

The importance of assistive technology in the productivity pursuits of young adults with disabilities

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Abstract

Background: Young adults with disabilities often use assistive technology (AT) to address personal needs, engage in communities and pursue educational and vocational goals. Little is known about their personal experiences and challenges of accessing and using AT for productivity-related activities.

Objective: This study aimed to learn from young adults about their experiences and use of AT in supporting their productivity.

Methods: Using a qualitative approach, 20 young adult AT users engaged in semi-structured interviews and a photovoice process. Data were analysed inductively.

Results: Three primary themes were identified: I Have to Figure it out Myself, With the Right AT, and Relational Aspects of AT Use. Although participants were experienced AT users, they were often left alone to figure out their emerging needs. They relied on AT to participate in productivity pursuits however stigma around AT use in unsupportive work environments were new concerns.

Conclusions: Young adults with disabilities draw on their experiences of AT use but may need to develop advocacy skills to ensure their needs are met in productivity-related environments.

Employers and supervisors should recognize AT as essential to young adult's engagement with productivity-related activities and have an important role in developing inclusive work environments.

Fourteen percent of Canadians identify living with a disability: specifically, 4.7% of individuals aged 15-24 self-identify a disability and 6.1% of those aged 25-34 report a disability [1]. The proportion of young people with disabilities in each of the age brackets is expected to rise in the coming years, as advances in medical technologies over the past decades have resulted in an increasing number of children living with complex health needs, many of whom use a range of medical and assistive technology (AT) [2,3]. This generation of children has grown up as active and engaged members within their own families, schools, and communities [4] and their experience of disability is not transient, but will extend throughout their lifetime [5].

Young adulthood is often viewed as a tumultuous period of human development, as the young adult begins to experience changing expectations and new roles. The period of development between adolescence and adulthood can be an exciting but challenging time for young people, including pursuits such as further education, moving out of the family home, starting a family, and finding employment [6-8]. Such challenges may be amplified for young people with disabilities [6-9] who may have greater care needs, mobility impairments, communication difficulties, and accessibility issues. Many young adults with disabilities use AT for these issues, defined as “all specialized aids, devices or services that enable persons with disabilities to carry out their everyday activities, such as by making it easier for them to get around (wheelchair, hand or arm support) or by helping them to hear, see or speak (hearing aid, Braille reading materials, keyboard device for communicating)” [10].

Productivity has been defined as “occupations that make a social or economic contribution, or that provide for economic sustenance. Examples include play in infancy and childhood, school work, employment, homemaking, parenting, and community volunteering” [11]. Occupations that focus on productivity and that are particularly pertinent to young adults include school work, post-secondary education, employment and volunteering. Engagement in

productivity-focused occupations is clearly an important role for young adult development beyond monetary compensation, providing organization and structure to one's day, social connection, meaningful engagement, a sense of inclusion, and self-identity [12]. Moreover, a population based analysis supports the importance of facilitating employment opportunities as an important social determinant of health for transitioning into young adulthood [13].

However, it is well-established that the employment rate of individuals with disabilities is significantly lower when compared to individuals without a declared disability. For example, in Canada in 2014, 49% of adults with a disability were employed (and only 26% of those with a "very severe" disability were employed) compared to a 79% employment rate for adults without a declared disability [14]. Honing in on young adults, the rates are comparably disparate. Forty percent of young adult Canadians with disabilities (ages 24-35 years) are neither in school nor employed while only 10% of young adults without disabilities are neither in school nor employed. Based on these findings, Statistics Canada concluded that: "Youth with disabilities are at a comparative disadvantage, with relatively low employment levels while still in school, and weaker labour force attachment after graduation" [15]. A systematic review of employment outcomes for young adults with disabilities highlighted that physical disability, motor impairments, and other functional limitations were associated with negative employment outcomes [16]. Similarly, a scoping review of challenges faced by young adults with disabilities seeking volunteer experiences highlighted that, while volunteering was a beneficial and desirable activity for young adults with disabilities, many identified challenges to volunteer work precipitated by negative attitudes or uninformed employers and organizations [12]. Thus it is clear that a variety of factors contribute to the challenges that young adults with disabilities face as they seek to engage in productivity-related activities.

In Canada, the duty to accommodate is a legal obligation of employers to eliminate or change rules or policies that may be discriminatory against individuals based on group characteristics, such as disability [17]. One aspect of accommodation includes putting into place measures to remove discrimination at both environmental (such as creating accessible work environments) and individual (such as providing AT) levels. However, while some accommodations such as modified hours or duties are relatively commonly provided others, such as provision of adapted devices for communication or computers and human and technical supports, remain largely unmet [14].

While the AT needs of an individual with a disability typically increase with age [18], the increased demand for AT upon entering young adulthood can coincide with diminished funding [6] and reduced access to AT and AT service providers [19] as the person transitions from pediatric to adult health and social services. In Manitoba, of the 75,380 individuals ages 15-64 who reported having a disability, 44% indicated use of adaptive equipment while 20% of those with disabilities reported unmet needs for AT, indicating cost and limited availability as the primary factors precluding access to the device [10]. AT has been identified as a general set of employment supports for young adults with disabilities [20], however, little is known about the experience and challenges of using AT in productivity-related activities for this population.

Thus, given the importance of productivity, the disproportionate unemployment rates, employer requirements to provide reasonable accommodation, and the significance of AT in the lives of young adults with disabilities, this study aimed to learn from young adults about the role AT plays in supporting their productivity. In this study we did not differentiate between paid work, volunteer work or involvement in the education (secondary or post-secondary) system but considered all of these areas as productivity pursuits. Learning from young adults can inform current or potential employers or supervisors about challenges and facilitators AT users who

they may employ or supervise face, and can shed light on ways that we can best facilitate the AT needs of young adults with disabilities as they engage in productivity-focused occupations.

Methods

A qualitative approach was taken to gain an understanding of the meaning that young adults with disabilities ascribe to their AT. The study was theoretically guided by a combined use of symbolic interactionism (and its focus at the individual level) and critical perspectives (with a societal focus) as a framework for addressing complex social phenomena [21]. Methodologically, concepts of grounded theory were used [22] to focus on social processes and temporal aspects, and critical and participatory research methodologies [23] were used as a means to empower individuals and promote social change.

Primary informants were young adult Manitobans with disabilities aged 17-35, who self-reported a permanent or progressive disability since birth, childhood or adolescence, had typical cognitive development for their age, and had the ability to engage in in-depth interviews (including those with a communication partner or using augmented or alternative communication systems). The participants were a user of a minimum of one AT device as a primary augmentation or replacement of daily function. They were recruited from a wide range of organizations and facilities where adult Manitobans AT users receive services or supports through letters of invitation made available through the communication systems of the respective organizations, for example handed out to consumers, posted on bulletin boards, or emailed to members.

Two primary methods of data collection informed this study: two in-depth intensive individual interviews with young adults with disabilities who use AT, and photovoice. Prior to the first interview, participants completed a demographic form. Interviews were held in a location of the participants' choosing, were audiotaped, and transcribed verbatim. The purpose of the first

interview was to gather information on the life experiences of the participants relative to their past, current, and future use of AT.

Following the first interview, participants engaged in the photovoice component of the study, where they were assessed for, and provided with, a camera. Cameras were individually modified to meet the physical needs of each participant so that they could be autonomous in composing and taking photos to capture their insider perspective on how AT influenced their participation. Photovoice is a participatory research data collection method where participants self-select photographs that they then use to inform the researchers about issues that they identify as meaningful [23,24]. In this study, the photovoice data collection consisted of asking participants to photograph relevant experiences that illustrated the meaning, experience, and impact that AT has on their home, school, work, social, and/or community participation. Specifically for some participants with communication limitations, the opportunity to use photovoice allowed the researchers to gain an inside view of their world through the pictures they took and shared that would have been difficult or impossible to share through verbal communication that is a hallmark of the standard qualitative interview. One participant who is blind elected to use a modification of photovoice where she used an audiorecorder to record her experiences of participation in situ as she navigated her community. Between the first and second interviews, participants selected 10-15 photos that were subsequently discussed at a second interview using the SHOWeD method [25]. Once data collection was complete for all participants, they were invited to one of two focus groups where a summary of the findings and photos was shared, and participants were invited to engage in critical dialogue about their AT and participation experiences. Focus group discussions allowed for confirmation of the study findings, and for generation of suggestions on ways to address AT access and gaps in the local context, for example participants recommended developing a website of local resources.

This study was approved by the University of Manitoba Health Ethics Research Board and all participants provided informed consent at study enrolment, and at each study interaction point. Participants were provided with a small honorarium and in keeping with the spirit of empowerment, and as the modifications made to the cameras were individualized, each participant kept the camera used for the photovoice data collection at the study conclusion.

Data analysis followed an inductive thematic analysis approach [26]. Text and photographic data were imported into NVivo™ 10.0 to aid in data organization and management. For each participant, the first and second interviews were read through in their entirety and photos viewed and captioned to gain an overall sense of the participant's experiences. Next, all first interviews were open coded on a line-by-line basis, highlighting the meanings, intentions, and actions of the participants [22]. After analyzing the first set of interviews, the second interview transcripts were coded in a similar fashion. Codes identified in the photographs were used to inform the analysis of the second set of interviews. As coding progressed, codes were compared within and between interviews and examined for similarity or differences. Those that were found to be similar were merged into higher level, more encompassing categories. Finally the entire data set were examined for overarching themes related to productivity experiences.

Several measures to enhance the study rigour and contribute to the overall quality of the study results were used. Credibility was addressed through triangulation of sources, methods, and engaging in in-depth and multiple interviews with participants to promote the development of a true picture of the phenomenon under study. Ten of the twenty participants engaged in the focus group and contributed to member-checking. The use of a detailed audit trail to describe the methods of data collection, analysis and interpretation decisions helped to support the dependability of the findings. Detailed descriptions of the participants, their context and the

research setting, as well as reporting findings using the participants' voice contributes to the transferability of the study results.

Findings

Twenty young adults, with a mean age of 24.7 years, participated in this study (Table 1). Three participants had severe communication impairments: each was accompanied by their mother (one with his personal attendant for the second interview), who served as the participant's communication partner and at times as proxy spokesperson, however all discussion occurred in the presence of the primary informant (young adult). Table 1 also depicts the level of education attained, current employment status and AT used by each of the participants.

Table 1. Participant demographics

The overall importance of work, education and/or volunteering in the lives of these young adults predominated the interviews and photovoice process. Participants communicated a sense of importance, commitment and pride that was attributed to their engagement in productivity-related activities. It was an important part of their lives and sense of self and the photos they shared often depicted aspects of their work or school environment. Assistive technology was highlighted by participants as key to their meaningful engagement in productivity-related activities. Three primary themes emerged from the experiences of young adult AT users in terms of using AT for productivity. "I have to figure it out myself" referred to the challenges that young adult AT users have faced as they transitioned from child to adult services and the strategies they have used to navigate this transition. The second theme, "With the right AT" addressed the importance and nuances of using AT as they engaged in productivity related activities. The final theme, called "Relational aspects of AT use", highlighted how participants recognized the stigma that can be associated with AT use but how work environments could be established that addressed and/or reversed this stigma.

“I have to figure it out myself”

As children, the AT services provided were streamlined, integrated, and cohesive. Funding was perceived as coordinated and available to meet the majority of their AT needs. Service providers were connected to them throughout their primary and secondary education systems and were “known” to them, providing on-going services to the participants as they matured and their needs changed. Families knew where to go with questions and were well aware of how systems worked.

However, this integration of systems and clarity of roles changed markedly as the participants transitioned out of the pediatric system. Despite having similar or greater needs in young adulthood, participants described adult services as fragmented, lacking in cohesion, and confusing. This was articulated clearly by a young man with cerebral palsy:

So the same system, the same government that pushed always and all the teachers and all the OTs and PTs and all the specialists who put all your energy in there, you did the right thing. And then they dropped the bridge. (*Participant 16*)

They spoke of “graduating” out of pediatric services and programs, and the challenges this brought. One person stated:

It was a huge difference because in high school I got all the support there. I had an educational assistant. In university, there hasn't been anyone like that so it's had to fall on my attendants and a lot of them don't have the background they need to help with that (AT needs) and help with my day-to-day care so that's been really challenging. (*Participant 14*)

As young adults, they went about addressing this gap in services and knowledge by learning to figure it out for themselves. Oftentimes, they felt uninformed as to what was available, or where they could locate services and thus needed to take a trial and error approach to gaining the needed information, as shared in the following:

You have to figure it all out on your own. And there's student accessibility services who will help make sure you're allowed to use it, but you have to figure out what 'it' is on your own. Because the people who know all the things about assistive technology, aren't there to help you anymore. (*Participant 18*)

For some participants, “figuring it out” for themselves became one of the strategies that they regularly engaged in and even equated with a shift towards increasing independence as an adult, described in the following:

My employment counsellor said, you know, when you're in post-secondary, there may not be an aide to help you around. You'll have to know your way around the building whereas in school there was an aide that was with me. So you know, more independence is expected of you once you're out of the school system, and you know, they try to prepare you for that. And at first it was scary but I'm more prepared for that now, and you know, I'm taking (para-transit) and I'm thinking about taking the bus, so you know, it gets better with time, for sure. (*Participant 9*)

Young adults also described an emerging responsibility for self-advocacy. While many participants relayed a history of advocacy efforts that their families had engaged in to address their needs and uphold their rights, many of these young adults were in transition towards taking on these advocacy roles for themselves. A few participants continued to rely on their parents and others as their advocates and “figuring it out” remained a considerable challenge. For example, one young man was unable to physically manipulate the technology in order to trial or explore the technology to learn about the functions, a key strategy that participants engaged in as they received new AT. This participant expressed his frustration of not receiving ongoing support and assistance:

Well I just find that like people give you something and go away...and you try and contact them and you just don't get anywhere. It's hard to figure everything out on my

own. They actually have this expectation I'll be able to figure it out without any training or knowing anything about it. *(Participant 14)*

However for the majority of participants, figuring it out yourself meant having, seeking, or finding, the available information in order to make an informed decision. One young man shared his thoughts:

I've always felt like I've been given most of the options or I've explored it myself to see if there are different options, but, I don't know that it's like that for everybody...when it comes to anything knowledge is power so the more you're able to learn about it yourself, and be aware of what's available then that's going to benefit you. *(Participant 15)*

Funding for AT which had been streamlined in pediatric programs was no longer available, or difficult to access. They began to experience bureaucratic funding challenges firsthand.

The first laptop I had received for university I got through the study grant through student aid. Which was a big rigmarole and more work again, because I had to actually apply for a student loan. I didn't need a student loan and then it would decline me, because you can't apply for the grant unless you're getting a student loan. And then I had to go and get so many quotes and then I had to prove why I needed the lightweight one.

(Participant 20)

“With the right AT”

Throughout, participants emphasized how the use of AT promoted their overall participation, engagement in activities, and independence. For example, one young woman shared a photo (Figure 1) taken at her workplace, a non-profit agency, where she demonstrated how she used AT to accomplish the same job duties as others.

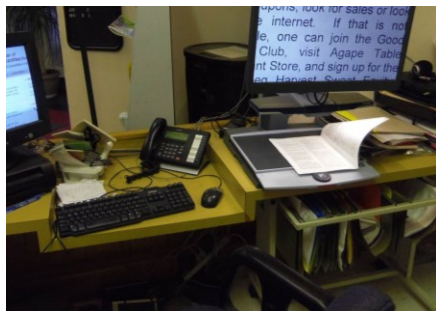


Figure 1. Participant 11 – Workplace. “The newsletter is both hard copy and electronic so that those who have visual impairments are able to listen to it on their computer or blow it up bigger. And then we have it on 14 font for everybody else.” *Participant 11*

The participants learned to appreciate selection and use of AT as a part of their growing responsibilities as young adults. This clearly was a part of their development, as this participant reflected back on her younger self:

I don't think it's something I could have even, I could have used, but it shouldn't have - I wasn't ready for AT, let's just say. I think AT for me was, you know, from 16 till 26. AT's, you know, in my opinion, it requires a lot of responsibility. You know, it's, the technical aspect to actually use it and you know, the respect for the AT itself because it's not cheap. But as a younger, AT was irrelevant. I didn't even know about it and even if I did, I wouldn't have used it. (*Participant 10*)

The young adults valued the specific functions that AT assisted with for example, one young adult described his experiences:

I don't have to struggle to write anymore, and I can actually finish exams in the right amount of time because before I had my AlphaSmart on tests and stuff I'd need extra time because I couldn't write fast enough to finish in the amount of time. (*Participant 18*)

The participants shared pictures of commercially available, modified or adapted devices, as well as dedicated AT. However, often it was the simple adaptations of technologies that

made a substantive difference in the ability of the participant to engage in work tasks. For example, one participant shared a photo of a customized name stamp, that he could use to sign his name on documents as hand-writing was overly laborious for him. Another participant took a photo to depict how the modified technology was essential to his work functions (Figure 2).



Figure 2. Adaptation to work tasks. “[Participant] has the button, the switch on his knee, on his lap, and he’ll hit it with his hand which will give power to the electric scissor for sixty seconds or less whichever, however we have it set up, but we always it set for a minute. And so that way the work, [participant] is essentially the motivator behind the work. It’s not just his staff sitting there doing all the work for him, [participant] is.” *Participant 6 (communication partner)*

These young adults had extensive experience in finding out about, learning about, selecting and using new technologies. Respecting the fact that the person “knows themselves best” when selecting their AT was important for empowering the young adult AT user.

I mean if you walk on something (prosthetic), for thirty years and all of a sudden you’re at a point where this just doesn’t feel right, and if somebody keeps saying, nope that’s right, you’re like, no it’s not right, like that’s you know, been like this for thirty years, like I know, right? (*Participant 15*)

It was clear that the unique abilities and needs of each individual needed to be considered in identifying appropriate AT. Whether able to use products that were available in

retail stores and then adjust features, or needing to use specialized AT, customization was essential as described by the following narrative:

My view of AT is it could be the simplest of things to the most complex, customized built thing for that individual and each person is going to require their own set of needs and their own set of AT. So to generalize it is okay, because you can't be too specific, but once you do have that generalized pool you kind of have to then take that individual and narrow it down and customize it to that person. (*Participant 20*)

Participants needed to trial AT, in order to ensure that it fit their needs. While this is possible in retail stores for some types of technology, it was not possible for many of the specialized AT. This participant shared how important it was to be able to trial a particular device:

It's hard to find, hard to obtain, but once you get it, it's amazing. The amount of work that goes into researching these devices before they make them is evident, like they've thought of a lot of things, it's just hard for someone to actually get it. There's no store. Even if they had one central store that you could go to and they just had all the types of AT there, and you could try things out. (*Participant 18*)

Available support, often with specialized AT knowledge, was essential. Without technology supports, the device itself would be under- or unused, as emphasized in this excerpt:

So I think that's really critical, is the people who are with (participant) every day. We're really lucky right now because everybody is pretty devoted to seeing things through and having (participant) as a strong focus, is critical. But again, they need to be supported in what they do as well. It's all good to have technology and to give it to the person, but it needs to be supported after that (*Participant 6 – mother*)

As life-long users of AT, participants were acutely aware that there were constantly new and

emerging technologies, that technology becomes outdated or obsolete, and that their own needs changed over time. This created a delicate and tenuous balance of ensuring they had the right AT to meet their current needs, but with a constant eye to the future.

You know, you're only given a certain amount and you can only, for example if I purchased a computer in the year 2010, I couldn't receive any more grants for funding for another computer for 5 years. So you've got 5 years to basically keep what you've got and use that. So, you know, in 5 years there's no reason that your technology should become obsolete, but the only thing that kinda worries me is that the software and the hardware don't, they don't evolve together. Software, it's like a living organism. It's moving, like it's always evolving. *(Participant 10)*

For some participants, the relationship with their AT went beyond viewing it as a tool to accomplish tasks, but rather perceived it as a part of self:

In a very weird way, I would describe it as an extension of my body. It just someone would think, oh, I need to bring that paper and pen, to me I think I need to bring my Netbook or my iPad and do it in that type of way. It's just everyone just thinks I'm just in love with my technology but it's, it makes me function, so. *(Participant 20)*

As they became comfortable as an AT user, they did not see themselves without AT, rather they felt that they would continue to use it to advance their personal future goals. Having worked with changing AT across their childhood, they recognized that there would continuously be new or emerging technologies that might be ones that they could access in the future in ways that would help them achieve their goals and contribute to their participation:

I used to just think of it as a, more of a burden when I was younger. It used to be well I've got to use this and I've got to use that. As now I'm getting older, and hopefully wiser, I realize that it's actually something that I need, that I need and it's what I'm going to be using to get me where I want to go. I can't, I could, you know, for all purposes, I guess,

turn your back on AT but what I have plans for my life, AT is a big part of it. I don't see myself being able to achieve what I want to achieve without assistive technology. It's something that I've become, it's like a symbiotic relationship with; it's definitely something very important. (*Participant 10*)

Relational aspects of AT use

As young adults who have grown up with a disability, participants relayed a history of societal reaction. At times this included a sense of exclusion and stigma that they attributed to their AT use as described by one participant:

I would say these things (AT) help me to do my work, but they also alienate me from the rest of the group. Not always, but sometimes. Like there is a difference between talking to someone having conversation than leaving someone alone and getting – like for me, having conversation with me and classmate, this situation is different from my classmate leaving me alone on my own. (*Participant 8*)

When not visible, disclosure of disability in the workplace was viewed as a difficult process. Use of AT was often a tangible symbol of disability, and something that led some to reconsider whether or not to use AT in the workplace as depicted in a photo that one participant shared (Figure 3).

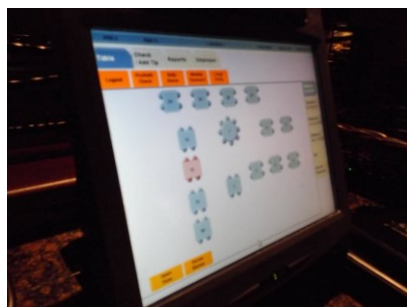


Figure 3. Challenges in using mainstream technology. “This is just the computer that I type things on...I will be trying to go so fast that I’ll see one thing and I think that it says what I mean and I click it, and then it turns out I ordered the wrong thing. And I get in trouble, and, it’s just, it’s really hard, because at a place like school, where my prof might know that I suffer from dyslexia and that is an issue... But to my managers, they don’t know that and...there have been many times where I feel like I should maybe talk to them about it. But I feel like, just the way my managers are, they would think that I was making up excuses...or they would think less of me if I told them that.” (*Participant 19*)

The sense that use of AT was considered a privilege by others rather than a necessary part of the work activities and environment was commonplace. Some employers needed to be convinced or educated so that they viewed the AT as a necessity rather than special or favored treatment. One young adult described the attitude of his employer and the impact on AT use as follows:

Yeah, and I also think that it’s ‘cause there’s always a cost. And then it becomes, ugh. ‘Cause I know when I had my first ergonomic assessment and then they said to buy a headset, my supervisor at that time was like, I have to pay two hundred dollars out of my budget for a headset, are you sure you need this? And then it went to the opposite extreme of well, if you’re needing this, does that not mean that everybody should be using this? (*Participant 20*)

Supportive environments included the involvement of peers and role models. Oftentimes there were particular individuals who were identified as instrumental in successful use of AT. While not exclusively, role models were often other people with disabilities using similar technology.

Well throughout school and I think part of university, I had a lady from the special materials where, I guess, that’s where I got my textbooks from where they developed.

She was like a role model. She was the teacher for technology for the students. Yeah, she was completely blind and she, you know, was very helpful and could show you the contractions or shortcuts for things and how to use things and put things in their perspective. You know, it was very practical, so. (*Participant 11*)

Inclusive environments meant an administrative or managerial commitment to ensuring the environment was accessible and inclusive. This support meant not only physical access, but also served to uphold the dignity of individuals, as reflected by a photo (Figure 4) taken by a young man with cerebral palsy and described in collaboration with his communication partner:

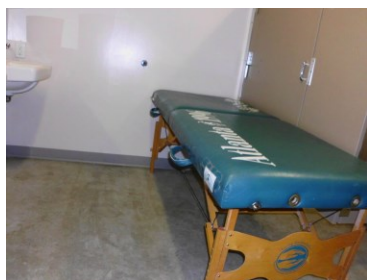


Figure 4. Inclusive environment. “In the restroom [of participant’s volunteer job] is a massage table that can fold up and collapse....the only way [volunteering] really works is if there’s room for [participant] to take washroom breaks and this is the easiest way. So this helps.... and there’s other restrooms for other people to use so it’s not like we’re tying up all the washrooms, it’s just for a moment. And that way no one’s barging in on [participant] and he maintains his privacy and his dignity.” (*Participant 6 communication partner*)

The importance and value of supportive environments and selecting work settings that were welcoming, inclusive, and supportive of their AT needs was paramount. Environments that were accessible and employers that articulated a commitment to inclusivity and were proactive in their duty to accommodate were viewed as particularly desirable by participants.

So it's just a matter of the approach that staff take, the approach that employers take. When I was recruited for my first job at [name of bank], they said they would make any work accommodations you needed, they would design anything for you. So that was something that drew me to them versus another financial institution that didn't really vocalize that. (*Participant 20*)

The importance of work, yet the realization of the challenges faced at the workplace was summed up by Participant 9 who, when asked about his future plans, responded: "I hopefully see myself getting a well-paid job, with a workplace that embraces equality. Hopefully...".

Discussion

These study findings offer a unique and in-depth understanding of the value of AT and the challenges that young adults with disabilities face as they pursue their productivity-related goals. These young adults emphasized how AT is not simply a device, but how the nuances of use are intertwined with the past experiences, needs, context and goals of the individual users. For some participants, this extended to an embodied sense of the AT, where the AT was viewed as a part of self, an experience that has also been described by wheelchair users [27] While the participants know what they need and what works for them, they are challenged by the fragmentation and lack of services and societal misconceptions about AT use. However, AT was clearly an important strategy for engagement in productivity as discussed by participants in this study and supported by other recent research reports. For example, Cimera and colleagues [28] found that young adults who were blind and visually impaired who received AT through a vocational rehabilitation program were more likely to find employment, and Denny-Brown et al. [29] highlighted how workers with disabilities relied on AT to prepare for and get to work, as well as to accomplish job-related tasks. However, these latter two examples must be tempered by the current findings and those of others [30] that clearly illustrate the individualized nature of AT.

Adopting a “one size fits all” approach to use of AT in work environments will not be effective as a mechanism to increase productivity outcomes.

Here, the young adults with disabilities were experienced AT users who knew themselves best, yet were in a transition stage where they were taking on new identities, roles and responsibilities. Oftentimes, this included the assumption of responsibility for ones’ own AT while there was a concomitant reduction in service or funding availability of AT. They lamented the lack of experts and services in this area as compared to what they had access to as children and this created a quandary, where one is reliant on AT, knows what he or she needs or wants, yet has additional challenges in acquiring or receiving support for use of the AT. Participants wanted to be respected for their self-knowledge, problem-solving skills in sourcing and using AT, and expertise as AT users.

Young adults with disabilities may need to develop additional or enhanced skills to address the additional environmental influences on development of identity; the development of self-advocacy and self-determination skills and attitudes may be particularly important for a young person with a disability [31]. Adolescents who experience a disability from birth may have strong dependency relationships on their families as a consequence of the role the parent has assumed as primary caregiver [32]. Relationships between young persons with disabilities and adults (e.g. parents, teachers and care providers) have been described as asymmetrical, where adults made decisions on their behalf, focused solely on meeting physical needs, and in some cases the relationship has been described as non-existent [33]. Promoting capacity-building development of young adults with disabilities has been identified as a key aspect of transition planning [34,35]. Assisting young adults to develop skills in requesting accommodations through formal training programs may be one strategy to help young adults who are transitioning from education to employment settings [36].

What can employers and supervisors do to create supportive workplaces and address the underemployment of talented young adults who can contribute in meaningful ways to the workforce? Knowledge of the ways that workplace accommodations can be implemented for individuals and experience hiring someone with a disability in the past have been shown to predict more favorable employer attitudes towards employees with disabilities [37], however employers still require additional information on how AT can be used in the workplace, and need to ensure the appropriate supports for AT use are in place [38]. Supportive work environments that include a culture of inclusivity and ready adoption of workplace accommodations is clearly a key aspect of successful engagement [16,29]. However, disclosing disability is a personal choice that may be difficult for young adults entering the workforce [34, 39]. For a young person with a disability, perception of stigma, or negative connotations connected with AT may be a deterrent to use [40] and young adults need to make difficult decisions between calling unwanted attention to oneself and fitting in with peers: this decision may affect whether or not they decide to use the AT [41]. Employers can work to normalize AT use by understanding and upholding their duty to accommodate, and viewing AT as a necessary tool [42] rather than a special privilege. Establishing a culture of support and inclusivity includes addressing management philosophy, committing to accessibility, and ensuring knowledgeable and disability-aware employees, including information technology support staff. Emerging technologies that are portable, universal, and have built in accessibility features hold promise for AT users [29,42]: AT users are aware of this changing culture of technology. A willingness to work with young adults to explore and adopt emerging technologies that may be useful for engaging in, and enhancing, productivity on an on-going basis can benefit the entire workplace. Creating a positive culture and awareness of disability and AT use can reinforce inclusion, promote relationship-building and create opportunities for inclusivity [34], addressing some of the negative attitudes or stigma that are perpetuated towards individuals with disabilities.

The study findings are limited in a few ways. In our sampling, we sought diversity in types of AT use, type of disability, and social situation. While this brought richness to the data, there were gaps, for example only three participants were married and all were completing, or had completed, high school. As our inclusion criteria included having average cognitive function, the experiences of individual with intellectual disabilities was not captured. Transferability of findings may be limited by the fact that all participants lived in the same province, thus were subject to the same availability of disability supports and services. While the focus group presented a summary of study findings, only 10 of the 20 participants were available to attend the focus group and participate in member-checking. Some participants had severe communication impairments and the richness of their communications may have been lost by limitations inherent in their communication device or methods, however, all participants engaged in the photovoice portion, providing added “depth” to their data.

Conclusions

Assistive technology is an important part of the lives of young adults with disabilities, and the value of AT is realized in individual’s homes, communities, schools and work settings. Those who have grown up with using AT anticipate that they will always use some type of AT to advance their personal goals and aspirations. However, the individualized nature of AT use and fragmented nature of adult AT services can create additional challenges for young adults with disabilities. As current and potential members of the workforce, it is essential that AT is not viewed as something separate from the person, but rather as something that is part of their everyday life. The wide gap in unemployment rates between individuals with and without disabilities must be addressed. Employers and supervisors who display a positive attitude towards accessibility and accommodation, and promote a culture of inclusivity, will be rewarded

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by the addition of an underemployed workforce; a group of young adults that is as interested and capable as their peers in contributing to society in productive ways.

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References

- [1] Statistics Canada. Prevalence of Disability in Canada 2006: Analytical Report. Ottawa, Ontario.; 2008.
- [2] Blum RW. Improving transition for adolescents with special health care needs from pediatric to adult-centered health care: Introduction. *Pediatrics* 2002;110(6 II):1301-3.
- [3] Kirk S. Transitions in the lives of young people with complex healthcare needs. *Child: Care, Health & Development* 2008;34(5):567-75.
- [4] Stewart D. Evidence to support a positive transition into adulthood for youth with disabilities. *Physical and Occupational Therapy in Pediatrics* 2006;26(4):1-4.
- [5] Stewart D, Stavness C, King G, Antle B, Law M. A critical appraisal of literature reviews about the transition to adulthood for youth with disabilities. *Physical and Occupational Therapy in Pediatrics* 2006;26(4):5-24.
- [6] Johnson KL, Dudgeon B, Kuehn C, Walker W. Assistive technology use among adolescents and young adults with spina bifida. *American Journal of Public Health* 2007;97:330-6.
- [7] Pascall G, Hendey N. (2004). Disability and transition to adulthood: The politics of parenting. *Critical Social Policy* 2004;24(2),165-186.
- [8] Young NL, Barden WS, Mills WA, Burke TA, Law M, Boydell K. Transition to adult-oriented health care: Perspectives of youth and adults with complex physical disabilities. *Physical & Occupational Therapy in Pediatrics* 2009;29(4),345-361.
- [9] Schultz AW, Liptak GS. Helping adolescents who have disabilities negotiate transitions to adulthood. *Issues in Comprehensive Pediatric Nursing* 1998;21(4),187-201.
- [10] Participation and activity limitation survey: Disability supports in Canada, 2006. Ottawa. 2008.

- [11] Canadian Association of Occupational Therapists. Enabling occupation: An occupational therapy perspective. Ottawa. 1997.
- [12] Lindsay S. A scoping review of the experiences, benefits, and challenges involved in volunteer work among youth and young adults with a disability. *Disability and Rehabilitation* 2015;1-14.
- [13] Viner RM, Ozer EM, Denny S, Marmot M, Resnick M, Fatusi A, Currie C. Adolescence and the social determinants of health. *The Lancet* 2012;379(9826),1641-52.
- [14] Statistics Canada. Study: Persons with disabilities and employment 2014; Retrieved March 1, 2016 from: <http://www.statcan.gc.ca/daily-quotidien/141203/dq141203a-eng.htm>
- [15] Statistics Canada. Canadian Survey on Disability, 2012. A Profile of the Labour Market Experiences of Adults with Disabilities among Canadians aged 15 years and older, 2012; Retrieved March 1, 2016 from: <http://www.statcan.gc.ca/pub/89-654-x/89-654-x2015005-eng.htm>
- [16] Achterberg TJ, Wind H, de Boer AGEM, Frings-Dresen MHW. Factors that promote or hinder young disabled people in work participation: A systematic review. *Journal of Occupational Rehabilitation* 2009;19(2),129-41.
- [17] Canadian Human Right Commission. Duty to Accommodate. Retrieved March 1, 2016 from: <http://www.chrc-ccdp.ca/eng/content/duty-accommodate>
- [18] Bartfai A, Boman IL. Policies concerning assistive technology and home modification services for people with physical and cognitive disabilities in Sweden. *NeuroRehabilitation: An Interdisciplinary Journal* 2011;28(3),303-308. Doi: 10.3223/NRE-2011-0658.

- [19] Hamm B, Mirenda P. Post-school quality of life for individuals with developmental disabilities who use AAC. *Augmentative and Alternative Communication*; 2006; 22(2), 134-147. Doi: 10.1080/07434610500395493
- [20] Achterberg TJ, Wind H, Frings-Dresen HW. What are the most important factors for work participation in the young disabled? An expert view. *Disability and Rehabilitation* 2012;34(18),1519-25.
- [21] Burbank PM, Martins DC. Symbolic interactionism and critical perspective: divergent or synergistic? *Nursing Philosophy* 2010, 11(1), 25-41.
- [22] Charmaz K. *Constructing grounded theory: A practical guide through qualitative analysis* 2006. Los Angeles: SAGE Publications.
- [23] Wang C, Burris MA. Photovoice: Concept, methodology, and use for participatory needs assessment. *Health Education & Behavior* 1997;24(3):369-87.
- [24] Strack RW, Magill C, McDonagh K. Engaging youth through photovoice. *Health Promotion Practice* 2004;5(1):49-58.
- [25] Dahan R, Dick R, Moll S, Salwach E, Sherman D, Vengris J, et al. *Photovoice Hamilton 2007: Manual and resource kit.* 2007.
- [26] Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative research in psychology* 2006;3(2),77-101.
- [27] Papadimitriou C. Becoming en-wheeled: the situated accomplishment of re-embodiment as a wheelchair user after spinal cord injury. *Disability & society.* 2008 Dec 1;23(7):691-704.
- [28] Cimera RE, Rumrilla PD, Chanb F, Kayab C, Bezyakc J. Vocational rehabilitation services and outcomes for transition-age youth with visual impairments and blindness. *Journal of Vocational Rehabilitation* 2015; 43,103-11.

- [29] Denny-Brown N, O'Day B, McLeod S. Staying employed services and supports for workers with disabilities. *Journal of Disability Policy Studies* 2015;26(2),124-31.
- [30] Hartmann KD. Assistive technology: A compensatory strategy for work production post mild brain injury. *Work*. 2010;36(4):399-404.
- [31] Jirikowic T, Rickerson N, Burgstahler S. Life after high school: preparing students with disabilities for successful transitions. *OT Practice* 2003 Oct 20;8(19):20-24.
- [32] Schultz AW, Liptak GS, Kirch AJ. Helping adolescents who have disabilities negotiate transitions to adulthood. *Issues in Comprehensive Pediatric Nursing* 1998 Jul;21(4):187-201.
- [33] Skär L. Peer and adult relationships of adolescents with disabilities. *Journal of Adolescence* 2003;26:635-49.
- [34] Stewart D, Gorter, JW, Freeman M. Transitions to adulthood for youth with disabilities: Emerging themes for practice and research. *The Prevention Researcher* 2013;20(2),3-6.
- [35] Stewart D, Law M, Young N L, Forhan M, Healy H, Burke-Gaffney J, Freeman M. Complexities during transitions to adulthood for youth with disabilities: Person-environment interactions. *Disability and Rehabilitation* 2014;35(23), 1998-2004.
- [36] Lindsay S, McDougall C, Sanford R. Disclosure, accommodations and self-care at work among adolescents with disabilities. *Disability and Rehabilitation* 2013;35(26),2227-36.
- [37] McDonnall MC, Crudden A, O'Mally J. Predictors of employer attitudes toward people who are blind or visually impaired as employees. *Journal of Vocational Rehabilitation* 2015;42(1),41-50.
- [38] Bruyère SM, Erickson W, VanLooy S. Information technology (IT) accessibility: Implications for employment of people with disabilities. *Work*. 2006;27(4):397-405.

- [39] Magill-Evans J, Galambos N, Darrah J, Nickerson C. Predictors of employment for young adults with developmental motor disabilities. *Work*. 2008;31(4):433-42.
- [40] Parette P. Transition and assistive technology planning with families across culture. *Career Development for Exceptional Individuals* 1999;22(2):213-31.
- [41] Craddock G. The AT continuum in education: novice to power user. *Disability & Rehabilitation: Assistive Technology* 2006 Jan;1(1-2):17-27.
- [42] Asselin SB. Learning and assistive technologies for college transition. *Journal of Vocational Rehabilitation* 2014;40(3),223-230.

Table 1. Participant Demographics

Participant	Age	Gender	Education	Employment status	Living situation	Nature of disability	Assistive Technology currently used
1	24	male	completed high school	employed full-time	parents' home	spinal cord injury	power wheelchair; computer with voice recognition; ceiling track lift with sling; accessible van; ventilator
2	18	male	attending high school	not seeking employment	parents' home	cerebral palsy	power wheelchair; adapted bicycle; standing frame; bathroom and shower equipment
3	22	female	attending postsecondary	not seeking employment	parents' home	cerebral palsy	manual wheelchair; computer with foot accessed mouse control and onscreen keyboard; adapted bicycle and skis; communication board
4	35	female	completed some postsecondary	volunteering	own home	cerebral palsy	manual and power wheelchair; electronic communication device; computer with joystick mouse; Electronic Aid to Daily Living (EADL) for doors, lights and electronics
5	25	male	completed high school	volunteering	parents' home	cerebral palsy	power wheelchair; smartphone with switch adaptations; electronic communication device; EADL for doors, lights, electronics
6	28	male	completed some postsecondary	volunteering & casual paid work	parents' home	cerebral palsy	manual wheelchair; computer with eyegaze-controls; EADL for doors, lights, electronics; switch-activated recorded messaging device; electronic switch activated scissors; adapted bicycle; adapted bowl and cutlery; shower chair, custom toilet seat
7	17	female	attending high school	casual work volunteering	parents' home	spinal bifida	manual wheelchair; shower chair; ceiling track lift with sling; accessible van; long handled reacher; adapted skis
8	28	male	completed postsecondary degree	currently seeking employment	parents' home	Usher's Syndrome	closed caption television (CCTV); screen magnification software; voice recorder; voice recognition software; hearing aids; vision and mobility cane
9	20	female	completed	not seeking	parents'	vision	screen reader; hand-held media player; talking

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			some postsecondary	employment	home		caller ID; talking books; talking clock; braille printer; digital talking book player; braille and speech portable computer
10	26	male	attending postsecondary	not seeking employment	parents' home	vision	CCTV; computer with built in zoom & screen reading software; screen magnification software on campus for exams; voice recorder
11	28	female	completed postsecondary degree	employed full-time	living with relative	vision	magnifier; monocular; CCTV; braille and speech portable computer; screen magnification software; scanner; vision and mobility cane
12	22	female	completed high school	volunteering & casual paid work	parents home	mobility	power wheelchair
13	21	male	attending postsecondary	casual paid work	parents home	non-verbal learning disorder	laptop; cell phone calendar
14	23	male	attending postsecondary	not seeking employment	own home	cerebral palsy	power and manual wheelchair; accessible van with lift
15	30	male	completed postsecondary degree	employed full-time	own home	Lower limb amputation	prosthetic legs (one each for daily use, hockey, swimming/showering); crutches
16	26	male	completed some post-secondary education	not seeking employment	parents home	cerebral palsy	power and manual wheelchair; laptop, eye tracking communication software; tablet
17	34	male	completed postsecondary degree	on long-term disability	own home	multiple sclerosis	power and manual wheelchair; ceiling track lift; accessible van; portable wheelchair ramps; emergency call system
18	18	male	attending postsecondary	not seeking employment	parents' home	limited fine motor coordination (unspecified)	portable computer; dictation software; smart phone with stylus and built-in note taking software and formula & symbol recognition; write to typed text tablet; rollerball mouse
19	19	female	attending postsecondary	casual paid employment	parents' home	dyslexia	text to speech software; computer; dictionary app on phone
20	31	male	completed	on medical	own	Ehlers-	laptop; ergonomic keyboards; various software

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			postsecondary degree	leave from full-time employment	home	Danlos Syndrome	on the computer (for converting files, dictation, communication); tablet; various apps to convert writing into text and for word prediction; microphone for dictation; smartphone with voice dictation; headset for phone
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