

## Assistive Technology as an Evolving Resource for a Successful Employment Experience

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**Abstract:** Strategic pooling of assistive technology, human resources and funding options has made meaningful employment possible for the 25-year-old man with cerebral palsy who is the subject of this paper. Since graduating from high school four years ago, he has held a part-time job at the warehouse of a bookseller. To perform his job, which involves processing inventory, he has always relied on an augmentative communication device that interfaces with the warehouse computer system and scanner. His assistive technology mix eventually included a new scanner, conveyor belt and an automated book loader. To varying degrees, an attendant has assisted with job tasks requiring manual completion. Though technology is imperative to the young man's success, multiple supports are required to ensure it.

**Keywords:** Evolving, Resource, Successful employment

The following case study highlights three significant factors in the successful integration of assistive technology into the workplace for an employee with multiple disabilities.

First, the employer, employee (Andy) and those supporting the employee recognized the technology as integral to a spectrum of resources necessary to find and hold a job. Second, the integration of assistive technology (AT) into Andy's current job has worked well largely because it was understood as a process evolving over time as opposed to an isolated occurrence. As Andy's employer noted,

It was a real pleasure to be continually evolving the technology so that more and more, the work being done was being done by Andy [with] less reliance on his assistant. I know this has made Andy very happy as well. (P. Kreps, personal communication, February 3, 2005)

A third and somewhat broader-based factor in Andy's success was that the process of career development began in high school with school-district funded pre-employment activity that included supported job experiences. Processes followed in helping Andy to achieve permanent employment that may be replicated with variations based on the needs and abilities of the individual seeking employment.

### Background: Transitions and Beginnings

Awareness of these factors has proven beneficial to Andy, who at age 17 expressed a desire to enter the workforce despite profound challenges associated with the cerebral palsy he acquired after nearly drowning in a swimming pool as a toddler. The accident left him without the ability to walk, use his hands or speak in his own voice. Andy presents cognitive delays and requires 24-hour assistance with daily activities including all aspects of personal care such as bathing and dressing. He takes meals through a gastronomy tube and wears a urinary catheter.

A good and enthusiastic student, Andy attended classes in the local public school district from kindergarten through 12th grade.

He was in a regular education program in elementary school. In high school, his schedule consisted entirely of elementary-level life skills classes. Andy held a straight-A average and though non-verbal, he acquired good spelling and reading skills. He has always used some form of augmentative and alternative communication (AAC) to express himself.

Andy's participation in social activities is comparable to that of his peers without disabilities. He enjoys spending time with family and friends, traveling and shopping, especially when it involves choosing gifts for others. Throughout his teenage years and young adulthood, Andy has volunteered for disability advocacy programs on a steady basis, a reflection of the prime importance that he and his family place on giving back to the community. Andy is also active in his church.

During high school, Andy relied on a manual wheelchair for mobility and eye gaze techniques for communication. He also used a manual communication board that his occupational therapist created from acrylic and white plastic plumbing pipe. Positioned upright on the tray of Andy's wheelchair, the board allowed Andy to spell out words using his eyes to track one letter at a time. The board also contained numbers and a small selection of words and phrases. It proved useful for classroom and social communication as long as Andy and his communication partners viewed it simultaneously.

### **Early Employment Experiences**

Shortly after Andy entered high school, his mother started to research and visit work sites that employed individuals with physical and mental challenges, with and without supports. Though doubtful that an appropriate job for Andy existed, his mother fulfilled her

commitment to help him find one in an effort that, in effect, spanned his high school years. Beginning with the high school transitional services department, she coordinated a continually growing and changing team of specialists and funding sources. Two priorities that remained constant were (a) to ensure that all parties worked together in Andy's best interest, and (b) to be aware of guidelines for spending available funding. Also, two probable reasons for the success that his mother experienced lie in the manner that she engaged the outside parties in this effort. She approached each entity with the understanding that the entity would be one in a network of multiple, interdependent resources required for Andy to achieve permanent employment. This approach helped to taper any concern that a particular entity would be one of few supporting this endeavor, or its sole support. When approaching each of her contacts, she specified the type and amount of assistance needed, and how it would fit into the bigger picture.

A key early step was working with Andy's main transition teacher to arrange a series of volunteer work experiences. These experiences gave Andy a realistic sense of job tasks he could and could not handle. Individuals who use augmentative communication surveyed about their employment in the community said that "a positive work ethic played an even more critical role in maintaining employment than job-specific skills or other factors" and that such a work ethic may "be developed and strengthened further through volunteer and part-time work experiences" (Light, Stoltz, & McNaughton, 1996, p. 223).

Legislative, professional and academic definitions regard transition activity for students with disabilities as an outcomes-oriented process (Will, 1984; Individuals with Disabilities Education Act of 1990).

Professionals similarly consider it a process that requires students to accept the responsibility for preparing for adult life as fully as their capabilities will allow (Halpern, 1994). The literature acknowledges activities outside of the classroom, including community service (Wehman, 2001) and “non-paid work done as a family member, citizen and leisure seeker” (Brolin, 1995, p. 54), as valid components of transition activity and goal-oriented, long-term career development.

Through his own volunteer experiences, Andy cultivated qualities desirable in employees and young adults in general. These qualities include his strong work ethic, excellent interpersonal skills, keen memory, good eye for detail and knack for making quick yet sound decisions based on his observations.

Andy’s first job involved supervising other students in the special education program assigned to clean the faculty lunchroom. The experience allowed him to demonstrate that he understood how to set and maintain standards of quality control, and could direct others to complete work that needed to be done in accordance with those standards through eye contact, head movements, facial expressions and vocalizations. While his aide moved him about the room to observe various tasks in progress, Andy alerted workers to errors such as wet spots on tables, litter on the floor and stray chairs. He told them where to retrieve and return tools and cleaning materials. Andy also watched the clock so he could inform his co-workers when it was time to return to class. Job challenges included that his methods of communication were at times subject to interpretation by unfamiliar communication partners. While generally comfortable in his supervisory role, Andy at times found it awkward to monitor the work of his peers—particularly when it meant telling them to redo improperly completed tasks. Another apparent drawback

to this volunteer placement was that it was unlikely Andy would find a similar job outside of the school setting.

In another job, Andy delivered mail to faculty and staff at the high school. His primary tool in this job was an accordion-shaped file folder with numerous labeled pockets containing mail for specific people. Andy would look at the name on a file, then immediately shift his gaze to the same name on a shelf of 100 mail slots. Andy’s school aide then would transfer the mail from the slot to the pocket in the file folder that matched the name. His aide would ask, “Is this the one?” to verify his instructions. The aide reported that Andy communicated the necessary information with 100 percent accuracy. Using eye movements, Andy then directed his aide to locations throughout the building for delivery of the mail, gazing at a name on the folder to let his aide know whose mail was in a particular pocket. His aide removed the mail from the pocket and handed it to that person. Andy demonstrated a higher level of satisfaction in this job than in the lunchroom job, particularly because of the opportunity to interact with faculty and office staff that it presented. The tasks (giving/following directions and managing large amounts of material and information, for example) and skills (attention to detail, interpersonal skills and clear communication via eye contact, for example) associated with this job more closely matched those that would be associated with a suitable paying job after high school, his team noted.

Those supporting Andy along with his parents felt that it was important for him to pursue work opportunities in the community at this point. An initial step was for his transition teacher to contact the state vocational rehabilitation office to enroll Andy for services. The vocational rehabilitation counselor assigned to Andy arranged for him to meet with the director of an agency that

placed and supported people with multiple disabilities in community-based employment situations. A formal 10-hour work assessment that the agency conducted over a period of two months to evaluate Andy's performance of a range of tasks that could be associated with various jobs provided a framework for future job matching. The tasks included distinguishing between colored and white paper for a possible job where Andy would push piles of recyclable material from his wheelchair tray into the appropriate bin, then putting the material into the correct bin with hand and arm movements.

Other tasks required Andy to move paper from his tray into a simulated shredder, alphabetize files using methods similar to those he used in the mail delivery job and simulate the activation of a switch to run a copier. A final task tested his observation skills for a possible job as a quality assurance agent or "secret shopper" who would evaluate customer service in establishments such as a bank, supermarket or restaurant. In this task, Andy listened to a series of sentences containing the word "bus" and indicated when he heard the word using his communication board. Andy scored a 100% accuracy rate in all of the tasks with the exception of alphabetizing files by the second letter (*Jenkins v. Jones*, for example), in which he scored a 75% accuracy rate. The assessment also included an observation of Andy on the mail delivery job.

Key recommendations of the assessment were to (a) make printed labels for the folders and mail slots that Andy used to ensure that he, his aide and others viewing the materials could see the names clearly, and (b) consider having Andy perform data entry involved in the preparation of his resume. While noting that Andy's mastery of eye gaze communication techniques would transfer into a highly marketable skill, the report also recommended that Andy find an AAC system

with advanced capabilities such as accessibility via scanning and computer access that would better serve him in the workplace. The section of this paper entitled "Implementing Assistive Technologies" includes further discussion of this process.

A recommended short-term objective in the work assessment was to seek a community-based volunteer job placement that would allow Andy to use his clerical skills. His transition teacher and a representative of the employment agency targeted non-profit organizations as possible work sites. This effort yielded an after-school job at the local library that involved identifying and facilitating the tracking of missing books.

Andy quickly learned his way around the library and the Dewey Decimal System so he could direct his aide to the locations of specific books. Working from a computer-generated list of missing books on a standup clipboard attached to his wheelchair, he examined book titles and their numeric sequence on a particular shelf to determine whether a book on the list was missing. If Andy could not find a book, he would look at his list and his aide would make a notation that the book indeed was missing. When Andy found a listed book on a shelf, he would look at his aide, who then would pull the book off the shelf so that Andy could transport it to a librarian for reentry into the system. If he found that a shelved book was out of sequence, he directed his aide through eye contact to return the book to its proper place. Andy performed well in this job, prompting the library to extend it through the summer, during which Andy served as the librarian for fellow students attending summer school, filling and delivering their book orders (E. Coomler, personal communication February 16 and 25, 2005; June 2, 6 and 7, 2005; C. Steury, personal communication, June 1, 2005).

## A Turning Point

The next challenge was helping Andy to recognize and utilize his skills and volunteer experience as a segue to meaningful paid employment. To achieve this, his team followed principles of person-centered planning, a process-oriented approach grounded in empowering people with disability labels by putting them in charge of defining the direction for their lives, not on the systems that may or may not be available to serve them (Employment and Disability Institute, 2005).

The roots of person-centered planning took hold between the early 1970s and mid-1980s as approaches to serving people with significant disabilities shifted from rehabilitation or medical models focusing on professional interventions to consumer-driven models emphasizing advocacy and independent living. By 1985, the term person-centered planning was widely used in reference to a variety of practices associated with the latter approach (O'Brien & O'Brien, 2002).

Person-centered planning raised different questions (O'Brien, O'Brien, & Mount, 1998) than those typically asked in traditional approaches to planning. For example, instead of asking "What's wrong with you?" or "How can we fix you?", person-centered planning asked "What are your capacities and gifts, and what supports do you need to express them?" "What works well for you and what does not?" "What are your visions and dreams of a brighter future, and who will help you move toward that future?"

With this contemporary approach, the disability became secondary to the process of planning for the kind of future that the individual with the disability desired.

Person-centered planning did not ignore disability. It simply shifted the emphasis to a search for capacity in the person, among the person's friends and family, in the community and among service workers. A person's difficulties were not relevant to the process until how the person wanted to live was clear. Then it was necessary to imagine and take steps to implement creative answers to this key question, "What particular assistance do you need because of your specific limitations (not labels) in order to pursue the life that we have envisioned together?" (O'Brien et. al., 1998, pp. 20-21).

The literature (Nisbet & Callahan, 1987) has noted that the more significant a person's disability, the greater the need for an individualized approach to employment. Yet person-centered planning dispels the notion that availability of funding and other resources must drive the person's success in employment or other major life activity. The belief that it is most effective to strategize from the person to the resource rather than from the resource to the person (McLean, 2002) is inherent to the process. Recent literature (Callicott, 2003) also names open-mindedness and attention to successful communication as hallmarks of some of the procedures followed in person-centered planning and suggested that such work also benefits from the objectivity that working with families requires. Callicott further describes the process as one that typically involves using large sheets of paper on the walls and multicolored markers as a skilled facilitator leads a group working together to help the individual with significant disabilities to identify barriers that the person faces in achieving successful community membership. As a tool to help the person accomplish goals and to support those closest to the person, the process can facilitate change and the restructuring of systems that are not responsive to the needs of people with disabilities.

In essence, the process made Andy a stakeholder in his job search, while helping those working on his behalf to identify his talents, interests and natural abilities, as well as the resources and supports that would benefit him. Andy's advocates throughout this process included his school aide and transition teacher, the employment agency director and an independent job development consultant that Andy and his parents hired. A person-centered planning specialist conducted a brainstorming session during which the group considered ways of matching Andy's work experiences and marketable skills with real job opportunities. Andy's friends and relatives participated in a second session held at his home in the spring of his junior year in high school. His mother noted that the mix of people who had just met Andy and therefore had no preconceived notions of his potential (i.e. the person-centered planning specialist) and people close to him (classmates and siblings, for example) added value to the process (Owens, 2003).

Information gathered at both sessions proved valuable in introducing Andy to potential employers. It included: (a) Andy's strengths and capacities (e.g., able to communicate reliably with his eyes, good hearing, attentiveness to detail, ability to stay on task, excellent memory, good people skills, positive attitude); (b) What would work for Andy as an employee (e.g., clear goals, a variety of tasks, morning work hours, a good night's rest, fairly predictable work routine, low to moderate noise levels, AT); (c) What would not work for Andy as an employee (e.g., being rushed to complete a task, working in isolation, excessively repetitive tasks, inadequate rest before starting the workday, working outdoors in cold weather, high noise levels); and (d) and types of jobs that would be possible for Andy (e.g., quality control, tracking inventory or information, doorman or security guard, host or greeter, interoffice mail delivery).

As his mother said, "We were all throwing out ideas about job possibilities. Andy's strengths were listed. Once we saw them on paper, we began to think of ways he could do a job with some limited natural supports" (Owens, 2003, p. 78). These supports, as well as funded supports that Andy utilized, are discussed in the "Key Supports" section.

The school district subsidized the work opportunities and supports (i.e., services provided by the school aide, bus transportation to and from his library job, pre-employment and job development services) available to Andy up to this point. Subsequently, the focus shifted to community resources that potentially would benefit Andy after graduation. One of these resources was the Careers, Community and Families Project (CCF) (Sowers, McLean, & Holsapple, 2001) that originated with the Family Management Grants Project (McLean, Greenwood, & Herrin, 1998) funded by the state Office of Developmental Disabilities that provided a modest amount of funding for job training and placement services to young adults with developmental disabilities. Each project took a consumer-and-family-directed approach to the employment process. Andy received word before his junior year that upon finishing school, he would become one of 25 CCF project beneficiaries.

### **Search for Employment**

In the months following the brainstorming session at Andy's home, the grant project director and the job development consultant joined his mother in contacting employers to discuss job possibilities. Cold calls were few. They focused instead on networking with personal acquaintances in lines of work that appealed to Andy and where his contribution would provide mutual benefit to himself and the employer, reflecting the tenets of person-centered planning. As McLean (2002) wrote,

Clarity about a person's interests makes it unthinkable to appeal to an employer on the basis of charity or disability. Clarity about a job that will really suit a person writes a script about strengths, common interests and community connections. (p 295)

While resume and interview preparation are "immaterial" to the person-centered planning process (D. McLean, personal communication, May 18, 2005), variations of each were used in demonstrating Andy's readiness for work. His resume was essentially a notebook that listed his experiences as well as his marketable skills along with his personal strengths and capacities as delineated at the person-centered planning meetings. The notebook also contained photographs that showed Andy working at his volunteer jobs and letters of reference from his supervisors. Job interviews consisted largely of questions to which Andy could respond "yes" or "no." His aide interpreted his responses for the employer as needed.

### **The Right Match**

The most promising opportunity evolved from the project director's contact with managers at a bookseller who were receptive to hiring Andy to work in the Price Task Force department of its warehouse. Together, they developed a position for Andy through job carving, a practice in which an employee with disabilities performs work carved out of an existing job (Sowers, McLean, & Owens, 2002). In his job, Andy would receive and process books for inventory. The work appealed to him because of his enjoyment of books and aptitude for detail. It involved tracking inventory or information, one of the job possibilities mentioned in the person-centered planning exercise conducted at his home.

When Andy was offered the job in his last semester of high school, a plan for necessary job accommodations and adaptations took shape. Given Andy's physical limitations, it was understood that he would require a unique combination of human and technological assistance to perform the job, and would do so in a different manner than typical employees, as discussed in the section sub-headed "Towards A Typical Workday" later in this paper.

### **Key Supports: Finding Personal Assistance**

The plan called for the services of an attendant to drive Andy to and from work, and assist him throughout each workday with personal care and job tasks that he could not physically perform himself. For individuals with significant speech and physical disabilities, the need for such assistance in the workplace is not unusual. Sixty-seven percent of augmented communicators surveyed about their community-based employment experiences (16 of 24 respondents) reported that they received some assistance at work, either with job duties or with activities of daily living. Researchers who conducted the survey noted that "if vocational opportunities are to be truly accessible to many people who use AAC, then provision must be made for assistance related to personal care and on-the-job training" (Light et. al., 1996, p. 221).

School district funds covered the cost of this assistance for Andy when his school aide worked with him during an initial on-the-job training period. He and his parents then hired private aides at the same starting rate of \$10 per hour using various sources of funding including state developmental disabilities funds matched by Medicaid and money available through the Plan to Achieve Self-Support (PASS) available to Andy as a Social Security beneficiary. The PASS is a work incentive that allows a person to set aside

money or resources for a specified period of time to reach a work goal (Social Security Online, 2005) without jeopardizing the Social Security income he receives. It provided the job coaching (i.e., the work-related support from the attendant) for Andy's first three years on the job. Extended PASS funding later was used to pay for the van Andy uses for transportation to and from work. Andy's father was able to obtain the van at a wholesale price, which helped to minimize this cost.

Andy has earned enough work credits to be eligible to switch from Supplemental Security Income to Social Security Disability Income, modestly raising the cap on his earnings potential while allowing him to keep his Medicaid benefits. The PASS is no longer in effect. Supported employment funding available through a Medicaid Home and Community-Based waiver is currently being used to pay the attendant.

Andy's mother identified finding, hiring and keeping reliable attendants as the most challenging process involved in ensuring that Andy would be able to hold a job, largely due to the associated administrative work (recruiting, background checks, payroll, reports and documentation for funding sources, etc.) that it entails. In the four years that he has worked at the book warehouse, Andy has had six personal attendants, including the school aide. The project director accompanied Andy on the job interview while an attendant did so on the initial on-the-job training. All of the attendants who worked for Andy were required to know and possess the ability to do the job of receiving inventory as both Andy and typical employees did so that they would be prepared to assist him as needed. In addition, they were responsible for the maintenance of Andy's feeding tube and catheter, for assisting him during restroom breaks and otherwise monitoring and helping

to ensure his safety and comfort in the workplace.

A nurse delegation, or review, is conducted every 90 days to ensure that the attendant care services that Andy receives meet Medicaid standards. During the delegation, typically conducted at Andy's home, a Medicaid nurse observes the attendant performing tasks such as cleaning the feeding tube and administering medication to Andy through the tube. Medicaid case managers have also conducted observations of the attendant's interaction with Andy in the workplace.

While Andy and those supporting him knew that he would always need an aide for personal care throughout the day, they eventually realized their hope that with time and the implementation of assistive technologies at the work site, he would become less dependent on the aide for work-related assistance. By allowing Andy to be more independent in his job and reducing the need for his paid attendant to assist with job tasks, the technologies fostered the natural supports that have also contributed to his success (D. McLean, personal communication, June 8, 2005). These natural supports have included ongoing job training and orientation that co-workers have offered Andy, as well as his social interaction with co-workers. Andy has developed positive relationships with people at work. His supervisor said that with his attendant serving as an interpreter, Andy is very good at initiating conversations about fun activities in his personal life. He has used the DynaVox to say that he is ready to work at the beginning of his shift. Andy makes it a point to visit the break room on breaks or even after work to talk with his co-workers. Andy has extended his socializing to bringing doughnuts to work for all to enjoy. By all accounts, Andy has achieved the balance in mixing business and pleasure that most employees seek without

losing sight of why he reports to work each day. As his employer said,

He takes his job seriously, he has a strong work ethic, he works hard, he takes pride in doing a good job. I think people, I know I do, see him and his approach to work as an example of someone who really wants to be a productive member of society and will do everything within his power to make it a reality." (P. Kreps, personal communication, February 1, 2005)

### **Implementing Assistive Technologies**

Also of primary consideration in the plan for Andy's employment was his reliance on an AAC system and a wheelchair, and how to implement these technologies to best serve him on the job.

In his early employment experiences, Andy relied solely on his well-developed eye gaze techniques for communication. The previously described manual communication board served as his means of self-expression in situations that were not job related, as did the Eyegaze Computer System manufactured by L. C. Technologies, Inc., that Andy used from 6th through 12th grade. While school funds were used to purchase the system, Andy's parents provided a monitor and its mounting system for his use of the system at home. A hands-off human-computer interface featuring synthesized speech output, the system required Andy to calibrate his eye movements with the movement of a dot on the screen to select vocabulary pre-programmed into the system. As Andy tracked the dot, his eyes, in effect, became like a mouse used to control the movement of a cursor on a computer screen. While the system allowed Andy to maximize his ability to convey messages through eye contact and provided computer access capabilities, it

posed significant limitations in portability. While a spare monitor at home helped to address the issue, the tower component of the system still had to be transported between home and school. Another negative was that it had to be set up in a dark room to work properly. Newer models of the system, including a laptop model considered for Andy, are less light sensitive and work well in a variety of environments. However, the laptop model would have required closing the lid (i.e., the screen) to ensure Andy an unobstructed view while moving about in his wheelchair. His parents preferred to avoid the extra task because it would increase Andy's reliance on his attendant.

The solution pursued for Andy as he prepared to leave school, was, as recommended in the work assessment, a communication system with scanning and computer access capabilities that would allow him to perform a broad range of job tasks. School and private speech-language professionals were consulted in this process. The head mouse system that Andy used for a trial period at school proved inappropriate because the controlled head movements that its operation required were physically taxing for him, particularly in stressful and time-limited situations. As a compromise, Andy's mother suggested a device he could operate by scanning with a head switch. A DynaVox 3100 was recommended.

The DynaVox was a key accommodation in the plan for Andy's employment. He learned to use the device during his occupational therapy sessions at school, practicing the single-switch scanning method of access that he uses. With head movements, he activates a switch on the right headrest of his wheelchair to scan a grid of communication buttons displayed on a page and to select buttons as they are highlighted. In his job, the DynaVox and its separate computer access component, the DynaBeam, would serve as his link to the

warehouse computer system. Employers and co-workers of individuals who use AAC have identified computer access, including interfacing an AAC device with a standard computer, as challenges for such individuals (McNaughton, Light & Gulla, 2003). Finding technology that would give Andy access to and interface with a standard computer system addressed this common and potentially problematic issue early in his employment.

Another goal in the plan was for Andy to learn to use a power wheelchair that would promote his independence in the workplace and for Andy to practice using the chair under the guidance of his father and brother outside of work hours. His mother enlisted the aid of the local Shriners organization in arranging an assessment of his ability to operate such a chair.

Securing funding for the wheelchair and the speech-generating device required much advocacy on her part. The insurance that she carries through her employer paid 80% of the cost of both the wheelchair and the DynaVox, while Medicaid authorized a 20% co-payment for each item.

Money from the extended PASS allowed Andy to compensate his father and brother for time spent training him to use the wheelchair. They conducted the training outdoors in their neighborhood.

Another set of technological adaptations identified as being potentially beneficial to Andy on the job were conveyor belts that could be operated by a head switch and an automated book loader. The project director began to investigate ways that these technologies could be funded, designed and implemented at the work site.

## **Toward A Typical Workday**

With accommodations (personal attendant services, power wheelchair, AAC system with desired capabilities) in place and plans for future accommodations (conveyor belt, book loader) underway, Andy set out to work. From the start, Andy was assigned to work a morning shift. Eager to work, Andy learned quickly while two co-workers trained him in fundamental job tasks. Funds from the CCF project and federal Workforce Investment Act dollars were allocated to reimburse the employer for the cost of the training.

While in training, Andy's primary job was to update information about books already in the warehouse computer system. He compared information for books on a computer-generated book list to similar information on a computer screen, then changed or added information on the screen accordingly. One of his tools was a page on the DynaVox that his father programmed with commands that the DynaBeam sent to the warehouse computer system via infrared signals. Andy executed these commands by pressing his head switch when the DynaVox scanned his desired selection. This page included an ENTER button that he selected if the information for a specific book was complete, buttons labeled HC and SC that he selected to denote whether a book had a hard cover or a soft cover, and an ESCAPE button that he selected if the information was incomplete. Scrolling down a page on the computer screens that Andy worked with required the selection of multiple tabs. To simplify this step, Andy's father created a macro—a keyboard shortcut allowing the completion of a task that would otherwise require the execution of a series of commands and numerous preprogrammed keyboard shortcuts defined by Microsoft for a wide variety of applications. The macro contained seven tabs on a single button, so Andy could scroll down a page by pressing his

head switch once instead of seven times to select the button.

When the training period ended, Andy started his permanent job of receiving new books for inventory. Employees typically performed the same job by placing books, one by one, under a stationary laser scanner or by using a hand-held laser scanner to scan the bar code for each book into the warehouse computer system. This would generate an inventory label that the employee then placed on the book.

For Andy, the cycle of tasks involved in receiving inventory went as follows. Andy's attendant loaded books at one end of a table, then placed them one at a time under the laser on the table in front of him. An ISBN bar code and other identifying information for the book programmed as defaults into the computer system would then appear on the receiving screen at Andy's workstation and a similar screen on a computer in his attendant's adjacent work area. Andy then would decide whether or not to receive the book into the warehouse inventory. To accept the book, he would select the ENTER command on his DynaVox by pressing his head switch. After Andy processed a book for inventory, his attendant stuck the label on it and moved it to a stack at the other end of the table. To reject a book, Andy would select ESCAPE from his command page. A book could be rejected for a number of reasons including inaccurate or inadequate identifying information, or unusual quantity and pricing issues. In such cases, the book would be set aside for later review. Neither Andy nor other employees with receiving duties are required to do anything more with rejected books.

Several weeks into the job, Andy found, as most workers do, that his performance tended to peak at certain times and to dwindle at others. The latter usually occurred while he was experiencing fatigue or stress that made it

difficult to control his head movements. At such times, it required multiple attempts to activate his head switch when the DynaVox scanned to a command that he needed to give the warehouse computer. To remedy the situation, Andy asked his father to re-program the page to increase his ability to execute this command accurately on the first try. The new page contained three rows of four ENTER buttons, ensuring that Andy would be able to perform the task with greater speed and ease than by targeting a single button. Its bottom row contained the less-frequently used ESCAPE button, and GO BACK and MASTER SCREEN buttons that Andy would select to get to other locations on the device.

Technical difficulties that arise while Andy is working are addressed by his attendant. For example, the attendant will reposition the DynaBeam on the DynaVox so commands to the warehouse computer can be transmitted readily. The attendant relays questions concerning the operation of the DynaVox and DynaBeam, by telephone as needed, to Andy's father, who in turn walks the attendant through the specific functions of the technology. This technical support may be considered a natural work support. Issues with the technology have rarely prevented Andy from working, the employer reported. In nearly four years, Andy had to sit out just one shift because the battery on the DynaVox needed to be recharged.

As Andy discovered that the new page on his DynaVox facilitated an essential function of his job, new developments occurred facilitating the design and implementation of a combination of technologies that would allow him to further increase his productivity. A team of engineers that the grant director found was hired for this work. Andy's father worked closely with the engineers as additional assistive technologies were integrated into Andy's workstation, a process

that occurred over the course of approximately one year.

The technologies included a conveyor belt wired along with the warehouse scanner into a new head switch attached to the left headrest of Andy's wheelchair and the later addition of a new scanner and automated book loader.

While the engineers completed a design for the loader early in the project, they decided to implement the technology in two phases to keep it cost effective. A support services brokerage created through a state self-determination project for adults with developmental disabilities provided funding for the conveyor belt while state vocational rehabilitation funds covered the cost of the scanner and loader. The incremental nature of the project allowed time to determine whether Andy possessed the stamina he would need to perform his job, with the aid of the conveyor belt alone, for extended periods of time. Another point of consideration was how Andy's use of the belt would affect the role of his attendant.

Design and implementation of the belt was completed in approximately four months. Selected from existing technology, the belt moved each book for a pre-determined distance to the warehouse scanner. Andy activated the belt with a press of the new head switch attached to the left headrest of his wheelchair. His attendant placed the books on the belt using painted lines demarcating zones on the belt as a guide for spacing the books. These marks also act as a signal for the belt to stop after it moves a book to a designated zone (under the scanner) so that its information can be scanned on the warehouse computer screen for Andy to view. Andy then accepted the information into the system by pressing the right head switch. While this setup gave Andy more control over his workflow, it was soon apparent that the arrangement hindered his productivity

because of its requirement that the attendant load and unload books to and from the belt. Meanwhile, the engineers began the loader design phase. Vocational rehabilitation approved extended funding to finalize the design, testing, and implementation of the loader. This work took another five months to complete.

The book loader was introduced into the mix of technology as Andy was about to begin his second year on the job, further simplifying and synchronizing his job tasks. While the warehouse scanner could read the bar codes on the books with nearly 100% accuracy when the attendant placed them under it, its limited capabilities and the level of precision with which the loader would place books under the scanner were not compatible. A more sophisticated model with the ability to scan bar codes that are not aligned with primary scan direction and to scan a larger area at once was selected. Somewhat ironically, the supplier of this scanner was one of the businesses that Andy's team had visited while developing potential job contacts for him. When it came time to find and negotiate the purchase of the better scanner, Andy's father revisited the contact at the store.

The loader, which resembles a shelf, sits approximately 14" above the belt and runs parallel to it. Loader, belt and scanner operate as one unit controlled by Andy's left head switch. Andy's attendant places a stack of books, facing upright, onto the loader. When Andy presses his left head switch, the belt senses a zone mark, stops and signals the loader. As a mechanism on the loader releases a book into that zone, the book slides down a ramp at a 45-degree angle onto the belt, which moves the book into position for scanning. Andy then presses his right head switch to execute the ENTER command to accept the book. When Andy hits the switch for the loader to release a new book, the belt moves the first book to Andy's attendant for labeling.

Under normal operation, the release of a book from the loader into an available zone occurs when the belt stops after moving a previously released book past the scanner. In the process of implementing the loader, the engineers encountered a timing problem caused by movement of the belt before the loader released a book onto it. Upon release, the book would land only partially in a zone as marked on the belt. When the belt stopped, a second book would be released into the same zone, resulting in a collision. The amount of time needed to ensure that a book landed entirely in one zone varied considerably depending on its thickness and how it was positioned on the release mechanism, so a solution based on timed releases was not feasible.

Perplexed, the engineers explained the problem to Andy, who proposed what would become a permanent solution. He would wait until the belt came to a complete stop before pressing his head switch to command the loader to release of the next book, which then would put the belt back in motion.

The attendant reported that the loader has significantly reduced the amount of physical effort and time involved in getting the books to Andy for processing. Before, the attendant frequently had to place a new set of books onto the conveyor belt, which could accommodate up to four books at a time. The loader accommodates 50 to 100 books, depending on the their size. Now, the attendant restocks it with a new batch of books only as Andy completes the receiving process for another batch. The attendant reports that Andy receives one or two books per minute on a typical shift. In May 2005, Andy processed 1,806 books, the third highest number of books processed by any of the 16 people in the department that month. He also achieved his highest weekly productivity to date that month when he processed 596 books in one week (D. Owens, personal

communication, December 13, 2004 and January 27, 2005; J. Brassfield, personal communication, December 29, 2004; C. Owens, personal communication, January 27 and June 12, 2005; P. Kreps, personal communication, February 1 – 3, 2005; T. Rich, personal communication, February 6 – 23, 2005; S. Noll, personal communication, February 18, 2005; W. Silfies, personal communication, May 24 – June 7, 2005)

### **Outcomes and Benefits**

While Andy has used a number of work supports, his job includes many elements of competitive employment. His wages, job tasks and the productivity expected of him are comparable to those of typical employees. He receives standard performance reviews and is responsible for making job (i.e., inventory) decisions. Measures of his success include steady pay raises (from a starting hourly wage of \$7.68 to \$10.01 per hour in his fourth year of employment) and an increase from 10 to 15 work hours per week.

The reality that the success Andy has experienced is not common among his peers with significant disabilities may be due in part to the general perception that participation in the Supplemental Security Income (SSI) program is a disincentive to working. Participants fear that gainful employment will jeopardize their eligibility for cash and medical assistance. A 1996 study (Berry, Price-Ellingstad, Halloran, & Finch, 2000) analyzed characteristics of 59,624 SSI recipients of transition age (16-24 years old) in the Rehabilitation Service Administration 911 case service database. All of the teens and young adults had exited a vocational rehabilitation program with employment outcomes. One finding of the study was that those who received SSI worked approximately 11 fewer hours and earned nearly \$100 less per week than their counterparts who were not enrolled in the SSI program. The

thoughtful and timely blending of resources that has served Andy well may be a catalyst for changing such patterns. Authors of the Berry et al. study suggest that the coordination of vocational rehabilitation services with Social Security work incentives (e.g., the PASS that Andy used) can improve employment outcomes, and support the introduction of work incentives and related technical assistance early in the transitional planning process.

It is noteworthy that neither Andy's employer nor his parents (with the exception of the private insurance that paid for the AAC device and power wheelchair) spent any of their own money in order for him to reach his work goal or retain his employment.

All along, assistive technology has been a necessary support that has allowed Andy to work competitively and reduced the need for his attendant to help him with job-related tasks. Due to the scope and constancy of his personal care needs, however, the technologies that he uses have not eliminated the need for the attendant to be present for the duration of his workday. There has been some consideration of technological applications that might allow Andy to stick labels on the books instead of relegating the task to his attendant, but it is speculative at this time. Additional benefits to the existing technology have surfaced. For instance, Andy has used statements programmed into his DynaVox to communicate during his performance reviews instead of relying on his attendant to speak for him, as he did when he interviewed for the job.

When Andy's employer planned a move to a bigger warehouse, the mix of technology that he uses was incorporated into the site blueprints and transported to the new location with ease. Andy's new workstation is open, making it easier to interact with co-workers and move about in his wheelchair than in his

former workstation, which was enclosed by partitions and a wall. His situation illustrates the desirability of long-range plans for assistive technology in the workplace. A holistic approach that takes the environment as well as personal and social aspects of the proposed accommodation into consideration ensures its effective use (Bailey, 2002).

The role of technology in Andy's employment has evolved smoothly because of the supportive roles of multiple resources. In balancing public resources with personal/private ones, Andy and his team achieved the kind of success often deemed unattainable within the disability community. Sowers et al. (2002) noted that "the different funding streams are rarely creatively commingled to enable individuals with developmental disabilities to access the resources they need to pursue a quality job or career" (p. 99). Light et al. (1996) noted that such pursuits require greater interagency cooperation between educational and vocational programs. An important, if less tangible, outcome of Andy's experience, were the collaborative relationships developed through the methodical yet positive approach that Andy's mother took to establish personal contacts and mobilize the pool of resources that ultimately would benefit him.

Andy appreciates the broader implications of his success. He has said,

Most people didn't think I could work in a real job in the community, but I was determined to prove that I could. I like that I proved a lot of people wrong. My advice to other young people is that you can and should work, and that you have to be determined and get other people to help you reach your goals. (Sowers et al., 2002, p. 102)

He has also noted that "I think because I have shown that I can work, many others now are thinking about the fact that they themselves can work, or that their son or daughter can work" (Oregon Teen Working a Dream Job, 2002, p. 2).

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