Published in final edited form as:

Intellect Dev Disabil. 2012 February ; 50(1): 53–68. doi:10.1352/1934-9556-50.1.53.

A Self-Report Computer-Based Survey of Technology Use by People with Intellectual and Developmental Disabilities

Emily Shea Tanis,

University of Colorado

Susan B. Palmer,

University of Kansas

Michael L. Wehmeyer,

University of Kansas

Danial Davies,

Ablelink Technologies

Steven Stock,

Ablelink Technologies

Kathy Lobb, and

Self-Advocate Coalition of Kansas

Barbara Bishop

The Arc of Douglas County

Abstract

Advancements of technologies in the areas of mobility, hearing and vision, communication, and daily living for people with intellectual and developmental disabilities (IDD) has the potential to greatly enhance independence and self-determination. Previous research, however, suggests that there is a “technological divide” with regard to the use of such technologies by people with IDD when compared with the general public. The present study sought to provide current information with regard to technology use by people with IDD by examining the technology needs, use, and barriers to such use experienced by 180 adults with IDD through QuestNet, a self-directed computer survey program. The study findings suggest that although there has been progress in technology acquisition and use by people with IDD, yet there remains an underutilization of technologies across the population.

Today, technology use permeates virtually every dimension of the human experience: physical, social, emotional, spiritual, occupational, and intellectual (Antón, Silbergliitt, & Schneider, 2001) and has changed the way people function in society. Not all people, however, have the opportunities or resources available to obtain and successfully utilize new and developing technologies. Further, technological advancements occur at such a rapid rate that even people who use technology often cannot keep up with technological innovations and advancements. This phenomenon has contributed to the emergence of a technological divide (Burns, 2008), referring to the disparity between people who have access to and subsequently use of technology and people who do not. More often than not, people with

intellectual and developmental disabilities (IDD) end up on the side of the divide with others who do not have access to or use technology (Wehmeyer, 1995).

Research shows that increased technology use positively impacts quality of life for people with IDD (Wehmeyer, Smith, Palmer, Davies, & Stock, 2004). Parette (1991) outlined three potential benefits of technology for people with IDD: “(a) the facilitation and automation of therapeutic regimens and educational activities; (b) the provision, restoration, or extension of a person's physical abilities; and (c) the provision of opportunities for greater participation in the mainstream society” (p. 165). Unfortunately, research also shows that technology is appreciably underutilized by people with IDD (Hoppestad, 2007; Kling & Wilcox, 2010; The Arc, 1993; Wehmeyer, 1995, 1998, 1999). Wehmeyer (1998) surveyed family members of people with ID about their son or daughter's technology use and found that in the majority of device areas (i.e. mobility, hearing and vision, communication, etc.), the number of people with IDD who needed a device outnumbered those who were identified as already using such a device. Contributing factors to underutilization of technology devices by people with ID included: (a) cost of device; (b) lack of information about device; (c) difficulties in obtaining an assessment and; (d) inadequate training to use the device.

Another barrier to technology use by people with IDD involves the ways in which technology is designed. Despite an emphasis on incorporating universal design features, device design features remain obstacles to their use by people with IDD (Mirchandi, 2003; Wehmeyer, Palmer, Smith, Davies, & Stock, 2008). Such barriers may be physical or cognitive. Take cell phone use as an example. In 2010, the PEW Research Center reported that cell phone ownership across the nation has grown and that people are now using their phones for more than just communication. Compared to data collected in 2009, cell phone users were more likely to use their mobile phones for taking pictures, sending or receiving texts, accessing the internet, playing games, sending or receiving email, recording video, playing music and sending and receiving instant messages (Smith, 2010). The proliferation of uses for a single device, however, typically introduces additional complexity. Bryen, Carey, Friedman and Taylor (2007) found that cell phone use by people with IDD was 27% compared with over 60% of the population (at the time the study was conducted). Bryen and colleagues found that a significant barrier to cell phone use by adults with IDD involved physical features of phones, such as the small size of the buttons needed to operate most cell phones. Other aspects of cell phone design are difficult for users with IDD because of cognitive complexity or confusing design; in many cases one pushes an “End” button to turn the phone both on and off. Most cell phone users can relate to the cognitive complexity of such devices when trying to do tasks such as changing ring tones or retrieving messages.

The lack of universal design features and cognitive complexity seriously limit the use of a wide array of technologies by people with IDD. Wehmeyer and colleagues (2004) examined the impact of technology use by people with IDD using Carroll's (1993) first-order domains of cognitive abilities (language, reasoning, memory and learning, visual perception, auditory reception, idea production, cognitive speed, and knowledge and achievement). Within each of Carroll's domain, Wehmeyer et al. examined research on utilization, and concluded that in most cases it is the lack of cognitive access and the failure of devices to incorporate universal design features that acted as barriers to their functional use in the areas of

communication, mobility, activities of daily living, environmental control, community integration, education, employment, and sports and recreation.

Recently, Wehmeyer and colleagues (2008) conducted a meta-analysis of single-subject design studies evaluating the use of technology by people with ID, including an examination of the degree to which the devices examined incorporated features of universal design. By and large, there were few, if any, mentions of universal design features with regard to these evaluation studies. Only “flexible use” was reported in any particularly high number of studies (26.5%), with every other design feature identified in fewer than 10% of studies.

There has, however, been progress with regard to federal policy and research pertaining to the use of technology by people with IDD across multiple categories. Federal legislation such as The Assistive Technology Act of 1998 and its subsequent reauthorizations, the Individuals with Disabilities Education Improvement Act of 2004, and the Workforce Investment Act of 1998 focus attention on the acquisition, training, and use of technology for children and adults with IDD. The Assistive Technology Act of 1998 as amended (P.L. 108-364), often referred to as the Tech Act, funds 56 US states and territories to improve awareness and use of assistive technology (AT) to all people with disabilities across the lifespan. In fiscal year 2008, statewide activities performed by the Tech Act programs provided information and assistance to 252,647 individuals; trained 62,344 professionals, users, and family members; and loaned 53,438 devices (NISAT, 2010).

For students, IDEA 2004 requires that all Individualized Education Program's (IEP's) consider assistive technology needs (20 U.S.C. 1414(d)(3)(B)(v)). Quinn, Behrmann, Mastropieri, and Chung (2009) utilized the National Assistive Technology Research Institute's (NATRI) *Status of AT Use Survey* to evaluate the use of AT by students receiving special education services. Of the 682 students surveyed, students with multiple disabilities in self-contained classrooms used AT most frequently. Although the study cited limitations due to sampling methodology, the authors were able to identify trends in technology use when compared to national statistics of students receiving special education services.

As students transition into adulthood, the Workforce Investment Act (WIA) of 1998 seeks to coordinate and improve employment outcomes through One-Stop Career Centers that are universally accessible and which includes access to technology (Timmons, Boeltzig, Fesdo, Cohen & Hammer, 2007). The WIA also notes that through the vocational process technology should be considered in job planning, training and retention. In a review of the literature on AT in the workplace completed over the past 30 years, Saurer, Parks & Heyn (2010) found positive outcomes for people with cognitive disabilities—including higher rates of accuracy and task completion, generalization of skills, and increased independence—as a result of AT interventions.

It is not within the scope of this article to comprehensively review the literature pertaining to application of all new and emerging technologies and people with IDD, however, it might be helpful to provide examples of several recent developments in the application of technology to several functional and life domains. In the area of mobility, Lancioni et al. (2008) examined the outcomes of 26 studies using treadmills with body weight supports (Accivatti,

Harro, & Bothner, 2006; Dannemiller, Heriza, Burtner, & Gutierrez, 2005; DeJong, Stuber, & Spady, 2005; Sanders, Begnoche, & Pietetti, 2005) or walkers with microswitches and contingent stimulation (Lancioni, Singh, O'Reilly, Campodonico, Oliva, et al., 2005; Lancioni et al., 2007) to increase locomotor behavior by children with IDD and found that overall, children experienced positive results in locomotor behaviors based on the two approaches. In addition to treadmills and walkers with microswitches, virtual reality has also been used as a mechanism to assess and train children and adults with IDD to use powered wheelchairs. Studies demonstrate marked improvements in skill acquisition when initially introducing people to new mobility devices (Erren-Wolters, Dijk, DeKort, IJzerman, & Jannink 2007; Harrison, Derwent, Enticknap, Rose & Attree, 2002; Hasdai, Jessel, & Weiss, 1997).

In daily living areas, environmental controls, and community integration technological advancements such as personal robots as nurses and caregivers has emerged as method for increasing independence and decreasing reliance on supplemental staffing (Braddock, Rizzolo, Thompson, Bell, 2004; Dario, Gugliemelli, Laschi & Teti, 1999; Stresign, 2003) Also, Lotan, Yalon-Chamovitz and Weiss (2009) demonstrated marked improvement in physical fitness as a result of a 5-6 week program using mainstream virtual reality systems such as Sony Play Station.

Finally, electronic and information technologies such as personal digital assistants and computers have demonstrated improved outcomes when utilized by people with IDD. Computers and PDAs have been shown to be successfully used by people with IDD as supports for a variety of tasks across multiple environments, including emergent literacy (Hetzroni & Schanin, 2002; Davies, Stock, King, Woodard, & Wehmeyer, 2008); improving vocational, transition, and employment skills (Lancioni, Van den Hof, Furniss, O'Reilly & Cunha, 1999; Riffel, Wehmeyer, Turnbull, Lattimore, Davies, Stock et al., 2005; Stock, Davies, Davies & Wehmeyer, 2006; Wehmeyer, Palmer, Smith, Parent, Davies, & Stock, 2008); promoting independent living skills (Standen & Brown, 2005; Standen, Brown & Cromby, 2002; Davies, Stock & Wehmeyer, 2002; Tam, Man, Chan, Sze & Wong, 2005); and providing means for communication (Schlosser & Sigafoos, 2006; Wilkinson & Hennig, 2007), including accessible cell phone use (Stock, Davies, Wehmeyer, & Palmer, 2008).

Purpose

Given the advancements in the application and availability of technology since prior technology use surveys were conducted, it is important to re-examine the technology-based experiences of people with intellectual and developmental disabilities and to determine what, if any, changes have occurred in technology use by this population and what barriers remain to such utilization. Further, unlike previous studies pertaining to the use of technology and barriers thereof, the present study sought to gather such information directly from people with intellectual and developmental disability through the use of a cognitively accessible, internet-based, multimedia self-report survey system. Information solicited included: (a) device use, (b) assessment procedures, (c) knowledge of available devices, (d) training, (e) device cost, (f) on-going support, and (e) barriers to technology use in the areas of mobility, vision and/or hearing, computer use, communication, and independent living.

Method

Participants

Participants were 180 youth or adults identified as having intellectual or developmental disabilities recruited through the self-advocacy network, described subsequently. Participants were grouped into four age ranges: 17 years of age and younger, 18 to 21 years of age, 22 to 39 years of age, and 40 years of age and older. Thirty-two percent of participants were 21 years old or younger and 68% were above 22 years of age. Males ($n = 94$) outnumbered females ($n = 86$) in nearly every age group except for participants who were 40 years and older, which included 35 women and 26 men. One hundred and twelve participants indicated that they lived at home (62.2% of the sample), 53 lived alone in their own home or apartment (29.4% of the sample), and 15 lived in a group home or nursing home (8.3% of the sample). Participants were asked about their employment and 59.3% of women were employed while only 46.8% of men were employed.

Procedure

Following survey construction activities, described below, participants were recruited via direct contact with disability advocacy and self-advocacy organizations nationwide. The Self-Advocate Coalition of Kansas (SACK), a statewide self-advocacy organization, served as a primary contact for project staff with regard to survey design, implementation, and participant recruitment. SACK leaders recruited participants by several means, including information distributed at local self-advocacy meetings and the annual state conference, emails sent to self-advocacy listservs and through the national self-advocacy association, Self-Advocates Becoming Empowered, and at the SABLE national conference. As discussed in the limitations section, this is a convenience sample and issues such as response rate could not be determined, nor were we able to obtain demographic data other than that reported here.

The online survey program, called QuestNet, supports the online collection of data using multiple means to present questions and provide answers, as well as flexibility in use. Within the QuestNet survey template, respondents are presented one question at a time that could be answered directly by choosing from several icon-driven options. That question is formatted in large font sizes with the option of clicking an icon depicting the image of an ear so the person can hear the question read aloud. Auditory and visual cues are also provided to enable respondents with IDD to navigate through the survey. Such features included providing an auditory description of the function of any icon if the person held the cursor over that icon (e.g., “press this button if you want to exit the survey”); hiding specific functions until they were appropriately used (e.g., the “next question” icon would not appear until an answer had been checked); providing large radial check boxes in which to click; providing verbal directions for responding to each item; and using pictorial representations of each button's function as the icon (e.g., and ear for hearing the item or response read aloud, a red stop sign for exiting, etc.).

In a pilot study of the system, Stock, Davies and Wehmeyer (2004) found the QuestNet system to be more reliable than a traditional written survey format. The researchers also

found that users preferred the QuestNet system as opposed to pencil and paper because it provided people with disabilities with a greater level of independence and allowed them to progress at their own pace through the material.

Upon completion of the survey, participants received a certificate of completion thanking them for finishing the survey. The QuestNet site provided information for technical assistance, and respondents were provided any support needed to complete the survey. Out of the 180 participants, 42.2% (n = 76) indicated that they had someone helping them to fill out the survey, perhaps to provide initial access to the survey and/or to explain the items.

Instrument

Survey questions were designed within the guidance of a total design method proposed by Dillman (2000) and items for the survey were based on a previous survey designed and used by Wehmeyer (1995, 1999) with modifications to make the survey more user-friendly for people with IDD. The survey was originally designed as a parent-report survey. Wehmeyer (1995) conducted an extensive review of the literature pertaining to technology use by people with intellectual disability. That search did not identify an extant survey, and project staff constructed a survey based upon technology use in multiple domains, including mobility, hearing and vision, communication, home adaptation, environmental control, and independent living, as well as computer use. This version of the survey was pilot tested with 80 respondents (Wehmeyer, 1995) and revised accordingly. That version was used by Wehmeyer (1998; 1999).

The items on the Wehmeyer (1995) survey were updated to account for advancements in technology in the intervening years and then reworded from a parent-report to a self-report version. There were 11 questions soliciting demographic information, and then a series of questions to which participants responded related to five domains in which technology is frequently used, including for mobility, hearing or vision, communication, and independent living. The survey also queried about computer use. The last questions queried respondents about the use of electronic and information technology such as e-mail, digital cameras, cellular telephones, or personal data assistants. Finally, a question about computer or technology training was included. Each section (four domains plus the computer use section) asked if the respondent used technology as a support in that domain or not. If the person did use technology, follow up questions queried respondents about which devices were used; what training was available and who provided that training; what problems the experienced using the device and, if problems existed, what supports were in place to address those problems; and what maintenance issues might exist. If the respondent answered “no” to the question as to whether he or she used technology as a support in the domain area, then a follow up question asked if they thought that they might benefit from technology support in that area. If the respondent answered no to this query, he or she was directed to go to the next domain area. If the respondent answer “yes”, he or she was directed to an additional 5 questions pertaining to what device might be useful, and what barriers existed to limit such access at the moment, including cost, knowledge about the device, assessment, or device complexity.

The electronic and information technology section consisted of five questions asking if the person with intellectual or developmental disabilities used email, a digital camera, a cellular or mobile phone, a PDA. Representatives from SACK (the self-advocacy group), The Arc of the United States, and AbleLink Technologies (who developed QuestNet), also reviewed the survey multiple times and provided feedback before the survey was finalized and items uploaded into the QuestNet format.

Results

Device Use

Table 1 provides the number and percentage of respondents who reported some difficulty related to a device-specific area (mobility, hearing and vision, communication, and daily living); the current use of technology in each of the four device-specific areas; and the perceived need of a device in specific area if the person did not currently have a device. Participants responded to multiple device-purpose areas, if applicable to their situation. Results indicated that 67.2% ($n = 121$) of respondents experienced difficulties in one or more of the domains detailed in the survey. Overall, respondents identified the use of 120 devices, and 57 respondents indicated a need for a device, across all device-purpose areas, but did not currently have such a device. In addition to difficulties, use, and need, respondents were asked if they had trouble with learning and memory, as technology has been shown to address these challenges (LoPresti, Bodine & Lewis, 2008). Forty-seven percent ($n = 85$) reported trouble in learning new things and 47% ($n = 84$) reported problems remembering what they learned.

When reporting about device-specific need, participants were asked to respond to the need for multiple devices in the same device-purpose area. So, for example, a participant could respond to the need for both a wheelchair and a walker within the mobility domain. The most frequently used device area was mobility (23.3%) and the most frequently identified device used for mobility was a wheelchair (81%; $n = 34$). Seventeen respondents reported that they used some other mobility device that did not include a walker or wheelchair. With regard to hearing and vision difficulties, 23 respondents indicated they used a technology device other than glasses to help them see or hear. Of the 23 respondents, seven used a text reader, nine used an adapted computer keyboard, eight used a hearing aid, and ten used another device unspecified to help them hear or see. When asked about communication, 13 respondents reported that they needed a device to help them talk or communicate. Respondents indicated that the most frequently used communication device was one that allowed the person to type in words to communicate (66.7%; $n = 18$). Of the 13 respondents who did not have but indicated a need for a communication device, three communication devices were identified as needed to support communication: a communication system that provides synthesized speech ($n = 12$), a picture or word board ($n = 11$), and a computer and keyboard ($n = 11$).

Finally, 47 respondents indicated a difficulty in the daily living device purpose area. Difficulty in this area was identified by those who reported physical challenges with their hands. Next, 28 individuals indicated that they used daily living devices to help around their home. Similarly, 28 individuals reported a need for a daily living device. Of the listed

devices, the most frequently reported was a switch to help turn things on and off (64.3%; $n = 18$). However, twenty-two respondents reported that they could benefit from some other daily living device beyond a voice activation device, an eating device, or switch to turn things on and off.

Barriers to Device Use

Table 2 presents the number of barriers identified for each device-specific area and the total number of times a given barrier was documented for respondents who indicated a need for a device-specific area and for current device users. The most frequently identified barrier for respondents who identified a need for a device but did not have such a device was cost ($n = 47$) followed by assessment ($n = 39$). The most frequently identified barrier for current device users was the occurrence of their technology breaking ($n = 67$). Mobility devices were cited most frequently as breaking, but when respondents were asked whether or not they had someone who could assist them if their device breaks, 37 of the 42 respondents with a mobility device responded “yes.” In addition to the frequency of a device breaking, 53 respondents identified assistance in using their devices as a frequent barrier to use. The complexity of device ($n = 9$) and knowledge of how to use a currently owned device ($n = 32$) were the least cited barriers to technology use. In the areas of communication and daily living, the number of respondents indicating that they did not know what device they needed ($n = 8$; $n = 17$) was greater than the number of respondents who knew what device they needed in these areas ($n = 5$; $n = 11$).

Computer Use and Barriers

Table 3 presents data with regard to use of and barriers pertaining to use of computer technologies. The barriers were analyzed according to current users and non-users who identified a need for a computer. Overall, 90.6% ($n = 163$) of respondents reported using computers, while 9.4% ($n = 17$) did not use computers at home, school, or work. Of the seventeen people who reported that they did not use a computer, 64.7% ($n = 11$) reported that they needed a computer for home, school, or work. The most frequently cited barrier for current users was lack of support using the computer when faced with a problem (85.8%; $n = 139$), while maintenance was cited as the second most frequent barrier (56.4%; $n = 92$) to computer use. Approximately 50% of respondents ($n = 81$) indicated the cost of programs and software as a barrier to computer use, and 42.9% ($n = 70$) reported general problems with the computer as a barrier.

When respondents who did not use a computer but indicated a need for a computer listed the barriers to computer use, they cited lack of assistance using a computer as the greatest barrier (81.1%; $n = 9$). Cost was the second most frequently identified barrier (63.3%; $n = 7$) for this group, while computer complexity and computer knowledge (knowing how to make a computer work) were reported equally as barriers to computer use (45.5%; $n = 5$).

Table 4 reports the percentage of computer-specific use for current users and non-users who identified a computer need. Current users reported searching the internet or World Wide Web as the most frequent reason for their computer use (91.4%; $n = 149$), while non-users identified playing games as the most frequent reason for wanting to use a computer (81.8%;

$n = 9$). Respondents who were computer users reported that writing and sending e-mail messages were also prevalent activities when they used the computer (86.5%; $n = 141$). Similarly non-users equally reported email and writing as motives for desiring a computer (72.7%; $n = 8$). Finally current users identified budgeting as the least frequent reason for computer use (33.7%; $n = 55$), while non-users identified searching the internet or World Wide Web as the least frequent reason they wanted a computer (54.5%; $n = 6$). Non-users were not asked as to whether or not they would use a computer for work.

Electronic and Information Technologies

Participants were asked four additional questions related to their use of: (a) e-mail, (b) digital cameras, (c) cell phones, and (d) pocket computers or Palm Pilots. Sixty-six percent of respondents ($n = 142$) indicated that they currently had an e-mail account; 34.7% ($n = 75$) reported use of a digital camera; 44.9% ($n = 97$) reported use of a cell phone; and 13.9% ($n = 30$) reported use of a pocket computer or Palm Pilot.

Training and Support

Table 5 provides information regarding the person who first trained respondents on the use of their currently owned devices, in addition to people who currently provide support for each device's use. The results were organized by device-purpose areas. Computer users were added to the table under the *information* device-purpose. It is important to note that respondents in this category did not report who was currently providing support. Family members constituted the largest group providing training for computer use (30.7%) and for hearing and vision devices (34.8%). Support staff and teachers provide the largest percentage of trainers for mobility (31.0%) and communication (40.7%) devices. Support staff and teachers also represented a large proportion of people providing training for hearing and vision devices (34.8%). In the daily living device-purpose area, respondents mainly reported that no one trained them to use their current device (42.9%). Overall, family members as a group provided the greatest amount of initial training for device use while staff and teachers were second on the list of initial trainers.

Across all categories except hearing and vision, respondents reported that they did not have a support person to help them use their device. When support was offered, family members provided the most support (42.9%) for daily living devices. On the other hand, family members provided the least amount of support for respondents using hearing and vision devices (13.0%). When support was provided using communication devices, family members provided the greatest amount of support (29.2%) while staff and teachers provided the greatest level of support for hearing and vision devices (43.5%).

Discussion

The purpose of this study was to gather information from people with IDD with regard to their self-perceived technology use, needs, and barriers. The QuestNet survey system provided users with multiple representations of relevant questions (i.e. pictures, text, and audio recordings) and applied error minimization techniques to improve reliability and to enable and support respondents with IDD to report their experiences with technology.

Before discussing these results, it is important to consider the limitations to the study and their implications for interpreting this data and generalizing the study results to the broader population of people with IDD. First, the sample size ($n = 180$) was limited and the nature of the data collection (e.g., computer-based) introduced potential bias in the sample. That is, because the survey was conducted online, it's reasonable to assume that the participants were more likely to use technology than the general population of people with IDD and, as such, the study's findings most likely represents a more positive picture than is reality. Exacerbating this issue is that participants were recruited who were involved with self-advocacy organizations, and this is a population that is more likely, probably, to use technology than people with IDD in the general population. Thus, results should be interpreted with caution and likely represent a "best-case" scenario. Another limitation to the findings involved the process by which participants were recruited. Project staff worked collaboratively with a state self-advocacy organization to identify potential respondents, both within the state and throughout the national self-advocacy network. This included sending out invitations through self-advocacy meetings, thorough listservs, and at state and national meetings. There is, therefore, no way to determine such issues as response rate and non-response bias, though we are presuming that there is a bias in that the respondents may well be heavier technology users than the general population of people with ID. Finally, we have opted to frame this discussion in the context of previous findings about technology utilization. These previous findings, though, were from parent report surveys. We recognize that we cannot necessarily equate self- and proxy-report measures, but believe that it is helpful nonetheless to examine the current findings in light of previous findings.

Device Use and Need

Previous studies have shown that people with IDD underutilize technology. Wehmeyer (1995, 1998) found that the percentage of people who needed devices outnumbered those who were currently using devices across all domains except mobility and communication. Although the results of the current study suggest that more adults with IDD are using assistive technologies, there remains an overall underutilization of devices across functional life domains.

The current study results demonstrated that respondents indicating their use of a device in any of the device-purpose areas (mobility, hearing and vision, communication, and daily living) outnumbered those respondents who indicated a need for a device in the same device-purpose area, but did not have a device readily available. The one exception to this trend emerged in the device-purpose area of daily living, where the number of respondents who indicated a need for a device equaled the number of respondents who identified the use of a device. Across domain-purpose areas we found that 120 respondents indicated use of any domain-specific device, while 57 respondents indicated they did not currently use, but needed a device.

On the other hand, when the number of respondents that indicated experiencing difficulties in device-purpose areas was compared to respondents who indicated a need or use of a device, we found that the total number of respondents who indicated the need or use of a device was fewer than the total number of respondents who indicated experiencing

difficulties in a given functional area. In the areas of hearing and vision and communication, fewer than half of the respondents who indicated experiencing a difficulty in the specified area actually used a device. Further analyses indicated that across all device-purpose areas, 40.2% of respondents indicated experiencing a difficulty in a functional area but did not report either the use or need of a device. This suggests that the number of respondents reporting the need for a device could potentially be underreported and technology even more underutilized by the population than responses would indicate.

The previous survey (Wehmeyer, 1998) identified mobility devices, communication devices, environmental control/daily living devices, and technologies that allowed for home adaptations as the most frequently used device-purpose areas, in that order. The current study identified mobility devices as the most frequently identified device-purpose area, daily living (most similar to environmental control/daily living devices in previous studies) as the second most frequently identified device-purpose area, and communication as the third most frequently identified device-purpose area. Like the Wehmeyer (1998) study, the current study identified daily living as the most frequently cited device-purpose area for which technology was needed and communication as the second most frequently cited area of need.

Barriers to Use

Again the results of this study mirror the results of past studies concerning barriers associated with technology use by people with IDD. Like past studies, the top barriers continue to be cost, assessment, and information. Depending upon the study year, however, these barriers exchange position within the hierarchy. In Wehmeyer (1995) cost and information were the greatest areas of need while assessment followed as reported by parents and caretakers of people with IDD. When Wehmeyer (1998) examined barriers reported on behalf of adults with IDD, information regarding devices was the most frequently reported barrier, followed by cost and then assessment. In 1999, Wehmeyer examined use and barriers of assistive technology by students with IDD. Similarly the top three barriers emerged again, this time: (1) cost, (2) information, and (3) assessment. In the current study, cost was identified as the most frequently cited barrier followed by assessment and then identification or information about potential devices. Wehmeyer (1995) suggested that there was a relationship between assessment availability and device availability. This was supported in the current study, which found that over half of the respondents who identified a need for a device within a device-purpose area also reported a need for an assessment in that area. By examining the trends across a decade of technology advancements and support developments it appears that people with disabilities continue to face many of the same challenges to availability and use of technology.

The present study also examined barriers to technology use reported by people who were technology users in any given device-purpose area. In each category except for daily living, the device breaking and assistance using the device were reported as the greatest barrier to use. In addition to the need for assistance using a device, individuals using daily living devices reported knowledge on how to use their own home living device as a barrier. Overall, it is evident that barriers to technology use by this population are multifaceted, and

emerge in phases, those prior to and following ownership. Thus, support for technology must also be comprehensive, systemic, and inclusive of on-going supports to avoid device abandonment.

Computer Use and Barriers

Results were encouraging as they pertained to computer use by people with intellectual and developmental disabilities. However, caution should be used when interpreting the data because of the nature of the self-report systems which utilized computers. Ninety-one percent of respondents in the study indicated that they had a computer at home, work, or school. This was a significant increase from the results indicated in Wehmeyer (1995) of 35%. Also encouraging were results from the percentages of respondents who reported they could benefit from a computer (63.7%), compared with 38% from Wehmeyer (1998).

Of those respondents who currently used a computer at home, work, or school, the majority reported that they used the computer to access the Internet or world wide web. Conversely, individuals who were not using a computer but identified that they could benefit from its use indicated “playing games” as the most frequent reason for using a computer. In past studies recreation and leisure have been identified as primary reasons for computer use by those people with IDD who could benefit from but lack availability to such technology.

Finally, barriers to computer use were examined. The top two barriers related to computer use by those did not have a computer but identified perceived benefit were tech support (81.1%) and cost (63.6%). In the Wehmeyer (1998) study cost, training, and complexity were as the most frequently cited barriers. When computer users in the present study were asked to identify barriers to use, they recognized tech support (85.8%) and maintenance (56.4%) as the top two barriers.

With regard to questions related to respondents use of: (a) an e-mail account, (b) a digital camera, (c) a cell phone, or (d) a pocket computer or Palm Pilot, study results indicated a positive trend. 142 respondents (78.9%) indicated that they had an email address. Although computers were more reliably used to play video games, email appears to be a primary mode of communication for our sample. Digital cameras were used by fewer respondents ($n = 75$, 41.7%). Digital cameras are beginning to be utilized for reasons other than leisure (e.g. augmentative and alternative communication devices), as these technologies emerge it is possible that we will see a surge in their use across disciplines. In this study, 66% of respondents used cell phones, while national polls suggest 69% of the general public use cell phones (Nysteadt, 2006). This suggests that people with IDD are using cell phones as frequently as the general public. Finally, pocket computers or Palm Pilots were used least as compared to the other advanced technologies ($n=30$; 16.7%). These results are intriguing because there have been several studies examining the positive outcomes (e.g. improved independence and productivity) related to the use of personal digital assistants (PDAs) by people with IDD (Bergman, 2002; Davies, Stock & Wehmeyer, 2002; Lancioni, O'Reilly, Seedhouse, Furniss, & Cunha, 2000). These results provide further evidence that there is a dire need for dissemination of information regarding the use and benefits of devices such as PDAs and financial supports to acquire them.

Training and Support

Family members were reported most frequently as providing training for computer use (30.7%) and staff and or teachers acted as initial trainers for the device-purpose areas of mobility (31%) and communication (40.7%). Initial training was shared equally by family and staff and/or teachers for hearing and vision devices (34.8%), and finally “no one” was cited most frequently as initial trainers for daily living devices.

In the three device-specific areas most frequently cited as used by respondents with IDD (i.e. mobility, daily living, and communication), staff and teachers were identified most frequently as providing the initial training. However when we examined the current supports for these devices, respondents indicated that no one was cited most frequently as providing support in these areas. Although, when support was provided in these areas, family members were the ones identified as providing current support. These results suggest that while staff and teachers introduce and initially train individuals with IDD to use devices, families overwhelmingly are responsible for ongoing support which they may or may not be qualified to provide. With the knowledge provided by these results, any device system training should include not only the potential user but also an integral family member as well to ensure ongoing success.

Implications for Policy and Practice

It is evident that although much work has been over the past decade to increase the availability, training, and retention of technology for people with IDD, there still remain barriers that prevent technology use. Implications for policy and practice are addressed through the lens of the three federal policies (The Assistive Technology Act of 1998, the Individuals with Disabilities Education Improvement Act of 2004, and the Workforce Investment Act of 1998) discussed previously.

First, it is important to note that several studies have demonstrated that people with IDD are capable of reliably reporting about their feelings and daily activities (Booth & Booth, 1996; Douma, Marielle, Dekker, Verhulst & Koot, 2006; Esbensen, Seltzer, Greenberg & Benson, 2005; Hartley & MacLean, 2006; Mactavish, Mahon & Lutfiyya, 2000; McVilly, Burton-Smith & Davidson, 2000) and that proxy reports offer misleading information regarding individuals with IDD (Burnett 1989; Epstein, Hall, Tongnetti, Son & Conant; 1989; Jenkinson, Copeland, Drivas, Scoon & Yap, 1992; McVilly, Burton-Smith & Davidson, 2000; Sigelman, Budd, Spanhel, & Schoenrock, 1981; Stancliffe, 1995; Wehmeyer & Metzler, 1995). This is not to ignore the fact that there are situations in which proxy reports are necessary to gather pertinent information (Ruddick et al., 2005). To address this conflict, prior to seeking proxy reports, a “conscious presumption of credibility” (Mactavish et al. 2000, p. 225) of self-reports must be established by professionals along with the development of multi-faceted measurement designs that address the diverse support needs of individuals with IDD. Thus, in the evaluation and administration of supports for technology used by state AT centers, schools, and one-stop career centers person-centered approaches must be utilized (Mirza & Hammel, 2009).

The National Information System for Assistive Technology reported that in fiscal year 2008, 4,459 family members were trained through the state AT centers; however based on our results it is evident that family member are the first resource for support using technology devices, thus policies and practices aimed at training families must be improved and implemented across the lifespan including the training of direct-care professionals.

Finally, the National Educational Technology Plan 2010 outlines the necessity for technology use by our students to “prepare them to be productive members of a globally competitive workforce” (p. 7) through recommendations in five areas: learning, assessment, teaching, infrastructure, and productivity. To advance outcomes in these essential areas, one-stop career centers must adopt and advance these recommendations to make the transition to the workplace effective and seamless for people with IDD.

Future research examining the use of technology by people with IDD should expand the national data related to technologically savvy and novice users. It should focus on self-assessments to identify personal goals and outcomes for people across the lifespan. It is also essential to explore technology use and barriers in the workforce to better prepare students and employees to become contributing members of their communities.

Summary

This study replicates findings from previous studies that technology may be underutilized by people with IDD, but also documents that progress has been made in the decade since the last major survey was conducted. It is particularly promising that computer use has risen substantially during this time and that people with IDD are using newer electronic and information technologies such as cell phones. On the other hand, many of the same barriers to utilization remain, including cost and training, and there remain, apparently, a relatively high percentage of people with IDD who either report that they could benefit from a device in some area of their lives but do not have access to such technology, or report that they have difficulties in a particular functional area but don't believe technology can address such difficulties.

Acknowledgments

Funding for this research was provided by Grant PR Award# H133E040019-01 Awarded to the University of Colorado (Rehabilitation Engineering Research Center on Advancing Cognitive Technologies) and the University of Kansas from the U.S. Department of Education, National Institute on Disability and Rehabilitation Research and Grant PR Award# R324B070159 from the U.S. Department of Education, Institute of Education Sciences, National Center for Special Education Research, also awarded to the University of Kansas. The contents of this report do not necessarily represent the policy of the Department of Education and endorsement by the Federal Government should not be assumed.

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Table 1

Frequencies of employment and living situations related to gender and age

Gender and Age	Employed		With family member or friend	In a group home or nursing home	Living Situation
	No	Yes			Alone in own home or apartment
Male					
1 to 17 years old	14	1	15	0	0
18 to 21 years old	9	6	13	1	1
22 to 39 years old	18	20	27	3	8
40 years old and Older	9	17	9	3	14
Total	50	44	64	7	23
Female					
1 to 17 years old	14	0	12	1	1
18 to 21 years old	5	9	11	1	2
22 to 39 years old	5	18	13	1	9
40 years old and Older	11	24	12	5	18
Total	35	51	48	8	30

Table 2

Frequency and Percentage of Respondents Indicating Difficulty Related to Device Area, Use of Device and Need for Device

Device Purpose	<u>Difficulty Related to Device Area</u>		<u>Use</u>		<u>Need</u>	
	Frequency	%	Frequency	%	Frequency	%
Mobility	58	32.8%	42	23.3%	6	4.4%
Hearing and Vision	55	30.6%	23	12.8%	10	6.4%
Communication	121	67.2%	27	15.0%	13	8.5%
Daily Living	47	26.1%	28	15.6%	28	18.4%

Table 3

Frequency of Responses to Barriers by Device-Specific Area of Those Who Identified A Need for A Device and Current Device Users Including Totals

<u>Device Purpose</u>					
Respondent & Barriers	Mobility	Hearing & Vision	Communication	Daily Living	Total
Barriers of Those Who Identify Need for a Device					
Device Identification	2	5	8	11	26
Assessment	3	7	8	21	39
Cost	4	7	12	24	47
Device Complexity	0	4	2	3	9
Barriers of Current Users					
Device Knowledge	2	3	7	20	32
Problems	10	8	14	5	37
Assistance	-	20	19	14	53
Break	30	9	16	12	67

Note. Questions regarding assistance were not asked of respondents who use mobility devices as implied by a dash in the table.

Table 4

Frequency and Percentage of Computer Use and Barriers

Use & Barriers	<u>Respond No</u>		<u>Respond Yes</u>	
	Frequency	%	Frequency	%
Use	17	9.4%	163	90.6%
Need	6	35.3%	11	64.7%
Barriers - Current Users				
Cost of Program/Software*	81	49.7%	81	49.7%
Maintenance	71	43.6%	92	56.4%
Problems	93	57.1%	70	42.9%
Assistance for users*	23	14.2%	139	85.8%
Barriers – Non-Users Who Identify Need				
Cost - Computer	4	36.4%	7	63.6%
Computer Complexity	6	54.5%	5	45.5%
Computer Knowledge		54.5%	5	45.5%
Assistance for potential use	2	18.2%	9	81.1%

Table 5

Frequency and Percentage of Computer Specific Use

Current Use & Potential Use	<u>Current Users</u>		<u>Non-Users Who Identified Need</u>	
	Frequency	%	Frequency	%
Write	141	86.0%	8	72.7%
Budget	55	33.7%	7	63.3%
Work	106	65.4%	-	-
Email	141	86.5%	8	72.7%
Internet or W.W.W.	149	91.4%	6	54.5%
Play Games	134	82.2%	9	81.8%

Table 6

Percentage of Responses to Trainers of Devices and Those Who Currently Provide Support for Device Use

Initial Trainer and Support	<u>Device Purpose</u>				
	Mobility	Hearing & Vision	Communication	Daily Living	Information (Computer)
Initial Trainer					
Family Member	23.8%	34.8%	29.7%	32.1%	30.7%
Staff or Teacher	31.0%	34.8%	40.7%	14.3%	21.5%
Company	21.4%	21.7%	7.4%	10.7%	21.5%
No One	23.8%	8.7%	22.2%	42.9%	26.3%
Current Support					
Family Member	28.6%	13.0%	29.6%	42.9%	-
Staff or Teacher	21.4%	43.5%	22.2%	10.7%	-
No One	50.0%	43.5%	48.2%	46.4%	-

Note. Data regarding current support was not obtained for the information (computer) device-specific domain