Breakout Group Report: Education for Employment Pathways

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Introduction

How can applied technology and research accelerate sustainable employment opportunities for people with disabilities through computer science (CS) skills training?

This paper emerged from an online symposium hosted by Microsoft in November 2020 along with ongoing discussions of participants within the Education to Employment Pathways working group. Members were from diverse stakeholder groups that included experts on accessible technology, university academics, evaluators, not-for-profit organizations, and K-12 school teachers. This work serves to elucidate ideas related to identifying and overcoming the barriers individuals with disabilities face within the education to employment pipeline. The specific questions this report sought to answer include:

1. What roles can students, educators, employers, policymakers, and other key stakeholders serve to distribute the responsibility of developing and maintaining successful education for employment pathways using a user centric approach?
2. What are promising practices that can occur at multiple developmental levels with respect to disability and age that contribute to the success of people with disabilities in employment (e.g., accessible information technology, inclusive pedagogy)?
3. What solutions can leapfrog from the lived experiences of people with disabilities— especially those of marginalized backgrounds or intersectional identities— to increase the success of people with disabilities in careers, especially those in fields such as science, technology, engineering, and mathematics (STEM)?

The following statements guide the work of the Education for Employment Pathways group:

- Problem Statement: Expertise and multidisciplinary collaboration are needed within and across industry, education, and research to increase successful pathways to STEM careers for people with disabilities.
- Vision Statement: A successful education to employment pathway is clearly defined, accessible, inclusive of people with a wide variety of disabilities, while providing multiple entry points ("onramps") through vulnerable points of life transitions (e.g., high school to college, gap years, burnout in work) for people with disabilities.
- Impact Statement: The creation of holistic transition solutions, including real world training as part of computing education, and distributing the responsibility across stakeholders, will see an increase in the opportunities in STEM, higher employment rates, and longer retention for people with disabilities.

Computer Science **and other IT Training**

Unlike previous generations where postsecondary degrees were entry points into the workforce (especially in IT careers), certifications offer additional modern tools for skilling up. Many of the skill development opportunities are offered online - limiting access to individuals with available technology and to courses designed to be accessible for them. Several digital global platforms launched groundbreaking initiatives in removing barriers to access. One is the Microsoft Global Skills Initiative meant "to foster a safe and successful economic recovery [with] expanded access to the digital skills needed to fill new jobs. One of the keys to a genuinely inclusive recovery are programs to provide easier access to digital skills for people hardest hit by job losses, including those with lower incomes, women, and underrepresented minorities." (Smith, 2020). Google Career Certifications, launched in response to the global pandemic, is another program designed to cultivate workers in the skills needed to land the most in-demand online jobs (Dishman, 2020).

There are broader issues within Computer Science Education that negatively impact women, racial/ethnic minorities, as well as people with disabilities. Addressing these issues would help contextualize the need for increased representation, as these beliefs are a major hurdle towards systemic change. Currently, computer science is not integrated as a standard part of the K-12 general education curriculum in many schools. Some schools do not include computer science courses due to a lack of resources, training, and expertise. Within K-12 Special Education programs, there are multiple challenges. It is difficult to imagine when students can learn computer science, given the time spent on remediating reading, writing and mathematics for students with dyslexia, other learning disabilities, and attention deficits (Ferrell, Bruce, & Luckner, 2014) and engaging in speech therapy, physical therapy, and occupational therapy. Students' needs for this facilitation support often require them to be out of the classroom during these learning opportunities. Consequently, the lack of participation in these learning

experiences contributes to these students' inability to compete with their peers who can leverage a much wider variety of learning opportunities.

In higher education, there is a strong “fixed mindset” around who is capable of learning computer science and that some students have an innate talent for it. This belief limits who instructors encourage to take CS courses (Miller, 2019). For students with disabilities to be successful, accessibility best practices must be applied in course development. Currently, issues are often only identified when a person with a disability experiences accessibility concerns. A proactive approach that embraces allyship shows some promise in correcting this situation (Burgstahler & Thompson, 2019). However, most CS faculty do not have the expertise in both working with students with disabilities and understanding how to provide instruction in computer science to fully include students with disabilities in their CS courses. The vast majority of CS faculty have not taken courses in accessible or universal design practices relevant to pedagogy and technology as a standard part of their training. As a result, there is limited access to learning real-world problem-solving skills, and at best, a focus on how students with disabilities might use technology. Increasing opportunities for students to engage in real world applications of computer science has the potential to accelerate multiple paths to employment.

Though there are complexities in understanding various effective delivery methods of CS and IT education to accommodate diverse communities, there are specialized organizations that have developed promising practices with 'boots on the ground' programming. Established programs include but are not limited to the following:

- DO- IT offers assistive and mainstream technology access, summer programs, online mentoring communities, internships, and other activities to prepare students with disabilities for college studies and careers, especially those in STEM;
- CS for All is a central resource for k-12 individuals and organizations serves as a connector for providers, schools/ districts, funders, and researchers;
- AccessCSforAll is a CS for All program that focuses on access to CS for high school students with disabilities;
- Tech Kids Unlimited’s mission emphasizes students with Autism Spectrum Disorders (ASD);
- Deaf Kids Code provides programming for middle and high school students who are deaf or hard of hearing;
- UDL4CS cultivates sustainable partnerships among educators/ districts PK-8
- NY PROMISE promotes positive postsecondary education outcomes for youth with disabilities between the ages of 14 –16;
- Correlation One hosts Data Science for All (DS4A), which is geared towards adults and special effort towards the deaf/hard of hearing;
- KIT Academy teaches kids with autism math and tech problem solving skills via roleplay

- Disability Action Center hosts an adaptive computer lab and classes that teaches basics on how to use a computer with adaptive technology;
- Kids Like Me has afterschool programs including a gaming club and STEM class
- Taking Autism to the Sky uses drones to develop social and tech skills;
- Stairway to STEM focuses on students with ASD transitioning to college, going into STEM majors;
- STEM^3 Academy is a school program to teach kids on the spectrum STEM.

These programs represent promising practices in this domain but with limited resources and types of funding (e.g., grants and gifts), there is often an inability to thoroughly test their effectiveness and to scale successful practices.

Computer science education and technology training without adequate support and balanced soft skills training impedes success in the workplace for individuals with disabilities. The development of soft skills is a prerequisite for securing and maintaining employment. The US Department of Labor (2020) has tool kits and accessible curriculum that serve as a guide to the development of soft skills. Communication skills, attitude, teamwork, networking, problem solving/ critical thinking, and professionalism are all listed as key topics for successful youth programs. In addition, many organizations, such as Asset Training, have created curriculum that address specific nuances of their communities.

Technology Accessibility

Technology used in academic and employment settings must be accessible to individuals with disabilities in order for them to prepare for and engage in STEM careers. Civil rights legislation (e.g., Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 and its 2008 Amendments) is designed to ensure that students with disabilities and staff have access to the tools necessary to succeed. Though increasing numbers of K-12 schools now offer computer science courses (e.g., cs4all.org) and some educators are making efforts to integrate accessible curricula into their classrooms, systemic failures in addressing accessibility gaps continue to result in students with disabilities experiencing accessibility challenges. For example, universal design tools for learning are often overlooked and not integrated into the classroom. Furthermore, the rapid movement of thousands of jobs and courses online because of the pandemic revealed just how inaccessible many hardware and software products are to this marginalized group (Anderson, 2020; Smith, Pineault, Dickson, & Tosch, 2020).

Some people with disabilities use both assistive and mainstream technologies. Many individuals who are blind use audible and tactile output; individuals with disabilities that impact reading skills may use text to speech technologies that read aloud digital text; individuals with low vision may use screen magnification software; individuals with fine motor impairments use assistive technologies such as speech recognition, alternative keyboards, and eye-gaze tracking

systems; individuals who are deaf or hard of hearing may depend on captions or transcripts to access audio content; and many people with or without disabilities use built-in accessibility features in smart phones and other consumer products. To ensure access to everyone, mainstream technologies need to be designed to be accessible to individuals with disabilities, including those who use assistive technologies. For example, the inaccessible design of many PDF documents makes their content inaccessible to individuals using screen readers. Unless a document is in a text format a screen reader has nothing to read aloud. Even if this condition is met, if it is not coded in such a way that screen readers can inform the reader of its structure and of content presented within images, the text may be presented to the reader as an unstructured linear stream which can be extremely difficult to parse.

There are many systems of support that could be put in place to support greater access to the STEM pipeline. One of these is making use of assistive technologies like software, devices, or equipment that can help a person with a disability perform a function or access information that might otherwise be difficult. Deaf/hard of hearing students may have a lack of visual learning tools and curriculum that is not kinesthetic enough. Some students with visual impairments may require screen readers to work with programming tools so they are to be able to learn to program. While traditional text-based languages work naturally with screen readers, tools such as Scratch Jr., which are popular as a primary programming language, use explicitly visual metaphors and, therefore, do not necessarily transfer. Some students who have ASD may thrive in a remote learning environment, but they also may struggle with inaccessible digital tools and cultural attitudes which feed into the broken entry points in their journey through education to employment. Better outcomes could be achieved by implementing curricula which provides skills support beyond their classrooms.

Inclusive Design Principles, Guidelines, and Practices

To ensure that new products are accessible to a broad audience, rather than focusing on an average or typical user, developers need to consider how the new technology could potentially erect barriers to some individuals. Luckily, existing and well accepted proactive design principles, guidelines, and practices are available to guide these efforts; unfortunately, they are not routinely applied. The seven principles of universal design (UD), the three principles of Universal Design for Learning (UDL), and the four principles that underpin the Web Content Accessibility Guidelines (WCAG) provide guidance in the design of all technology used in education and employment (Burgstahler, 2020). Together, the principles require that a broad spectrum of abilities and other characteristics of potential users be considered in the development process. UD is defined by the Center for Universal Design (n.d.) as “the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.” The principles of UD require that a product or environment is designed for equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use (Story, Mueller, & Mace, 1998, pp. 34–35).

Seven UD principles, originally applied to the design of architecture and commercial products, have been broadly applied to the design of IT hardware and software used in education and employment along with the facilities and furniture where they are housed (The Center for Universal Design in Education, n.d.). Three UD-inspired principles tailored specifically to instructional settings—Universal Design for Learning (UDL)—require that instructors offer students multiple means of engagement, representation, and action and expression (Center for Applied Special Technology, 2018).

Four UD-inspired principles promote the inclusive design of digital tools and content and underpin the widely accepted Web Content Accessibility Guidelines (WCAG) published by the World Wide Web Consortium (W3C, 2018). The principles recommend that all information and user interface components of technology are perceivable, operable, understandable, and robust. While the WCAG standards were developed to apply to web-based technologies, their principles, guidelines, and success criteria can also be applied to digital media, software, and other technologies (W3C, 2013).

The total of fourteen principles that underpin UD, UDL, and WCAG have been roughly summarized into three guidelines for the inclusive design of digital materials, tools and practices used in educational and employment settings (Burgstahler, 2020):

- Provide multiple ways for participants to learn and to demonstrate what they have learned
- Provide multiple ways to engage
- Ensure all technologies, facilities, services, resources, and strategies are accessible to individuals with a wide variety of disabilities

Universally designed technologies and pedagogies that are engaging and effective for all learners and employees result when designers assume that users will have a wide variety of abilities, understand challenges individuals with disabilities often face, and engage in design approaches that result in accessible, usable, and inclusive cyberlearning applications. The combination of UD, UDL, and WCAG principles, together with their guidelines and successful practices, is particularly suitable for addressing accessibility issues related to the technology itself, as well as relevant physical spaces and pedagogical aspects of learning. The set of three principles is general enough that they stand the test of time. Few practitioners and researchers have embraced a paradigm shift from designing for some to designing for everyone.

Carolyn Phillips leads Tools for Life, an assistive technology program, and believes that the effective use of assistive technology by employees with disabilities "is undeniably linked to their long-term success in the workplace." Carolyn Phillips also states that it is “a barrier that exists in the workplace and to be able to bridge over that barrier - even knock down that barrier - for future generations, [one must have] an assistive technology solution or strategy. Many assistive technology solutions are decidedly ‘low tech’. For example, a simple seat cushion can make all the difference for an employee whose job requires hours of sitting. Other assistive technology

devices are taking full advantage of the latest advances in technology including virtual reality, artificial intelligence, and speech recognition" (Administration for Community Living, 2019).

Two areas of research can make important contributions to the IT field: (1) building powerful assistive technologies that benefit individuals with disabilities and (2) creating mainstream products that are accessible to people with a wide range of disabilities, including those who use assistive technologies. Recommendations from a collaborative group representing multiple stakeholders that developed a white paper that addressed these issues (Burgstahler & Thompson, 2019), include that technology researchers:

- Apply relevant standards-compliant coding practices along with UD, UDL, and WCAG principles and practices as they design technology;
- Include people with disabilities and someone with broad IT accessibility knowledge to their research teams;
- Implement an agile, iterative design process that involves users with a wide variety of disabilities and other human characteristics in all phases of the research and design process;
- Establish practices for considering accessibility within workflows, beginning with the first design step; and
- When sharing research results report experiences of individuals with different types of disabilities along with other demographic groups as well as limitations of the study with respect to accessibility.

Other stakeholder groups can support positive changes toward more accessible technology.

Students and employees with disabilities and their allies who report accessibility barriers for themselves and others can encourage instructors and employers to choose technology tools and employ practices that are more accessible, especially when they not only register a concern, but suggest a solution.

- Online learning designers and instructors can apply UD, UDL, and WCAG principles throughout course development and delivery.
- Makerspace, computer lab, and other learning facility designers' managers can take into consideration the wide variety of characteristics that potential users might have.
- Personnel or disability services staff can be responsive to requests for accommodations from students and employees with disabilities that find digital tools and practices inaccessible.
- Personnel who procure technology can meet an institution's legal and ethical obligations for access by putting processes in place that support the procurement of accessible digital products and services.

- Companies and educational institutions can include accessibility knowledge and skills among the qualifications required or desired in job announcements. They can also offer professional development on accessibility to current employees.
- Postsecondary computing and IT departments can ensure that their students learn about accessible design practices before graduation.
- Funding agencies can require that funded projects that develop technology and pedagogy address accessibility issues and that all projects ensure that their websites, videos and other outreach materials and activities are designed to be accessible to individuals with disabilities.

Employment Opportunities

A recent 2021 Forbes article on the state of autism and employment notes how companies and universities have lagged in terms of hiring people with disabilities (Bernick, 2021). According to the US Bureau of Labor Statistics less than 19% of people with a disability in the US were employed in 2019, compared to 66% of those without a disability. Since March 2020, 1 in 5 workers with disabilities have been dismissed from employment, compared with 1 in 7 in the general population, according to the U.S. Bureau of Labor Statistics. This means that there are few successful pathways for cultivating the talent pool of people with disabilities to be able to compete. According to Senator Tom Harkin, “The rate of unemployment for adults with disabilities is just about today where it was 30 years ago…We’ve come a long way towards independence and participation. The final frontier is competitive, integrated employment for persons with disabilities.” To cross this final frontier, businesses require training, backed by research, to demonstrate that building an accessible workplace is part of the cost of running a successful and diverse business, not an optional addition. Partnerships with federal and state entities could lead to the development of policies and resources, including incentives, to help businesses maintain accessible workplaces, both large and small.

There are many questions to consider for organizations in the initial stages of increasing employment opportunities for individuals with disabilities in the workforce including:

- How might the workforce be more suitable and accommodating? (e. g., barriers for care, time off, medical leave, flexibility on number of hours worked and working from home)
- Could job peer mentors be on site to help with social skills and work-based competencies?

The goal is not to "fix" people with disabilities and differences, but to improve their functioning in the workplace by involving:

- Initial skill building for a new employee with disabilities along with ongoing learning opportunities to develop depth of expertise once employed.

- Flexibility in meeting job prerequisites based on framing skill sets (work-based competencies).
- Sustained employment.
- Professional development.

There are many unseen barriers to creating a more accessible workplace for both the employer and interns, which is why training plays such a critical role for employers. Without a work culture that fully embraces disability, employers may unwittingly discriminate or fail to pay a competitive salary to individuals with disabilities. For instance, current Supplemental Security Income rules are inflexible, and employers are unaware of the impact on this federal disability service. If an individual is employed either for a brief time or is fired, they then must undergo a lengthy re-application process for SSI if they receive those benefits. A helpful solution would be to have companies give people with disabilities a choice of how they want to be paid (i.e.: In the case of an internship, perhaps the student can choose a gift card or payment towards their post-secondary tuition.) A simplified comparison of disability benefits/SSI vs. company salary (World Institute on Disability DBI Calculator) could help companies and potential employees to make informed decisions and clarify incentives to work.

Work-based learning experiences and internships are crucial to making the shift towards inclusive employment and must be a positive experience for the employer and student. A 2020 Accenture report, Getting to Equal in 2020 Disability Inclusion, states four factors (employ, enable, engage, and empower), that unlock inclusivity in the workplace and notes that people with disabilities are an untapped resource of talent (Henneborn & Jerdee, 2020). Harnessing access to real world experiences like shadowing, internships, and mentoring creates a more meaningful outcome. The potential employer develops a better understanding and can improve the onboarding process. The potential employee becomes better acquainted and assimilated with the particular environment. Professional development is also a crucial aspect to preparing the student and helps to put more meaningful integrated skill sets into place. One example is the Microsoft Ninja Camp, a pan-disability camp that provides technical training and job shadowing experience for high school students with disabilities.

Vocational school opportunities (which should also include CS training) and other non-traditional iterations are important to get students who are part of special education access to employment experiences. School district special education departments and corporate businesses should work together to open the doors to internships, job-shadows, and other opportunities to see what is possible, to provide valuable employment experiences. In addition, students may be able to gain pre-internship experiences through out-of-school time programs and State Education Departments Rehabilitation services such as ACCES-VR in New York. A key aspect of transitioning from education to employment is employee-employer fit. Although there are ample avenues for students without disabilities transitioning to the workforce to get this information, and to determine this "fit", the opportunities for people with disabilities to make the same informed decision are almost nonexistent. At the same time, mechanisms for

employers to help students to transition to an accessible workplace are sparse. It is important that employers and prospective employees with disabilities have a positive experience surrounding accessibility for successful work experience. A multi-stakeholder effort is needed to improve opportunities for students with disabilities to make an informed decision of choosing a workplace, for students with disabilities to be successful in the workforce, and for employers to provide an inclusive work environment. Accessibility training and inclusive mindsets should be nurtured in employees while they are being educated about working with people with disabilities. For example, accessibility related curriculum should be taught to all students to prepare current and future employers and managers to create an inclusive workplace. Employers should support a "dry run onboarding" process to ensure accessibility for their prospective and new employees. Internships are a crucial interaction point for students to experience a workplace, and for employers to experience a student's skills as a potential employee post education. A key requirement to ensure this mutually positive experience may be to create pre-internship programs which can be shorter in length than a typical internship along with social skills and workplace competency support.

Information about the accessibility experience of working at a workplace is often unavailable publicly to people with disabilities. They should have similar information to their peers without disabilities to make informed decisions about choosing a workplace through websites like Glassdoor and LinkedIn. We need to build similar repositories of information of disability inclusion for different companies and self-identified accounts of this information, along with accessible, lived work experience ratings by employees with disabilities.

Businesses and schools could increase transparency with a scorecard that measures institution-wide steps toward becoming more inclusive of people with disabilities (e.g., offering awareness training, building a mentorship program. Using a scorecard approach would be good for an institution's brand, especially if a certification or seal of approval is created. In turn, this scorecard would create transparency for people with disabilities to feel comfortable in attending courses and applying for a job. Ideally, this would also create a wealth of understanding around the best practices in teaching, recruiting, hiring, and maintaining the employment of people with disabilities.

Managers involved in making workplace policies should set a goal to promote inclusive culture while setting these policies. Culturally responsive management must share their disability, inclusion best practices with other companies to make more workplaces accessible and to promote consistent accessibility experiences across workplaces. For example, Disability: IN's Autism at Work Roundtable is a cross-company effort which publishes widely usable resources like The Autism at Work Playbook, and Microsoft has published best practices to interview people with disabilities.

Acceleration **in and between Pathways**

A successful education for employment pathway should be clearly defined, accessible, inclusive, and diverse, while providing multiple entry points ("accessible onramps") to move through vulnerable points of an individual's life including transitions (from middle school to high school and then to college) so students with disabilities can secure sustained employment. Many students with disabilities do not complete high school and/or college and/or do not complete it in a typical four-year sequence. The statistics are staggering. According to data from the National Deaf Center for Postsecondary Outcomes, in 2019, 83.7% of deaf adults in the United States had successfully completed high school. The largest gaps in educational attainment between deaf and hearing people are present when looking at associate's or bachelor's degree completion. This is important because educational attainment narrows the employment gap between deaf and hearing people. The largest employment gaps are among people who do not complete high school, and the smallest gaps are among people with master's or bachelor's degrees (Garberoglio, Palmer, Cawthon & Sales, 2019). For example, only 18.8% of deaf adults in the United States had completed a bachelor's degree or more, compared to 34% of hearing adults (Garberoglio, Palmer, Cawthon & Sales, 2019).

Fewer undergraduates with disabilities persist to graduation relative to their peers without disabilities. (Friedensen, 2018). For some students with autism spectrum, a 2015 Drexel University report notes that 36% of young adults with autism attended any type of postsecondary education of any kind – including 2-year or 4-year colleges or vocational education. Of those who continued their education, 70% attended a 2-year college at some point. About 40% of those who disclosed their disability to the postsecondary school got some type of help (Roux, Rast, Rava, Anderson & Shuttuck, 2015). In comparison, approximately 59% of non-disabled students who enroll in four-year colleges ultimately graduate with a bachelor's degree (National Center for Education Statistics, 2014) and only about 41% of individuals with a disability, including ASD, graduate (Newman et al., 2011) from a granting institution. A 2013 data set showed that autistic students show higher persistence than non-autistic students (or are more likely to stay in school). The same study showed that students with autism were more likely to be in STEM fields than other students with disabilities and people without disabilities (Wei, Shattuck, McCracken, & Blackorby, 2013).

Low self-esteem and low expectations along with a lack of self-advocacy knowledge (which must be taught) help explain why young adults with learning disabilities attend four-year colleges at half the rate of the general population and why those who do attend college are less likely to complete it (National Center for Learning Disabilities, 2017). Similarly, for students with ADHD, 32.2% of students with the combined type of ADHD dropout of high school, compared to 15% of teens with no psychiatric disorder (Breslau et al. 2011). These students are 11 times more likely to be unemployed and not in school, 61% more likely to have ever been fired, compared to 43% of the comparison group (CHAAD, 2021).

There are also low success completion rates for some students with serious mental health conditions (Davis, 2019) as well as chronic health conditions (National Center for Chronic Disease Prevention and Health Promotion Division of Population Health, 2017). Overall, many students with disabilities have various levels of academic growth which often does not line up to specific grade-level benchmarks. Students with disabilities have different sets of skills and competencies based on their schooling, support, and other key factors such as parent involvement, acquired social skills and ability to self-advocate for accommodation.

Furthermore, intersectionality is an aspect that must be taken into consideration where policies affect those students who live at the intersection of two or more identities. Data from the U.S. Department of Education reports show a consistent pattern of schools suspending or expelling Black students with disabilities at higher rates than their proportion of the population of students with disabilities. Data shows the large majority of out-of-school suspensions are for nonviolent behavior. The most recent available data reflect that, except for Latinx and Asian American students with disabilities, students of color with disabilities were more likely than white students with disabilities to be expelled without educational services. Research reflects that, in addition to missed class time, excessive exclusionary discipline negatively impacts classroom engagement and cohesion and increases the likelihood excluded students will be retained in grade, drop out of school, or be placed in the juvenile justice system. Research also shows that zero tolerance policies and the practice of exclusionary discipline in schools in the absence of consideration and application of alternatives to exclusionary discipline are ineffective in creating safe and healthy learning environments for students, teachers, and staff (U.S. Commission on Civil Rights, 2019). Such factors can prohibit students from navigating through education for employment pathways by populating the education to prison pipeline instead.

Some businesses note that “In fact, inclusion is something which has to permeate a company’s whole culture if it is to mean anything and, when it does, all the issues can be tackled together. Indeed, real change in the boardroom involves looking beyond simple demographics to, for example, disability” (Polman, 2020). To illustrate, recent “Autism at Work” conferences held at Microsoft in Seattle (2018) and in Florida at the Els Center for Autism (2019) featured dozens of Fortune 500 companies who have created programs for individuals with autism. Parent advocates questioned why only “Asperger-type” individuals were accepted into these specific programs. Answers include the fact that low support individuals are easier to employ because they can code-switch and/or camouflage their differences. In such programs, people with disabilities are unable to be their full authentic self at work because they do not fit cultural/societal norms. This is often an exhausting process that sometimes leads to burn out and exit from the workforce.

People with disabilities have tremendous potential, but opportunities are limited by the lack of representation, whether during the school years, in employment, or looking for role models. Increasing allyship at multiple developmental stages can serve to accelerate pathways to employment opportunities. Educators, students, and employers need to see examples of people with all types of disabilities working in STEM in diverse roles and sectors. This is important both for people with disabilities, to create a sense of self-efficacy, and for allies, especially employers, who have a significant impact on how disabilities are represented in the media and on the job (Casey, 2020).

It is critical that vocational rehabilitation and other supports in a student's life are aware of the many different types of jobs and roles within STEM fields that can help identify the right fit to guide students along suitable paths. Some entry level jobs like game testing, quality assurance, network administrator, and customer service may be a great career for many people and a starting point for others. However, many programs only prepare students for entry level jobs; opportunities for further training are necessary to support those with the capability and desire to move on.

To accelerate pathways to employment, various stakeholders need to take part. Fundamentally, for this change to occur, businesses could receive training, backed by research, to demonstrate that building an accessible workplace is part of the cost of running a successful and diverse business, not an optional addition. Partnerships with federal and state entities could lead to the development of policies and resources, including incentives, to help businesses maintain accessible workplaces, both large and small.

Once businesses are ready to make a pledge for change, as some CEOs have adopted in The Valuable 500 or Disability:IN, they can begin taking action to include programs for pipelines to employment. This pledge for change includes a focus on disability specific recruiting, making applying accessible through a usable website to apply with clear company statements on how to request accommodations, equitable interviewing processes, and an onboarding process for new employees with disabilities. Inclusive culture also needs to be built in K-12 and higher education and between students, faculty, and employers. Finding and acting on opportunities could potentially impact the lives of people with disabilities in many ways. There would be more opportunities to enter the path to employment during early school years, fewer barriers to entry in the workplace, and integrated, inclusive accessible experiences once employed. Businesses and schools could increase transparency with a scorecard that measures institution-wide steps toward becoming more inclusive of people with disabilities (e.g., offering awareness training, building a mentorship program. Using a scorecard approach would be good for an institution's brand, especially if a certification or seal of approval is created. In turn, this scorecard would create transparency for people with disabilities to feel comfortable in attending courses and applying for a job. Ideally, this would also create a wealth of understanding around the best practices in teaching, recruiting, hiring, and maintaining the employment of people with disabilities.

Mentorship has the potential for developing a stronger sense of self-efficacy and a growth mindset. It provides support for students and early-stage employees at various developmental levels to ensure that the pathway to employment is well maintained throughout a person's educational and professional career. Mentorship can help identify students' interests and strengths and encourage them to draw analogies between their interests and computer science and other STEM fields. It can help students hone in on their skills and express those strengths clearly to an employer. A well-informed employer would be able to take those strengths and carve out a position that leverages those strengths, rather than expecting a person with disabilities to take on a role that requires too many other skills for which they may be incompatible. This would create an increase in the diversity of roles that people with disabilities take on in employment settings.

Numerous routes to employment including both traditional and non-traditional pathways, prior work experience, skilling, and exposure to role models with disabilities provides a smoother transition to explore creative and innovative careers in technology industries. Fundamental to this transition are the learning reflections of employees with disabilities and moreover, the mentoring and coaching opportunities that promote positive representation and ensure that people with disabilities can engage in coaching to maximize both their growth and their potential. A variety of projects and experiences available to young people through programs such as Deaf Kids Code and Tech Kids Unlimited can help them build expansive portfolios which provide a scaffolded approach to both the promotion and development of their skills and expertise. Non-traditional pathways such as apprenticeships, graduate-apprenticeships, bootcamps and holiday schools such as Firecamp, provide vast and varied opportunities to develop digital skills and, importantly, leadership experience. Ongoing development can be supported through certifications sponsored by companies for industry recognized credentials. Alternative approaches include digital badges such as iDEA, which is a program with online challenges, where young people can develop teamwork, maker, citizen, and entrepreneurial skills.

Next Steps

The Education for Employment Pathways group met and sought to identify and address problems related to the barriers that individuals with disabilities face within education to employment pipelines and pathways. The team sought to identify impactful solutions across industry, education, and research. The actionable recommendations included use of computer science curriculum and accessible technology tools that support accessible education practices; advocacy by and on behalf of individuals with disabilities to require responsiveness to accommodation requests; transparency through a scorecard of steps taken on employer pledges for pipeline programs for people with disabilities; and funding for developing technology and pedagogy that address accessibility issues. Respecting that there are traditional and non-traditional pathways toward employment, the team's actionable recommendations

included increasing visibility for the non-traditional pathways and supporting initiatives that provide professional development so that entry-level employees mature successfully along their career trajectories.

Next steps forward include:

- Establish partnerships with community organizations, researchers, and industry actors who train individuals with disabilities for employment, especially in strong, emerging industries where full careers are available. Define 6-month milestones for these partnerships and transparent reporting on progress toward milestones.
- Expand federal government and industry funding for STEM programming for students with disabilities, including non-traditional students, and including informal learning activities that develop employable skills through lived experiences.
- Invest in successful mentorship programs, including non-traditional mentoring models and mentoring communities, matching individuals with disabilities with mentors who may coach them throughout their career trajectories.
- Establish a resource database of certificate and career training programs for students with disabilities that both students and employers may leverage in mainstream hiring platforms.
- Conduct research to further:
    - The effectiveness of CS skills training for each disability segment and individuals with intersectional identities;
    - Integrated professional development strategies and resource kits for Special Education and CS teachers to meet the needs of students with disabilities in STEM;
    - Indicators for success and the scaling of informal learning activities in various scenarios (e.g., at home STEM kits, specialized programs).

Reaching the goal of increased pathways and success for people with disabilities in STEM careers can only be achieved through innovation to improve accessibility and acceleration through multiple stakeholders working together.

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