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ORIGINAL PAPER

Applied Cognitive Technologies to Support the Autonomy of People with Intellectual and Developmental Disabilities

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Abstract

Objectives Increasingly, access to technology is a necessity if one is to participate fully in all life domains. Technology is critical to enable people with and without disabilities to live autonomous, self-determined lives. This article provides a synthesis of recent information concerning technology that might promote the autonomy of people with intellectual and developmental disabilities, focusing on technology emerging from the field of applied cognitive technologies.

Methods To explore these issues, we provided a synthesis of the major theoretical perspectives pertaining to autonomy and self-determination, emphasizing the notion of autonomy-as-volition, and selected exemplary research findings that illustrate how technology can promote autonomy.

Results There is clear evidence that people with intellectual and developmental disabilities can be supported to be more autonomous across multiple domains using applied cognitive technologies.

Conclusion In today's ever increasingly technical world, access to usable technology is not simply a convenience, it is a necessity. If people with IDD are to be supported to live, learn, work, and play in their communities, they need to have access to cognitively accessible technology.

Keywords Applied cognitive technologies · Intellectual and developmental disabilities · Autonomy · Self-determination

In 2013, The Coleman Institute for Cognitive Disabilities at the University of Colorado convened leaders in the field of applied cognitive technologies and issued the *Declaration of the Rights of People with Cognitive Disabilities to Technology and Information Access*. The premise of the Declaration, which is provided in Fig. 1, was that with the rapidly changing pace of technology innovation and with the fact that technology access and use was no longer simply a convenience but a necessity, people with cognitive disabilities were at significant risk for economic and social harm if they do not have the opportunity to successfully navigate and acquire such technology (Braddock et al. 2013). The Declaration argued that access to usable technology was not only a necessity, but it was a fundamental right since such technology use had become the gatekeeper to a myriad of basic human functions, from obtaining and holding employment to learning in school to integrating in one's community.

The concern that people with intellectual and developmental disabilities (IDD), particularly, were being left out of the technology revolution has been documented in surveys conducted over the past two decades and more. Multiple national surveys of people with IDD and their families have shown that technology is underutilized by or inaccessible to people with cognitive disabilities (Anderson et al. 2018; Palmer et al. 2012; Tanis et al. 2012; Wehmeyer 1998). Barriers to technology use identified in these studies ranged from the complexity of devices to cost and maintenance (Lussier-Desrochers et al. 2017). Further, there are risks associated with being online, certainly, that must be considered (Chadwick 2019).

But, despite these barriers and risks, multiple literature reviews and meta-analyses have confirmed that technology can support people with IDD to live fuller, richer lives in their

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Fig. 1 The *Declaration of Rights of People With Cognitive Disabilities To Technology And Information Access* (http://www.colemaninstitute.org/wp-content/uploads/2017/01/TheDeclaration.pdf)

The Declaration of Rights of People With Cognitive Disabilities To Technology And Information Access

WHEREAS:

Twenty-eight million United States citizens have cognitive disabilities such as intellectual disability; severe, persistent mental illness; brain injury; stroke; and neurodegenerative disorders such as Alzheimer's disease;

People with cognitive disabilities are entitled to inclusion in our democratic society under federal laws such as the Americans with Disabilities Act (ADA), the Developmental Disabilities Assistance and Bill of Rights Act (DD Act), the Individuals with Disabilities Education Act (IDEA), Section 504 of the Rehabilitation Act, and under state and local laws;

The disruptive convergence of computing and communication technologies has substantially altered how people acquire, utilize, and disseminate knowledge and information;

Access to comprehensible information and usable communication technologies is necessary for all people in our society, particularly for people with cognitive disabilities, to promote self-determination and to engage meaningfully in major aspects of life such as education, health promotion, employment, recreation, and civic participation;

The vast majority of people with cognitive disabilities have limited or no access to comprehensible information and usable communication technologies; People with cognitive disabilities must have access to commercially available devices and software that incorporate principles of universal design such as flexibility and ease of use for all;

Technology and information access by people with cognitive disabilities must be guided by standards and best-practices, such as personalization and compatibility across devices and platforms, and through the application of innovations including automated and predictive technologies; Security and privacy must be assured and managed to protect civil rights and personal dignity of people with cognitive disabilities;

Enhanced public and private funding is urgently required to allow people with cognitive disabilities to utilize technology and access information as a natural consequence of their rights to inclusion in our society;

Ensuring access to technology and information for the 28 million people with cognitive disabilities in the United States will create new markets and employment opportunities; decrease dependency on public services; reduce healthcare costs; and improve the independence, productivity, and quality of life of people with cognitive disabilities.

THEREFORE, BE IT RESOLVED THAT:

We the undersigned hereby affirm our commitment to equal rights of people with cognitive disabilities to technology and information access and we call for implementation of these rights with deliberate speed.

INITIAL ENDORSING ORGANIZATIONS

American Association on Intellectual and Developmental Disabilities

American Network of Community Options and Resources

The Arc

Beach Center on Disability, University of Kansas

Burton Blatt Institute, Syracuse University

Coleman Colorado Foundation and Coleman Institute for Cognitive Disabilities, University of Colorado

Institute on Disability and Human Development, University of Illinois at Chicago

Kansas University Center on Developmental Disabilities

Self Advocates Becoming Empowered

Sibling Leadership Network

communities. Wehmeyer et al. (2008a, 2008b) conducted a comprehensive meta-analysis of single-case design studies of technology use by people with IDD, finding that technology could support more successful functioning across multiple domains, including school, employment, independent living, and community inclusion. Wehmeyer et al. (2006) conducted a meta-analysis of technology used by people with intellectual disability to support employment related activities, finding that such technology was effective and that the presence of universal design features (discussed subsequently) improved employment performance outcomes. Damianidou et al. (2019a, 2019b) extended the Wehmeyer et al. (2006) study to include studies through 2016, confirming both the positive impact of technology use in work settings and furthering the evidence of universal design features. Stock et al. (2011) conducted a synthesis of findings pertaining to the role of technology to support more independent community access for people with intellectual and cognitive disabilities. These community access features included technology to support community navigation, including the use of public transportation, navigation within buildings, and access to community information. Again, the findings validated the importance of technology use to promote greater access to the community.

This paper synthesizes recent information concerning technology that might promote the autonomy of people with IDD. One of the drawbacks of the rapid pace at which technology changes and emerges is that prior syntheses and reviews of the literature rapidly become obsolete in light of technology platform changes and other aspects of technology evolution. This synthesis is not intended to be a comprehensive, systematic review of the literature in the field; indeed, the focus is the work of the authors in the area of applied cognitive technologies. The intent, instead, is to frame the importance of technology within what we see as important for efforts to ensure that the objectives of the Declaration are met. The synthesis uses as its frame three components: changing understandings of disability and the importance of technology in person–environment fit models of disability; the central role and features of applied cognitive technologies that address the aforementioned barriers to technology use, particularly in terms of usability; and an understanding of autonomy as independence and volition in considering how technology solutions can support people with IDD and achieve the objectives of the Declaration.

Person–Environment Fit Models of Disability and Technology

By now, most people who are familiar with intellectual disability are aware of social models of disability that have begun to change how disability is understood. Social models differ from bio-medical models of disability in that the latter conceptualized disability as an internal pathology, while the former views disability as arising "from the discrimination and disadvantage individuals experience in relation to others because of their particular differences and characteristics" (Bach 2017, p. 40). In our own work, we have adopted a person–environment fit model of disability as a way to conceptualize the role of technology in addressing issues associated with the experience of disability (Wehmeyer 2013). Person-environment fit models fall under the realm of social models of disability. Within a disability context, person-environment fit models have been based upon and driven by the World Health Organization's International Classification of Functioning, Disability, and Health (ICF; WHO 2001). The ICF provides "a multidimensional framework for the description of human functioning and disability" (Buntinx 2013, p. 9). In the ICF, functioning is used as an umbrella term for "neutral or non-problematic functional states," and disability is used as "an umbrella term for problems in functioning" (p. 9). Importantly, disability is presented in the ICF as part of and not apart from typical human functioning. The ICF frames human functioning in the context of interactions of impairments to body structure and functions (due to health or medical issues) with environmental and personal factors and, in turn, the impact of those interactions on a person's activity and participation (Wehmeyer et al. 2008a, 2008b). In the 2010 terminology and classification manual on intellectual disability (Schalock et al. 2010), the state of functioning referred to as intellectual disability was conceptualized as a function of the fit between the person and the context in which that person wanted to function. Unlike bio-medical models of disability, which view disability as a characteristic of or a problem within the person, person–environment fit models of disability view disability as existing only in the gap between what a person can do and the demands of that context (Thompson et al. 2010).

An important implication of social and person–environment fit models of disability are that they pave the way for strength-based approaches to supporting people with disability. By focusing on ways to enhance personal capacity and modify the environment or context, the focus in disability supports shift from fixing or curing a person to providing personalized supports that enable success. Supports are "resources and strategies that aim to promote the development, education, interests, and personal well-being of a person and that enhance individual functioning" (Thompson et al. 2009, p. 135). Keeping in mind that the ICF views disability as an umbrella term for problems of functioning, and that essentially functioning is defined in terms of a person's engagement in activities and participation in the full spectrum of life, then one can view supports as anything that facilitate activities and participation.

There are several implications for the role and use of technology within person–environment fit models. Technology can be employed as supports that improve the capacity of a person, as evidenced by the myriad of reviews and meta-analyses discussed previously, and thus help to reduce the gap between what the person can do and what the person wants to do. For example, a person who has difficulty navigating around their community can utilize GPS-enabled devices to improve their capacity to do so. Second, technology can be employed as a support to modify or adapt the context, environment, task, or activity to improve functioning. For example, sticking with the example of navigating one's community, signage that is also presented through a scannable QR code provides a means by which a person who might have difficulty reading or seeing the signage can get the information they need.

Applied Cognitive Technologies

The second component of the framework within which we examine how to respond to the issues raised by the Declaration and the aforementioned research documentation of technology inaccessibility and underutilization involves the application of applied cognitive technologies as supports that enable people to function successfully. Wehmeyer and Shogren (2013) pointed out how technology was referred to impacts how it was understood. Two terms are used to refer to technology used by people with IDD: assistive technology and cognitive prosthetics. Neither of these terms, however, adequately capture the potential for technology to support people in the twenty-first Century.

Perhaps the term assistive technology (AT) is most frequently used in reference to technology to support people with IDD. Wehmeyer and Shogren argued, however, that the term had acquired a specific meaning as it had been applied in various fields. That is, by and large, AT had come to refer to technology that in some way mediated the person's performance of a basic function, whether communication, mobility, sensory, or independent living. The definition of AT in the US Technology Related Assistance to Individuals with Disabilities Act of 1988, which is in turn adopted in almost all federal disability legislation, defines assistive technology devices as "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" (https://www.govinfo.gov/content/pkg/STATUTE-102/pdf/STATUTE-102-Pg1044.pdf). There is a subtle but important difference in this definition and what might be considered a broader class of technology to promote human functioning. That is, AT is technology to increase, maintain, or improve functional *capabilities* of individuals with disabilities. By and large the types of technology that are considered under the term "assistive technology" are devices like alternative or augmentative communication devices, wheelchairs, hearing aids, prosthetics, cognitive aids, and adaptive switches, utensils, and tools. What these have in common is that they are intended to improve basic human functions of communication, mobility and motor skills, sensation, and cognition. The bulk of the literature in technology use by people with intellectual disability has evaluated the use of AT. As important as such technology is, simply enhancing basic "functional capabilities" is not the only way to improve human functioning. What often does not get considered under the umbrella of AT are technology devices that have meaningful roles in promoting human functioning that are used every day by all people, such as smartphones and other telecommunication products, video equipment, and websites. These technologies are multifaceted and as connected and smart devices perform more than a single function.

Without belaboring the point, the term cognitive prosthetics, though not as widely used as the term assistive technology, has similar limitations. A prosthetic is a device that replaces something that is missing from a person. Fundamentally, this is comparable with the role of increasing, maintaining, or improving functional capabilities of individuals with disabilities, with a specific focus on cognitive functional capabilities.

Wehmeyer and Shogren (2013) argued that these terms were less helpful when considering the potential for the types of technologies envisioned by the Declaration to benefit the lives of people with intellectual disability. Taking into account issues pertaining to person–environment fit models of disability and strength-based approaches to disability, Wehmeyer and Shogren suggested the term Applied Cognitive Technologies (ACT) to capture the broader range of technologies referenced by the Declaration. They defined ACT as "technology supports that enable people with cognitive disabilities to successfully function in inclusive environments, to increase participation in tasks and activities in inclusive environments, and to promote social inclusion, self-determination, and quality of life" (Wehmeyer and Shogren 2013, p. 92).

Wehmeyer and Shogren (2013) identified three waves of research and development of ACT. In the first wave, research and development focused on prompting and cueing technologies; literacy supports; sociobiobehavioral, adaptive behavior, and independent living supports; communication technologies (mainly email); and monitoring technologies. Second wave research and development focused on wayfinding and navigational supports; smart homes and smart technology, including remote supports; voice communication and conversational agent technologies; and the use of multimedia and web accessibility. The third wave focused on cloud and app-based technologies, social media and social networks, self-determination and personal autonomy supports, mobile digital image communication applications, health-related technologies, and context aware and location-based learning (p. 93). It is with development and application in, particularly, the second and third waves that the objectives of the Declaration might be more fully achieved.

Autonomy

The third wave of research and development in ACT includes a focus on self-determination and personal autonomy, and it focuses on technology to support autonomy that is the third element of this article's framework. Promoting self-determination has been recognized as an important element in disability supports (Wehmeyer et al. 2017). According to Wehmeyer et al. (2017), acting as a causal agent in one's life (e.g., self-determined action) enables one to meet basic psychological needs pertaining to autonomy, competence, and relatedness. A causal agent is someone who makes or causes things to happen in their own lives.

People who are self-determined act volitionally; that is, they act based upon their interests and preferences with the intent to enhance the quality of their lives. It is this notion of volitional action, or autonomy, that we suggest is at the heart of the Declaration, and it is worth looking at the issue of autonomy in more detail. Autonomy has, generally, two meanings: autonomy-as-independence and autonomy-as-volition (Soenens et al. 2018). When most of us think of autonomy, it is likely we think of the first meaning, which is roughly equivalent to acting more independently. When we think of the use of technology, we think about ways that technology can enable us to do things more independently. While that is an important role of technology, perhaps more important is the role of technology in supporting a person to act volitionally: to do what they want to do.

Certainly, there is considerable congruence between these two meanings in most cases, but not always. We can do things independently through coercion or compulsion. What is more important than technology just helping us to be more independent is technology helping us to do the things we want to do (and doing so more independently!). To that end, the remainder of this article considers how technology can promote autonomy-as-volition by looking at advances in applied cognitive technologies.

Applied Cognitive Technology to Promote Autonomy

Previously, we discussed research and development in ACT. Most of these developments can certainly be characterized as enhancing autonomy-as-independence. Some may, however, be more important than others to enhance autonomy-as-volition for people with IDD. We would acknowledge that, at some level, any technology that promotes greater independence probably does promote greater autonomy (as volition). Thus, it is without a doubt that communication technologies promote autonomy-as-volition by enabling people to communicate preferences, interests, and opinions, and mobility technologies promote autonomy-as-volition by enabling people to successfully get around their homes, communities, work places, and so forth with greater ease. But, as we see the essence of the Declaration, while traditional assistive technologies fall within the realm of important technologies to which people with disabilities must have access, these are technologies that, by and large, are designed for and marketed to people with disabilities to address a single deficit or functional need. Our focus, as such, will be on electronic and information technologies that are more widely available and the potential for these to benefit people with IDD. Rather than group these by type of technology, we have opted to group them by the function the technology serves to promote autonomy-as-volition. And, to somewhat counter the implications of rapidly changing technology and to emphasize technology from the second and third waves of ACT research and development, we limit the synthesis to articles published in the past decade (2010 to 2020).

Getting Around One's Community

Obviously, being able to get around one's community becomes important to autonomy-as-volition for a number of reasons; being able to pursue preferred hobbies, recreation, exercise, and leisure activities; being able to engage in one's preferred religious activities; completing tasks and activities related to one's vocation, and so forth. Promoting such community access begins with planning one's transportation needs. Even if one owns a car, if one is going to an unfamiliar location, knowing to use GPS-enabled mapping apps or devices may be necessary. If one is reliant on public transportation, the planning needs become even more important.

Fixed-route bus systems are the most frequently available public transportation systems but can often require multiple decisions and the recognition of complex information to navigate travel. The use of mobile technologies was identified as a means to support people with IDD to navigate such systems. Mechling and O'Brien (2010) used computer-based video instruction to successfully teach a municipal bus route to three people with intellectual disability. In a follow-up study, Mechling and Seid (2011) effectively used picture, audio, and video prompts on a mobile device to train three high school students with IDD to independently navigate a pedestrian route in their community. Kelley et al. (2013) successfully taught adults with IDD independent pedestrian navigation tasks in their community using an iPod with video prompts.

Increasingly, the opportunity to use connected devices that are multifaceted improves the opportunity for people with IDD to learn and practice trip planning activities. Stock et al. (2019) showed the utility of a suite of desktop computer and smartphone/device apps to assist people with intellectual disability to plan for their trip and transportation needs if they are relying on fixed-route bus system. The Smart Travel Concierge System (STCS) evaluated by Stock et al. consists of four subsystems, all of which incorporate features that support cognitive access: a web-based self-assessment system to determine areas of strengths and support needs pertaining to skills to use a fixed-route bus system, a transportation skills learning library that uses multi-media features to enable people with IDD to learn skills that were identified through the self-assessment, a mobile app-based personal scheduling system to support planning for a trip, and a video-based trip virtualization system. Using the STCS system, Stock et al. (2019) found that people with IDD improved their transportation planning and acquired needed transportation skills.

Of course, GPS-supported devices provide an immediate source of supports when one begins navigating one's community. In initial and follow-up studies (Davies et al. 2010; Stock et al. 2011), researchers developed a GPS-supported application for an early mobile device (PDA) to enable people with IDD to navigate a fixed-route bus system. The device used GPS data to deliver personalized, cognitively accessible information about waypoints along the route and when the person should exit the bus to get to their destination. These studies demonstrated that people with IDD could independently use a public bus system.

One feature of the third wave of ACT development was the expansion of context-aware technology. That involves, simply, technology that uses information such as GPS data to identify a person's specific location and to tailor what options are available to them as a function of that context. Connected and cloud-based technology uses such information to provide prompts for activities such as knowing which bus stop to use, but it can also assist people to navigate contexts once they arrive at their destination. So, for example, Davies et al. (2018) evaluated a smartphone-based app that provided different communication options based upon the environment in which the person was functioning. For example, the vocabulary one needs when in a grocery store will differ from that one needs within a work or school environment. Davies et al. found that people with IDD could successfully use the GPS-enabled communication device to navigate community-based contexts.

Finally, most people use widely available map apps to navigate their community (or when traveling). Unfortunately, such apps are often still too complex for off-the-shelf use by people with IDD and the information provided may not be cognitively accessible. McMahon et al. (2015) evaluated the efficacy of three different navigation aids for college-age students with IDD; a print map, Google maps app, and an augmented reality (AR) navigation application.

The future of transportation supports to enable navigation to promote autonomy certainly involves expansions of existing technologies, but as is almost always the case, most such commercial products fail to incorporate the features that would make them cognitively accessible. Not only are map apps currently overly complex (and we should note, this is often a function of the operating system… swiping, double clicking, keyboarding, and such functions often make it difficult to even get to an app), but app-based rideshare services such as Uber or Lyft may have some utility in providing transportation options for people with IDD (though expenses may be an ongoing barrier), but the app is often difficult to use. And, of course, in a decade (probably more) autonomous vehicles may provide more options, though again cost will be a barrier, along with policy and legal issues.

Living Where One Wants

There are a myriad of ways in which technology can support a person to live where and with whom that person prefers. Among the most obvious involve the use of technology supports to assist with tasks throughout the house (preparing meals, cleaning, doing laundry, etc.). A host of studies illustrate the utility of tablet-based technologies providing video modeling and video prompting to perform such tasks more independently. For example, Mechling et al. (2013) showed that young people with IDD could navigate multi-step menu screens to perform cooking, cleaning, and home maintenance tasks when video prompting was provided on the device. Another area of home-living supports that has been relatively frequently investigated is the use of technology-based schedulers or planners that enable people to keep track of activities and functions during their day. Thus, Soderstrom et al. (2019) implemented iPad-based day planning technologies to support people with IDD to successfully set and adhere to daily tasks and planning activities. Lancioni et al. (2017) validated the efficacy of a smartphone intervention with a calendar app incorporating verbal and pictorial prompts to assist people with IDD to independently start activities and carry them out.

It is important, however, to point out that technology can be used to restrict autonomy-as-volition under the guise of promoting independence (O'Brolchain 2018). This seems to be of greatest concern in the home living domain because it is within that domain that the right to privacy exists most evidently. There are a host of ways in which technology might intrude on one's privacy, from issues pertaining to digital health records, to monitoring technologies, to remote sensing technologies. Any technology designed to store personal information, monitor a person's movements or whereabouts, or sense personal health or related information has the potential to be used in ways that invade one's privacy (O'Brolchain and Gordijn 2019). Add to this the difficulty that people with IDD may have in providing informed consent, and the risk to autonomy-as-volition in the name of increasing independence increases. Thus, when such technologies are in place, support providers need to ensure that to the greatest degree possible the person understands the benefits and risks to them of the technology, assents to the technology's use and personal data management, and that there are policy checks and technology solutions in place to try to maximize the benefits of the technology to the person and to minimize the intrusion on privacy and autonomy.

All that said, it is a fact that many people with IDD need supports to function more successfully in their home and other contexts. Often, those supports come in the form of people: direct support professionals who provide day-to-day living supports, therapists who come and go, and so forth. One area of focus in supporting greater autonomy has been with regard to remote and sensing technologies that can replace the presence of other people in a person's life. These technologies are often referred to as remote supports. In an evaluation of technology supports and funding by state developmental disability agencies, 16 states reported funding electronic or remote technologies specifically for supported living (Tanis et al. 2020). Certainly, relationships are important for anyone, but having someone else perpetually present due to risks that may only manifest periodically can restrict autonomy and privacy. Tasse et al. (2020) conducted focus groups with people with IDD pertaining to what they liked and disliked about remote support technologies in their homes as part of a statewide initiative. This technology involved the "provision of supports by staff of an agency provider at a remote location who are engaged with an individual through equipment with the capability for live two-way communication" (p. 641). The types of technology employed to achieve these supports include: "(a) Motion sensing system; (b) Radio frequency identification; (c) Live video feed; (d) Live audio feed; (e) Web-based monitoring system; or (f) Another device that facilitates live two-way communication" (p. 641).

Tasse et al. (2020) discussed the ethical and safety concerns associated with this initiative, noting that while the state "require[s] that the organization conducting remote support services explain to the individual involved the extent to which the service would limit their privacy" (p. 641), there are concerns on the part of people with IDD on the use of monitoring video cameras, issues with regard to health care information security, and the retention of digital data for long periods of time. The interviews with people with IDD involved with his initiative were a means to begin to gather information about people's feelings about these issues. Overall, Tasse et al. found that people with IDD believed that the technology resulted in "greater independence by being provided with a safe environment and personal time without having direct care staff in the home" (p. 644). Only a small percentage (6%) of respondents felt that they had no privacy due to the technology, while most people felt that they had some or a lot of privacy and, in some cases, that the remote technology provided more privacy than did the previous use of direct support staff in the home to provide the same services.

Keeping in mind that the ICF, discussed previously, defines human functioning in terms of a person's engagement in activities and participation in the full spectrum of life activities, then one can understand how technology to support routine tasks in one's home can contribute both to reducing the need for support and in potentially increasing autonomy-as-volition as well as independence. Soderstrom et al. (2019) positioned their examination of technology to enable people to plan for and implement activities in their lives in terms of impact on self-determination. The qualitative analysis in this study determined three categories of benefit for the use of this technology: predictability in life, participation in communication, and self-determination. All of these categories relate to autonomy-as-volition. Being able to better predict one's tasks and actions allows for greater control, enhanced communication opportunities provide more chances to express preferences and interests, and enhanced self-determination, which refers to volitional action, directly enhances autonomy-as-volition.

Taking Care of One's Health

We have already mentioned the role of technology in health records (and the potential risks to privacy associated with them) but taking care of one's health is an important area regarding expressing one's preferences. Health care systems are, by nature, complex and often difficult to navigate. Health care information can be equally complex, with no clear "best" solution to a health-related problem. Technology can play a role in providing more accessible information pertaining to health care issues and in enabling people to communicate preferences. In many ways, this involves ensuring that information provided through the Internet or the World Wide Web is accessible. There are multiple barriers to accessing online information for people with IDD that arise, from searching for and retrieving information to navigating through websites, to identifying reliable information (Buehler et al. 2016).

Beyond the use of the Internet to get health-related information, technology can provide people with IDD chances to more actively monitor critical health-related factors and to engage in actions to improve health. McMahon et al. (2013) used a smartphone app that used the device's camera and a barcode scanning app to then display, using augmented reality technology, and identify ingredients in packaged food items and enable young adults with IDD to identify foods that might have allergens harmful to them. Ausderau et al. (2019) used photovoice technology in supporting people with IDD to take photos of things that are important to them and then constructing narratives around those photos in partnership with the person, to identify themes around health, nutrition, and physical activity as a means to further opportunities to pursue healthy activities in these domains.

Exercise and weight management are frequent targets for technology use by people with IDD. Guerra et al. (2019) implemented blended online and telehealth sessions in the POWERS for ID Project to support people with IDD to adhere to exercise and weight loss regimens, finding promise in the technology, though also noting the importance of relationships in supporting people. Naslund and Gardelli (2013) showed that use of information and communication technologies, such as cell phones, can empower users with intellectual disability and enhance their physical activity levels. Chang et al. (2016) showed that using an "air mouse" (a microsensor using a gyro sensor) to detect walking activities could increase walking activities, thus potentially improving health. McMahon and McMahon (2016) reviewed existing literature pertaining to technology use to promote physical activity and exercise of people with IDD, including virtual reality, micro-switches, and other forms of technology. This review found that such technology use had positive benefits for improved physical activity as well as, in some cases, more immediate benefits like improved physical condition.

Pursuing a Fulfilling Career

The area that has received, perhaps, the most attention among technology use domains is that of employment. One area of the employment domain that is of importance in considering the role of technology to promote autonomy-as-volition is the job interest and assessment process. Davies et al. (2018a) evaluated a cognitively accessible, cloud-based iPad app that presented short videos of jobs in various industries. Users would view two such videos back-to-back, and then select one of them as preferred over the other. The app stored information on a series of choices and used that to create a career interest report that provided users with IDD information about the types of jobs that seemed to best align with their interests. Similarly, Morgan and Horrocks (2011) used a video-based job assessment and interest preference process to support young adults with IDD to identify preferred jobs. Subsequent evaluation of job performance indicated that these young people were more likely to be engaged in tasks at a higher rate in the high preference jobs.

Once a job has been identified, training becomes a next step in obtaining that position. Stock et al. (2010) used computer-based animation technology to teach young people with IDD work-related social skills. Participants viewed avatars engaged in a work-related activity involving possible conflict situations (such as, with the boss or a co-worker), then selected from among several possible courses of action. The animated scenario then played out according to the course of action selected so participants with IDD could view the relative success, or lack of success, of the selected course of action. Several studies have shown the efficacy of video-modeling and other video-related devices to promote job and employment skill acquisition of people with IDD (Cavkaytar et al. 2017; Goh and Bambera 2013).

Finally, autonomous motivation is supported by one's perception of one's competence, and technology can enhance the performance of people with IDD. Damianidou and colleagues (Damianidou et al. 2019a, 2019b; Damianidou et al. 2018; Damianidou et al. 2019a, 2019b) conducted meta- and thematic-analyses of the use of technology to support employment success for people with IDD. These studies confirmed that the use of a wide array of technology types were effective in promoting enhanced workplace and employment performance. Perhaps not surprisingly, types of technology that embodied features that promote cognitive access had the best outcomes in promoting positive outcomes. These included, primarily, newer generation technologies like smartphones and augmented reality. New applications of vocational technologies include the use of augmented reality to support job tasks and remote job coach supports.

Pursuing One's Passions

As a final area, one of the areas that make for a good life is pursuing one's passions, interests, hobbies, and preferred activities. We have indirectly discussed many of these in prior sections. For example, many people exercise as a form of relaxation and enjoyment. Cooking is another area that goes beyond simply daily living activities and becomes a passion and hobby for some people. Likewise, travel is a frequently mentioned leisure activity. Further, all of the above uses of technology can impact all sorts of areas of interest; many people like to read as a recreation activity. Transportation technology, discussed previously, can come in handy to help a person with IDD to get to a library and back. Digital talking books and audiobooks can enable people who do not read well to read books of their preference. Cognitively accessible web platforms and plain and simple language can enable people with IDD to search for reviews of books they might want to read and to track the books they have read, and so on.

Literacy goes beyond simply reading what others have written and includes written expression. Many people have a passion for writing, whether it be a daily diary or journal, online blogs, or short stories or novels. Davies et al. (2018b) evaluated a cognitively accessible iPad app designed to support people with IDD to use multimedia tools to engage in written (and graphic) self-expression. Another form of written and image communication important to many people involves the use of social media. In addition to access to written communication, social medial access and engagement lead to the advancement of social capital (Tanis and Fisher 2019). Davies et al. (2015) developed a cognitively accessible app to enable people with IDD to post and read messages on Facebook. And another means of communication that has both work and personal value involves email. From arranging times to meet with people for dinner to emailing a question to the owner of a quilt shop, we use email all the time to pursue our interests and passions. Cihak et al. (2015) taught young adults to send and receive emails on computer and tablet devices using a modified email client.

Of course, devices do not have to be use-specific. Maich et al. (2019) showed a wide array of devices, from smartwatches to smartphones, that could have multiple uses to support people with IDD across multiple domains, including numerous leisure activities. Lancioni et al. (2020a, 2020b) showed that various elements of a smartphone, from apps to alarms to internet access, could be implemented to support the leisure activities of people with IDD.

Lancioni et al. (2020a, 2020b) demonstrated that people with IDD and motor impairments could use a tablet with a multimedia player to watch preferred videos, movies, and television shows.

Finally, technology can be invaluable to enable some people with IDD who need more extensive supports to communicate preferences. Cannella-Malone et al. (2018) implemented mainstream eye gaze technology to identify preferences for young people with IDD with physical disabilities who could not communicate verbally or gesturally.

Conclusions

We began this article by referencing the *Declaration of the Rights of People with Cognitive Disabilities to Technology and Information Access*, and noting that it argued that access to usable technology was not only a necessity, but it was a fundamental right since such technology use had become the gatekeeper to a myriad of basic human functions, from obtaining and holding employment to learning in school to integrating in one's community. In this article, we have attempted to craft the argument (and provide evidence for such an argument) that, additionally, access to such technology is a fundamental right because of its important role to enable people to live autonomous lives: not only more independent lives but lives that are based upon people's preferences, interests, values, and dreams.

Further, technology is critical in moving the IDD field toward strength-based approaches to disability introduced by the WHO and other bodies. Technology provides a critical support to bridge the gap between what a person can do and what that person wants to do. But, unless technology incorporates the design features identified in applied cognitive technologies that ensure that people with cognitive disabilities can access and use it to pursue a better life, whether that involves getting around one's community, living where one desires, caring for one's health, engaging in a meaningful career, or pursuing one's passions. As illustrated by the limited synthesis of the literature in the past decade, there are a myriad of ways in which ACT can support these objectives and promote greater autonomy. As such, it is important that stakeholders in the IDD field, including people with IDD, their families and friends, professionals, and others remain vigilant to ensure that the demands of the Declaration are, indeed, met.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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