and effective communication and information delivery that allows deaf students to maximize formal and informal learning opportunities.

- Ensure that important campus announcements are accessible. Consider using multiple systems for communicating campus announcements.
- Include with all communications standard language on how to request accommodations for campus activities and related programming.
- Proactively plan for and grant requests for accommodations for academic and social activities occurring outside the classroom setting.

Environment: Accessible physical and online spaces that accommodate and adapt to a wide variety of deaf student experiences.

- Consider integrating both visual and auditory systems within the architectural and physical surroundings of buildings and classrooms (e.g., visual fire alarms, loop systems in auditoriums, televisions with captions).
- Establish working groups to address the accessibility of information across campus platforms, including emergency communications and audio-visual displays.
- Encourage flexible classroom setups that allow students to maximize visual and auditory access to content, peers, and auxiliary aids.

Services: Comprehensive accommodations for deaf students that are readily available, reliably provided, individually customized, and monitored for quality and success.

- Outline expectations and responsibilities for students, faculty members, and access providers related to effective implementation of accommodations.
- Establish protocols for collecting regular feedback from students regarding accommodations and auxiliary services; conduct periodic evaluations of services for quality and effectiveness.
- Create and implement institution-wide accessibility policies and practices.
- Collaborate across departments to arrange and pay for services; foster a community responsibility for inclusion.
- Offer, introduce, and train students to use a range of accommodations to maximize experiences and learning across campus.

Social Engagement: The complete immersion in a campus experience that seamlessly includes deaf students in all events and opportunities to socialize, network, and connect.

- Encourage deaf student participation in campus-wide leadership, clubs, and related activities to infuse the values, experiences, and perspectives of deaf students on campus.
- In student life and residence life offices, increase knowledge about how to request accommodations; shift responsibility for accessibility from deaf students to event planners.
- Encourage networking opportunities, like internships, teaching assistant positions, job shadowing, or mentoring, that will strengthen relationships among faculty members, students, and the larger college community.

Successful implementation in each of these six domains requires that all members of the system become accountable for facilitating an accessible and equitable educational environment by increasing knowledge and committing to

shared goals. While systems change requires the investment and participation of all its members, the call here is for institutions to consider the domains in this framework in examining their own systems and the extent to which accessibility can be improved in their programs and campuses. Most people on a college campus do not realize how they contribute to access barriers and do not know how that can be changed. We recommend that campus leaders seek opportunities to communicate with students, faculty members, and administrators about what the institution is doing well and where improvements are needed.

The data from measures such as this one can be used to consider how to make policies and services more inclusive to all deaf students. It is critical for institutions to understand the demographics of the deaf population that they serve when considering the accessibility domains measured here. Improving support for a broad range of deaf students is an important first step toward ensuring educational equity. For example, in data collected using this measure (Palmer et al., 2019), many students preferred to use sign language over spoken language in all contexts, especially for receiving information. Among students who used spoken language, more of them preferred using spoken languages for sharing information, or speaking for themselves, than for receiving information. Deaf students who prefer to speak for themselves may distrust service providers to relay their ideas accurately. Furthermore, students reported that they were more comfortable receiving information through spoken language in one-on-one settings than in classes. These findings reinforce the notion that accommodations need to be dynamic instead of fixed and unchanging. Just as deaf students adjust their communication strategies across settings, they also adjust their requests for accommodations.

This work is only a starting point for what are more complex and broader conversations regarding educational equity for deaf students. The results of years of oppression due to audism and ableism have led to this need for attention to accessibility for deaf students (Listman, et al., 2011); yet for many deaf students who are also people of color, racism has also had a significant impact on their support and belonging at postsecondary institutions (Stapleton, 2017). The majority of deaf students in the sample for this measure identified as white, and at a higher rate than is found in the overall deaf college student population. Issues of intersectionality (Crenshaw, 1989), as well as overlapping and compounding impacts of both audism and racism for deaf students, is a factor that this measure does not explicitly address. While this measure centers accessibility on the experiences of deaf students, there is further work to be done to amplify the experiences of deaf students of color. This is an area for

further conceptualization of the construct of accessibility, research on student perspectives, measure development, and policy implementation.

Conclusion

Deaf students pursue a college education at a comparable rate to their hearing peers (Newman et al., 2011). Yet they are unable to maximize the collegiate experience because institutions are not prepared to provide equitable access to the full range of programs and services available. The extent to which students are able to start off on the right foot, stay on track, and successfully complete college can be attributed to a combination of institutional and individual readiness (Cawthon et al., 2014). Many institutions uphold their legal responsibilities for providing accommodations, yet they often only satisfy minimum requirements without thinking about students' overall learning experience.

Deaf students pursue a college education at a comparable rate to their hearing peers (Newman et al., 2011). Yet they are unable to maximize the collegiate experience because institutions are not prepared to provide equitable access to the full range of programs and services available. The extent to which students are able to start off on the right foot, stay on track, and successfully complete college can be attributed to a combination of institutional and individual readiness (Cawthon et al., 2014). Many institutions uphold their legal responsibilities for providing accommodations, yet they often only satisfy minimum requirements without thinking about students' overall learning experience.

Disability service offices and personnel are often the gatekeepers of engagement for deaf students. Decisions made in this office can create barriers or open doors on campus. Many decisions about accommodations are made uniformly without a consideration of the individual needs of deaf students across contexts. This is problematic because what works for one deaf student does not necessarily work for all deaf students. Flexibility in both policy and practice is essential. The diverse experiences of deaf students require disability service professionals to have sufficient knowledge and training to efficiently implement access services that are adaptive and flexible.

Institutions can use the factors identified in the current study and measure to design accessible and equitable opportunities for deaf students and to foster an inclusive setting for all students to thrive. Access is more than an accommodation or an afterthought; it's a multidimensional framework that is woven throughout an institution. Access manifests in the actions, attitudes, and behaviors of leadership, faculty members, staff members, and students on campus. The domains described above are instrumental in designing

accessible opportunities and inviting deaf students into the college community. In the end, many of the challenges and promises of accessibility are navigated and capitalized upon in communications between individuals and small groups of people. Strategies for students (e.g., how to approach the disclosure process) may look very different than strategies for faculty and staff (e.g., captioning media materials on campus). The goal of universal equitable access for all students, and the foundational belief that all students need to be granted credentials and degrees with all the rights, privileges and responsibilities appertaining thereto requires a coordinated effort and participation from members across the system.

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Appendix A

Accessibility Survey Questions

(1 = “Not Likely,” 2 = “Somewhat Likely,” 3 = “Likely,” 4 = “Extremely Likely”)

1. Online course materials are likely to be accessible to me.
2. Videos my classmates share are likely to have captions.
3. Faculty use technology-based live polls during class to encourage classroom participation.
4. Images descriptions are likely to be available if I need them.
5. Faculty are likely to support individual differences and diverse perspectives in the classroom.
6. Faculty are likely to work with me towards solving access challenges (e.g., assignment format, classroom activities, room arrangement).
7. I am likely to feel welcome engaging in conversations with faculty.
8. I am likely to feel welcome engaging in conversations with classmates.
9. Classmates are likely to support individual differences and diverse perspectives in the classroom.
10. Classmates are likely to work with me towards solving access challenges (e.g., small-group discussions, group projects).
11. Faculty are likely to give me enough time to process information in class.
12. Faculty are likely to provide slides or notes ahead of time.
13. Faculty are likely to make an effort to communicate with me (e.g., make direct eye contact, wait for the interpreter to finish, write notes back-and-forth).
14. Faculty are likely to adapt their teaching strategies to accommodate my communication preferences.
15. Faculty are likely to engage in discussion of class content via email.
16. Faculty are likely to supplement lectures with slides and/or handouts.
17. Videos that are display around campus are likely to have captions.
18. Safety and emergency announcements are likely to be accessible to me.
19. Classrooms are likely to be free of excess distracting noise (e.g., loud fans, echoes)
20. Campus housing is likely to have accessibility features such as flashing light doorbells.
21. Campus fire alarms are likely to be accessible to me.
22. Classroom lighting is likely to be appropriate so I can easily see my instructor or interpreter.
23. The Disability Service Office is likely to consider my communication preferences when providing services.
24. What is the most difficult thing about being a student at your institution?
25. I am likely to be provided with consistent access providers (e.g., speech-to-text, interpreters).
26. The Disability Service Office is likely to provide dual-accommodations such as interpreters and in class speech-to-text providers.
27. The Disability Service Office is likely to collect formal feedback from me about my service providers.
28. The Disability Service Office is likely to respond to my requests in a timely manner.
29. The Disability Service Office is likely to have a clear policy about what to do if I cannot make it to class.
30. My school is likely to provide accessible opportunities for networking.
31. My school is likely to host deaf-related events on campus.
32. I am likely to see a deaf faculty member on campus.
33. I am likely to have opportunities to connect with role models.
34. I am likely to have a deaf peer I can talk to that is supportive.
35. I am likely to become friends with my classmates.
36. I am likely to call campus home.
37. I am likely to participate in campus student activities.
38. I am likely to ask for help from my friends.
39. I am likely to ask for help from resources or offices on campus.