Comments from Peer Reviewers

" The importance of this paper is its success in conveying the role of technology in the education and career success of individuals with disabilities. This article will be an important contribution to the field of postsecondary education.... The author constructed a fact-filled primer on the importance of technology for the education of individuals with disabilities. She clearly tied this into their future success and employability and she focused mainly on technologies used within postsecondary settings. [Step by step], the author walks a novice through (a) the importance of technology access for students with disabilities, (b) commonly used terminology, (c) multiple examples of how technology improves participation and success in education and careers, (d) the legislative underpinnings that support equal access, (e) the challenges and barriers that impede access to and full use of technology, and (f) the implications that the current state of affaires has for future researchers, policy, and service. The author uses multiple, current and credible sources in constructing the paper and this provides a strong tone to the manuscript. Moreover, her use of specific examples helps the reader to understand on a personal level what technology access truly means to an individual."

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White Paper

The Role of Technology in Preparing Youth with Disabilities for Postsecondary Education and Employment

Individuals with disabilities are less than half as likely as their non-disabled counterparts to own computers, and they are about one-quarter as likely to use the Internet.

Abstract

Access to electronic and information technology has the potential to promote positive postsecondary academic and career outcomes for students with disabilities. However, this potential will not be realized unless stakeholders assure that all individuals with disabilities have *access to technology* that promotes positive academic and career outcomes; learn to *use technology* in ways that contribute to positive outcomes; and experience a *seamless transition* of availability of technology as they move through educational and career environments.

How the report is organized

This paper explores the role technology can play in helping students with disabilities successfully transition to postsecondary studies and employment. It defines terms; provides examples of electronic and information technologies and their applications in precollege and postsecondary education and employment; summarizes legal issues that apply to technology access for students with disabilities in precollege, postsecondary, and employment settings; explores promising practices; and lists topics for future research. Ultimately, assuring that all of the educational and employment opportunities that technology provides are accessible to everyone will strengthen our economy and promote equal opportunities in all adult life activities.

1. *Definition of Terms*
2. *Examples of IT and Applications*
3. *Summary of Legal Issues*
4. *Exploration of Promising Practices*

Access to Technology for People with Disabilities

Today, technology has become essential in almost every educational, employment, community, and recreational environment. Access to electronic and information technology can help students with a wide range of abilities and disabilities prepare for

and succeed in adult life. Specifically, for people with disabilities, such access has the potential to maximize independence, productivity and participation in academic programs and employment. In addition, for those who have the interest and aptitude, advanced technology skills can open doors to high tech career fields that were once unavailable to people with disabilities.

Although the benefits of technology may be even greater for people with disabilities than for people without disabilities (Anderson-Inman, Knox-Quinn, & Szymnski, 1999; Blackhurst, Lahm, Harrision, & Chandler, 1999; DO-IT, 2001; Goldberg & O'Neill, 2000; Hasselbring & Glaser, 2000; *Success stories*, 2002), individuals with disabilities are less than half as likely as their non-disabled counterparts to own computers, and they are about one-quarter as likely to use the Internet (Kaye, 2000). In addition, the design of many Web pages, instructional software programs, productivity tools, telecommunications products, and other electronic and information technologies erects barriers for some individuals with disabilities (Burgstahler, 2002; Schmetzke, 2001). For example, Web pages that do not include text alternatives that can be read by speech and Braille output systems limit information access by a student who is blind; the content of a videotape that does not have captions is inaccessible to a viewer who is deaf; and office equipment that cannot be operated from a seated position is inaccessible to an employee who uses a wheelchair for mobility.

Taking advantage of the power that technology offers in improving the precollege and postsecondary academic outcomes for individuals with disabilities is critically important because people with disabilities today experience far less career success than their non-disabled peers (Benz, Doren, & Yovanoff, 1998; Butterworth, 1998; DeLoach, 1992; Gilson, 1996; McNeil, 1997, 2000; National Council on Disability, 2000; National Organization on Disability, 1998; Phelps & Hanley-Maxwell, 1997; Wagner & Blackorby, 1996). However, these differences in achievement diminish between individuals as they gain more education. For example, the employment rate for individuals with disabilities who do not complete high school is 15.6%; for those who complete high school it is 30.2%; for those with some postsecondary education it is 45.1%; and for those with four years of college it is 50.3% (Yelin & Katz, 1994a, 1994b). Clearly, technology access that leads to greater success in precollege and postsecondary education has the potential to improve career outcomes for people with disabilities.

Today, individuals with disabilities are significantly underrepresented in postsecondary education and a significantly lower percentage of students with disabilities than those without disabilities eventually earn degrees (Horn & Berktold, 1999; National Council on Disability, 2000). The largest and fastest growing reported disability among freshmen who report having disabilities is learning disability – 40.4% in 2000 as compared to 16.1% in 1988 (Henderson, 2001). Percentages of students with disabilities reporting other types of disabilities are 16.1% blindness or partial sight, 15.4% health-related impairments, 8.6% hearing impairments, 7.1% orthopedic impairments, 2.9% speech impairments, and 16.9% other impairments (Henderson). Even those who complete postsecondary studies are likely to have fewer work-based learning experi-

ences than those who do not have disabilities. Lack of job skills and related experiences before graduation create additional barriers to employment for people with disabilities (Benz, Doren, & Yovanoff, 1998; Benz, Yovanoff, & Doren, 1997; Blackorby & Wagner, 1996; Luecking & Fabian, 2000; National Council on Disability, 2000; National Council on Disability and Social Security Administration, 2000; Phelps & Hanley-Maxwell, 1997; Unger, Wehman, Yasuda, Campbell, & Green, 2001). The poor employment figures for people with disabilities coupled with the positive impact of postsecondary education and work-related experiences makes increasing their success in these activities an important goal. The cost of failure to reach this goal, to these individuals and to society, is high (Blackorby & Wagner, 1996; Gajar, 1998; Reskin & Roos, 1990; Stodden, 1998; Stodden & Dowrick, 2000; Wagner & Blackorby, 1996; Yelin & Katz, 1994a, 1994b).

High tech careers are particularly accessible to individuals with disabilities because of the combined effect of the increasing use of electronic and information technology and of the advancements in assistive technology that provide access to computers and other electronic equipment for people with a variety of disabilities (Closing the Gap, 2001; Smith & Jones, 1999). A bachelor's degree or higher is a prerequisite for many of these challenging careers (Price-Ellingstad & Berry, 1999/2000). Although few students with disabilities pursue high tech postsecondary programs and careers and the attrition rate is high (Malcom & Matyas, 1991; National Science Foundation, 2000; Office of Disability Employment Policy, 2001), those who succeed in these fields demonstrate that opportunities do exist for people with disabilities who have successfully overcome the barriers imposed by facilities, electronic and information technology, inadequate academic preparation, lack of role models, and negative attitudes (Blumenkopf, Stern, Swanson, & Wohler, 1996; Burgstahler, 1993-2001, 2001; DO-IT, 2001; Heidare, 1996; National Science Foundation, 1989; Presidential Task Force, 1999; Stern & Summers, 1995; Stevens, Steele, Jutai, Kalnins, Bortolussi, & Biggar, 1996; Stodden, 1998).

In order for students with disabilities to pursue postsecondary academic and career options, they must have access to the high tech tools available to their nondisabled peers. These include computers, Web sites, telecommunications products, instructional software, and scientific equipment. Full access requires that built-in barriers to these tools and resources as well as facilities in which they are housed be removed and appropriate assistive technology be readily available (National Center for Education Statistics, 2000a, 2000b; Schmetzke, 2001; Waddell, 1999).

Today, the full potential of using technology to prepare young people with disabilities for postsecondary education is not being realized (National Council on Disability & Social Security Administration, 2000). Funding is reported as the top barrier by providers and policy experts (National Council on Disability, 2000). Consumers identify the two biggest barriers to be lack of knowledge of stakeholders about appropriate assistive technology and lack of funding to purchase assistive technology (Fichten, Barile, & Asuncion, 1999; National Council on Disability). Many graduates of teacher education

programs are not adequately prepared in the general use of computer technology and in classroom applications (Anderson & Pelch-Hogan, 2001; Hasselbring & Glasser, 2000; National Center for Education Statistics, 2000a, 2000b; National Council on Disability). In addition, as reported by the National Council on Disability (p. 25), "the rapid acquisition of educational technology has not sufficiently addressed the needs of students with disabilities. Access for students with disabilities is just beginning to be identified as an important factor when purchasing educational technology." Consequently, products with inaccessible characteristics are often purchased, inaccessible electronic resources and educational software is developed and purchased, and inaccessible facilities are constructed. Many computer support staff, regular education teachers, and special education teachers are not sufficiently trained to use mainstream and specialized equipment and on how these technologies can work together to maximize access to education for students with disabilities. As summarized by Hasselbring and Glasser (p. 118), "Lack of adequate teacher training has an especially strong impact on students with disabilities because technology is often a critical component in planning and implementing an educational program for these students."

Other barriers to technology access for individuals with disabilities include lack of trained professionals to evaluate assistive technology, difficulties in locating assistive technology to test by individuals with disabilities, confusion about existing laws and policies regarding assistive technology and accessible electronic and information technology, gaps in laws and policies that fund assistive technology, and the bureaucracy of public programs and insurance companies (National Council on Disability). In particular, because of differences in laws and funding for technology between precollege and college environments, even students who are lucky enough to gain access to empowering technology in precollege settings, may not be allowed to take it with them when they exit high school.

Clearly, much work needs to be done before the full potential of today's technology to promote postsecondary academic and career success for students with disabilities is realized. However, it is easier to agree on the problems that exist than the interventions that will overcome them. Most would agree, however that the situation would be much improved if the following three conditions were assured.

- All individuals with disabilities have *access to technology* that promotes positive academic and career outcomes.
- People with disabilities learn to *use technology* in ways that contribute to positive postsecondary academic and career outcomes and self-determined lives.
- There is a *seamless transition* of availability of technology for all people with disabilities as they move from K-12 to postsecondary to career environments.

Next, this paper defines terminology related to the use of technology by people with disabilities. Then, it describes what specific roles technology can play in preparing young people with disabilities for postsecondary education and employment. Next,

legal issues in precollege education, postsecondary academic, and employment settings are discussed. After that, some of the issues that must be addressed in order for young people with disabilities to gain the full benefits that technology has to offer as they transition from precollege education to postsecondary education and employment are summarized. Finally, implications and recommendations are suggested.

Terminology

Throughout this paper, "technology" includes electronic and information technology and assistive technology that provides access to electronic and information technology. "Information technology" is defined as "any equipment or interconnected system or subsystem of equipment, that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information. The term 'information technology' includes computers, ancillary equipment, software, firmware and similar procedures, services (including support services), and related resources." (Office of the Federal Register 2000, p. 80499) "Electronic technology" encompasses information technology, but also includes any equipment or interconnected system or subsystem of equipment, that is used in the creation, conversion, or duplication of data or information. Electronic technology includes telecommunications products such as telephones and office equipment such as copiers and fax machines.

Many electronic and information technology products are designed in such a way that they are inaccessible to people with some types of disabilities. For example, a person with a visual impairment may not be able to interpret instructions if they are presented only in a visual format; a person who is deaf cannot access content if it is only presented aurally. An important term to define is "access," as it relates to the use of computer hardware, software, and other technology. According to the National Science Foundation, "access implies the ability to find, manipulate and use information in an efficient and comprehensive manner" (Lesk, 1998). Too often even those individuals with disabilities who have a computer and Internet connection, still cannot make full use of its capabilities because of the inaccessible features of hardware and/or software (Waddell, 1999). They have technology, but do not have access to all of the benefits it delivers to others.

"Assistive technology" is defined as "any item, piece of equipment, or system, whether acquired commercially, modified, or customized, that is commonly used to increase, maintain, or improve functional capabilities of individuals with disabilities." (Technology-Related Assistance, 1988). Assistive technology enables people with disabilities to accomplish daily living tasks; assists them in communication; and provides greater access to education, employment, and recreation. It can be used to maximize physical or mental functioning and minimize the impact of a disability. Examples of assistive technology include scooters and wheelchairs, alternative automobile controls, environmental controls, prostheses, communication aids, hand splints, hearing aids, and alternative input and output devices for computers. An "assistive technology ser-

vice" is defined as "any service that directly assists an individual with a disability in selection, acquisition or use of an assistive technology device" (Technology-Related Assistance). For this paper, only assistive technology that interfaces with electronic and information technology and related services are relevant.

The process of creating products that are accessible to people with a wide range of abilities, disabilities, and other characteristics is called "universal design." Universal design is defined by the National Center for Universal Design at North Carolina State University as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design." (*What is universal design?*, 2002) At this Center, a team of architects, product designers, engineers, and environmental design researchers established a set of principles of universal design to provide guidance in the design of environments, communications, and products. General principles include: the design accommodates a wide range of individual preferences and abilities; the design communicates necessary information effectively, regardless of ambient conditions or the user's sensory abilities; the design can be used efficiently and comfortably, and with a minimum of fatigue; and appropriate size and space is provided for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility. The concept of universal design has been applied to all teaching and learning activities (Bar & Galluzzo, 1999; Bowe, 2000; *Universal design for learning,* 2002). In particular, when producers apply universal design principles as they create electronic and information technology, the products are more usable by everyone, including people with disabilities. They minimize the need for assistive technology and are compatible with commonly used assistive hardware and software. Below are a few examples of accessible electronic and information technology and its benefits to students with disabilities in educational settings.

- Accessible Web pages allow students with disabilities, including those who have sensory impairments, to access information; share their work; communicate with peers, teachers, and mentors; and take advantage of distance learning options.

- Accessible instructional software (on disks, CDs or other media) and documentation allow students with disabilities to participate side-by-side with their peers in computer labs and classrooms as they complete assignments; collaborate with peers; create and view presentations, documents, spreadsheets; and actively participate in simulations and other computer-based activities.
- Accessible telephones make communication accessible to everyone, including those with mobility, visual and hearing impairments.

The following section provides examples of roles technology can play in the lives of individuals with disabilities.

Roles of Technology For Students With Disabilities

The following examples demonstrate how electronic and information technology can be used by students with disabilities and contribute to their independence, productivity, and participation in academics and careers. Specifically, technology can help them:

- Maximize independence in academic and employment tasks. Example: A student with a mobility impairment uses a hands-free keyboard and mouse to operate a computer to take class notes, access library resources, and complete papers rather than have an assistant write for her.

- Participate in classroom discussions. Example: A student who cannot speak uses a computer-based communication device to deliver speeches and participate in class discussions.

- Gain access to peers, mentors, and role models. Example: In a supported Internet community, a student who is deaf uses electronic mail to chat with other teens, gain support for college and career transition from mentors, and meet role models. (Burgstahler, 1997; Burgstahler & Cronheim, 2001)

- Self-advocate. Example: A student who is deaf uses a TTY and relay service to arrange appointments regarding internship accommodations with her supervisor.

- Gain access to the full range of educational options. Example: A student who is blind and uses speech output technology fully participates in an Internet-based distance learning course that employs universal design principles to assure access to people with disabilities.

- Participate in experiences not otherwise possible. Example: a young man with no functional use of his arms and legs experiences completing a chemistry experiment through a computer simulation and observing sea life while swimming in the ocean through virtual reality.

- Succeed in work-based learning experiences. Example: A student who has no use of his hands independently operates a computer to draft and edit articles in a journalism internship at the local newspaper office.

- Secure high levels of independent living. Example: A young person who has a developmental disability uses a cell phone to maintain regular contact with care givers as he participates in community activities. Example: A

teen with a mobility impairment uses a voice-controlled system to operate the television, turn lights on and off, open doors, and perform other tasks of daily life.

- Prepare for transitions to college and careers. Example: A student with a learning disability that makes it difficult for him to read uses a computer with a speech output system to explore internship and career opportunities, take self-paced career readiness and interest tests, and research the academic programs and services for students with disabilities offered at colleges of interest.

- Work side-by-side with peers. Example: A girl who is blind and a boy who has no use of his hands work on the school newsletter with fellow journalism students; she uses speech output technology, he uses a voice recognition system, and other students use standard input and output devices on a local area network in the computer lab.

- Master academic tasks that they cannot accomplish otherwise. Example: A student with a learning disability uses a set of software tools to support her management of reading, writing and study demands in a postsecondary setting (Anderson-Inman, Knox-Quinn, & Szymanski, 1999).

- Enter high tech career fields. Example: A child who shows interest in engineering at a young age, but does not have the fine motor skills to manipulate objects, gains technical knowledge using the Internet, operates computer simulations of engineering tasks, and develops a solid foundation for college studies and a career in engineering.

- Participate in community and recreational activities. Example: An adult who is blind can privately cast his vote for President of the United States because the voting booth is designed to be accessible to everyone.

These and countless other examples demonstrate the important roles electronic and information technology can play as young people with disabilities pursue postsecondary education and careers. First, they realize the same benefits as individuals without disabilities – they write articles, develop spreadsheets, access Internet-based resources and services, work side-by-side with their peers. In addition to these benefits, however, some people with disabilities use technology as compensatory tools which allow them to do things that are otherwise impossible because of their disabilities. For example, technology can provide a voice for those who cannot speak in the customary way; can allow people to "write" even though they do not have functional use of their hands; can make it possible for individuals to use the telephone even though they do not have the ability to hear.

The following section summarizes key legislation related to technology access for people with disabilities in elementary and secondary schools, postsecondary institutions, and employment.

Legislation

Although educational institutions and employers have legal obligations to provide technology access to students and employees with disabilities, barriers still prevent people with disabilities from gaining full access to technologies that can help them reach their full potential.

The Individuals with Disabilities Education Act (1997, formerly called P.L. 94-142 or the Education for all Handicapped Children Act of 1975) mandates that each state provide a free and appropriate education for all children, regardless of their abilities or disabilities. It requires that Individual Education Plans (IEPs) be developed for students with disabilities who meet certain criteria and that assistive technology and transition, among other things, be considered in the development of IEPs.

Section 504 of the Rehabilitation Act of 1973 prohibits discrimination against individuals with disabilities in programs and services that receive federal funds, which include the vast majority of educational institutions. The Americans with Disabilities Act of 1990 (ADA) reinforces and extends the requirements of Section 504 to public programs and services, regardless of whether or not they receive federal funds. Precollege programs must provide access to all children, regardless of disabilities; thus, all students with disabilities, regardless of whether they have IEPs, have a right to the same technology access that is provided to students without disabilities. For qualified students who disclose their disabilities and present appropriate documentation, postsecondary institutions must provide reasonable accommodations to assure equal access to program offerings (Frank & Wade, 1993; McCusker, 1995; West, Kregel, Getzel, Zhu, Ipsen, & Martin, 1993). Although the ADA does not specifically mention electronic and information technology, the United States Department of Justice clarified that the ADA applies to Internet-based resources – "Covered entities that use the Internet for communications regarding their programs, goods, or services must be prepared to offer those communications through accessible means as well" (Patrick, 1996). The ADA mandates nondiscrimination in employment as well, requiring reasonable accommodations for employees with disabilities; such accommodations may include the purchase of assistive technology.

Provisions of the Carl D. Perkins Vocational and Applied Technology Education Act of 1990, the Rehabilitation Amendments of 1992, the School-to-Work Opportunities Act of 1994, and the Technology-Related Assistance for Individuals with Disabilities Act of 1998 further dictate program access and support services that must be provided to people with disabilities (Fisher & Gardner, 1999). Unfortunately, many elementary, secondary, and postsecondary educators and service providers have difficulty understanding and applying the maze of conflicting definitions, eligibility criteria, and policy implications of legislation that impacts the provision of technology access for individuals with disabilities (National Council on Disability, 2000).

Section 508 of the Rehabilitation Act requires that agencies of the Federal government develop, purchase and use electronic and information technology that is accessible to individuals with disabilities. The Architectural and Transportation Barriers Compliance Board (Access Board) developed standards to which these agencies must comply (Office of the Federal Register, 2000). Even for those who are not covered entities under Section 508, the standards developed by the Access Board provide a good starting point for organizations seeking to meet their ADA obligations. They include standards for accessible desktop and portable computers; Web-based resources; video and multimedia products; software and operating systems; and self-contained, closed systems such as photocopiers and fax machines.

Although educational institutions and employers have legal obligations to provide technology access to students and employees with disabilities, barriers still prevent people with disabilities from gaining full access to technologies that can help them reach their full potential. These challenges are discussed in the next section of this paper.

Discussion of Barriers and Solutions

Technology has the potential to improve the educational, career, and adult living outcomes for people with disabilities. However, this potential will not be realized unless barriers to reaching the following goals are overcome.

1. All individuals with disabilities have *access to technology* that promotes positive academic and career outcomes.

2. People with disabilities learn to *use technology* in ways that contribute to positive postsecondary academic and career outcomes and self-determined lives.

3. There is a *seamless transition* of availability of technology for all people with disabilities as they move from K-12 to postsecondary to career environments.

Questions that must be answered in order to reach these goals are discussed below. The specific goals addressed in each discussion section are indicated in parentheses immediately after each question.

ACCOMMODATIONS VS. UNIVERSAL DESIGN

How can the creation of universal design of electronic and information technology be promoted? [1] Designing inclusive environments that are accessible to everyone, with and without disabilities, minimizes the need for individual accommodations. Employing the universal design approach to the development of technology devices, facilities, information resources, and services is a critical step towards ensuring that students with disabilities are provided with full access to programs and activities in the school, workplace, and community. Promoting the use of electronic and information

Technology choices for people with disabilities should be driven by both short-term and long-term needs.

technology standards established by the Federal government can help educational and employment entities move closer to this goal (National Council on Disability, 2000). Librarians, educators and others who purchase technology products for schools need to demand that accessibility considerations be included in the procurement process. Similarly, distance learning program providers must employ universal design principles to make courses accessible to potential students with a wide variety of abilities and disabilities, including those who are blind and use speech or Braille output systems. A universal design approach to electronic and information technology selection and use in schools can help to reduce technology costs as well as facilitate the transfer of technology from secondary to postsecondary educational settings; promote cross-application and compatibility in education and workplace settings; reduce stigma, cultural and attitudinal barriers for students with disabilities; and make it easier to respond to changing technology needs of students.

FUNDING

Who will assure funding so that children with disabilities can gain access to empowering technology? [1] Funding is often cited as a barrier to technology access for people with disabilities (e.g., National Council on Disability, 2000). Although the cost of technology is often lower than anticipated and funding is sometimes suggested as a constraint when issues of selection and management are actually more challenging, technology does cost money and must be paid for in some way. This issue is likely to grow increasingly important as elementary and secondary educators continue to be faced with implementing the assistive technology requirements of IDEA, as technology in general becomes more widely available as a tool for student learning, and as awareness of assistive technology becomes more widespread. Besides consideration of the overall costs, deciding who (school, government agency, insurance, family) should pay for technology under specific circumstances and who owns the technology as a person transitions between various levels of education and employment create additional challenges to be overcome (National Council on Disability).

Technology choices for people with disabilities should be driven by both short-term and long-term needs. Besides initial purchase, questions about who is responsible for upgrades and technical support during all life stages must be answered. Funding is needed for training personnel to deliver technology services at various academic and employment levels and during transition periods, as well as for increasing technology awareness among all key stakeholders, including parents, educators, librarians, service providers, employers, and people with disabilities.

SELECTION

Who will select appropriate technology and provide ongoing support for students with disabilities at various levels in the educational and career preparation process? [1, 2] The planning and implementation of effective technology for students with disabilities requires specialized knowledge and skills regarding legislation, policies, and technology applications and products by those in decision-making and support posi-

tions. These individuals include special education teachers, occupational therapists, community service providers, students with disabilities, families, and technology professionals (Blackhurst, Lahm, Harrision, & Chandler, 1999; National Council on Disability, 2000). Increasing the knowledge and skills of these individuals regarding the availability and potential uses of technology is a critical step towards ensuring that students are provided with the tools and supports that will increase readiness and motivation as they transition to postsecondary education and employment. Service providers need to have the capacity to keep pace with the rapidly changing technology that can benefit students with disabilities. With the growing complexity of computing environments and number of commercially available assistive technology devices, staff at smaller institutions face special challenges in acquiring and maintaining current information about technology options and the most appropriate applications for students with disabilities.

FULL PARTICIPATION IN PRECOLLEGE ACADEMIC AND EMPLOYMENT OFFERINGS

How can educators, career services staff, and employers be better trained to understand the capabilities and accommodation needs of students with disabilities and use technology to help people with disabilities fully participate in academic and employment offerings? [2] Sometimes technology is used in a very limited way to enhance the education of students with disabilities. For example, a computer might be available to a student in a computer lab, but not used by the student for test-taking because an individual teacher is not aware that the student can use this technology or because they are not sensitive to the need for students with disabilities to complete their work independently as they prepare for postsecondary studies and careers. Similarly, assistive technology is not always readily available to a student who might, with this technology, be able to participate in work-based learning experiences, such as a summer internship. This problem, in part, can be addressed with increased funding for assistive technology; greater awareness of the availability and potential uses of assistive technology on the part of stakeholders, including educators, career services staff, parents, and employers; and effective coordination between these individuals (National Council on Disability, 2000; National Council on Disability and Social Security Administration, 2000).

PEER AND MENTOR SUPPORT

How can students with disabilities employ technology to gain access to meaningful peer and mentoring relationships on the Internet? [2] Potential role models who have disabilities and are experiencing success in college and careers are often separated from potential protégés by great distances and both potential mentors and protégés face more complex transportation challenges than individuals without disabilities. Peer and mentor support can be provided via moderated discussion groups on the Internet (Burgstahler & Cronheim, 2001). Supportive electronic communities can contribute to the self sufficiency of people with disabilities. Such activities, however, incur administrative time and costs.

ANYTIME, ANYWHERE ACCESS TO TECHNOLOGY

How can educators and employers assure that appropriate technology is available when and where people with disabilities need it? [1,3] Sometimes accessible technology is available to a student with a disability in a special education resource center or other isolated location, when it is most needed in the classroom and at home. Often technology available to students at the secondary school level does not transition with them as they pursue postsecondary education and employment. Funding and management strategies should be flexible enough to provide maximum benefit of technology access for each individual student. Coordinated education and community service systems are essential in ensuring that transfer of technology is a seamless process. This can be facilitated by the development of interagency and/or cost sharing agreements that identify specific roles and responsibilities of agencies to address the technology needs of both students with disabilities who have IEPs and those who do not.

PROMOTION OF SELF-ADVOCACY, INDEPENDENCE, AND SELF-DETERMINATION

How can parents, educators and service providers encourage students with disabilities to use technology to self-advocate, perform daily tasks independently, and move toward self-determined lives? [2, 3] Successful transition is integral to a student's realization of postsecondary education, employment, and adult living objectives. Like all other aspects of the transition process, the role of technology should be addressed in a way that maximizes the involvement of the student. Student transition plans should include self-advocacy objectives in the technology area so that students are able to articulate their technology needs to others (e.g., teachers, professors, employers) and access training and support throughout their lives (Blackhurst, Lahm, Harrison, & Chandler, 1999). Ideally, by high school graduation, students with disabilities are experts on the types of technology that serve them best, the technical support requirements of their systems, and resources available to them.

WORK-BASED LEARNING

How can students with disabilities gain access to high tech work-based learning experiences to prepare them for the world of work? [2,3] Internships, job shadows, service learning, and other work-based learning experiences can help students with disabilities gain job skills, explore accommodation options, and learn to use technology in work settings (Benz, Doren, & Yovanoff, 1998; Benz, Yovanoff, & Doren, 1997; Burgstahler, 2001; Luecking & Fabian, 2000). Such experiences can improve their chances for a successful school-to-work transition. Individuals who coordinate work experiences for high school and college students as well as participating employers need greater awareness of the potential contributions and accommodation needs, including assistive technology, of students with disabilities. Stakeholders should work together to assure that students have access to appropriate technology for employment settings and that students are included in the process in such a way that they gain the

knowledge and self-advocacy skills they need for success in postsecondary education and careers.

LEGISLATION AND POLICY

How can the maze of confusing and conflicting laws, rulings, and policy be simplified? [3] Policy makers and advocates should explore ways to clarify existing legislation and use consistent terminology and standards. Dissemination of current laws, policies and resources should be tailored to the needs of various stakeholders and disseminated widely. Differences that occur as students transition between academic levels and academic and career environments should be clearly addressed. Policy makers and advocates should also identify and correct inconsistencies and gaps in legislation and policies regarding the selection, funding, and support of assistive technology (National Council on Disability, 2000).

AWARENESS

How can we assure that key stakeholders have general knowledge of how technology can benefit individuals with disabilities? [1, 2, 3] To be assured that good decisions are made by IEP teams and other decision-makers, all stakeholder groups need to be aware of the types of technology options available to enhance the academic and career outcomes for individuals with disabilities (Blackhurst, Lahm, Harrision, & Chandler, 1999; National Council on Disability, 2000). These groups include general and special education teachers, occupational therapists, rehabilitation counselors, policymakers, paraprofessionals, pre-service and in-service trainers, employers, interagency and community service providers, students, families, technology professionals, postsecondary disabled student services staff, and medical equipment providers. Individuals within these groups represent key stakeholders in the process of ensuring that students are provided with appropriate technology and support services as they pursue education and careers (Blackhurst, Lahm, Harrision, & Chandler). If stakeholders are not aware of how technology can support students with disabilities, these students will not have assistive technology adequately considered in the IEP process; they will not have access to the full school curriculum; they will not be provided with developmentally appropriate devices and services; they will fail to use technology effectively; and they will not become prepared to self-advocate regarding their technology needs in future stages of their lives. Because of the large number of students with learning disabilities, stakeholder knowledge of how technology can promote the success of this group in educational and employment settings is especially important.

RESEARCH

How can we promote research that will improve our understanding of issues related to technology access for people with disabilities and its impact on post-school outcomes? [1, 2, 3] Mainstream electronic and information technology as well as assistive technology is in a constant state of rapid development. We cannot assume that what was impossible yesterday for people with disabilities is not possible today.

Students with disabilities should be taught to use technology in ways that maximize their independence, productivity, and participation in all academic and employment activities.

The National Science Foundation, the Department of Defense, the U.S. Department of Education and other national and private funding agencies should be encouraged to support basic research and promising practices that employ technology to improve the postsecondary education and career outcomes for individuals with disabilities.

The current conditions, legal issues, potential applications, and challenges regarding the use of technology by individuals with disabilities discussed in this paper thus far lead to the implications for practice listed in the next section.

Implications for Policy and Practice

Federal legislation, demands by people with disabilities and their advocates that they be included in all life experiences, increased acceptance of diversity, improved medical care, and advancements in electronic and information technologies have contributed to higher expectations and improved preparation of students with disabilities for postsecondary academic programs and careers. As a result, young people with disabilities are better prepared to pursue higher education and ever-increasing numbers of students with disabilities are attending postsecondary academic institutions. Technology has an important role to play in promoting the success of people with disabilities in employment and careers. However, legal mandates for computer access for students and employees with disabilities are not always reflected in practice, even within organizations that have developed access policies. Stakeholders are not fully aware of technology options, legal issues, and advocacy strategies. These stakeholders include people with disabilities, parents and mentors, government entities, paraprofessionals, policy makers and administrators, precollege and postsecondary educators, librarians, technical support staff, and employers. These individuals must diligently work together if the following goals are to be reached.

1. All individuals with disabilities have *access to technology* that promotes positive academic and career outcomes.

2. People with disabilities learn to *use technology* in ways that contribute to positive postsecondary academic and career outcomes and self-determined lives.

3. There is a *seamless transition* of availability of technology for all people with disabilities as they move from K-12 to postsecondary to career environments.

Promising practices to be considered in order to reach these goals include those that follow. Most recommendations support multiple goals, as indicated by the numbers in parentheses.

- Administrators and policymakers should establish policies, standards, and procedures at all academic and employment levels to assure that accessibility is considered when electronic and information technology is procured. [1]

- Administrators and policymakers should establish policies, standards, and procedures and provide training and support at all educational levels to assure that Web pages, library resources, computing and science labs, and distance learning programs are accessible to everyone, including students with disabilities. [1, 2]

- Policymakers and administrators should assure that funding is available to purchase appropriate assistive technology at all levels of academic programs, in employment settings, and during transition periods between these stages. [1, 3]

- Agencies should collaborate on planning, funding, selecting, and supporting assistive technology to assure continuous technology access and support as students with disabilities transition through academic levels and to employment. [1, 2, 3]

- Educators, librarians, parents, support staff, computer lab managers, and other stakeholders should have access to training so that they will be able to design accessible facilities and activities; select accessible computers and software; purchase appropriate assistive technology; and assure that students with disabilities use technology for their maximum benefit as they pursue academics, careers, and self-determined lives. [1, 2, 3]

- Legislators and policy makers should take steps to clarify existing legislation; disseminate information about current laws, policies, and resources tailored to the needs of various stakeholders; and use consistent terminology and standards. They should identify and correct inconsistencies and gaps in legislation and policies regarding the selection, funding, and support of assistive technology, especially as individuals transition between all academic and employment levels. [1, 2, 3]

- Students with disabilities should be included at all stages of technology selection, support, and use so that they learn to self-advocate regarding their needs for accessible technology in the classroom and workplace. [1, 2, 3]

- Students with disabilities should be taught to use technology in ways that 1) maximize their independence, productivity, and participation in all academic and employment activities; 2) facilitate successful transitions between all academic and employment levels, and 3) lead to successful, self-determined adult lives. Technology should be used to support mentoring relationships; access to electronic information; participation in science labs; communication in class

discussions; self-advocacy practice; independent living tasks; work-based learning opportunities; and other academic and career preparation activities.

- Students with disabilities at high school and college levels should participate in internships and other work-based learning experiences where they can practice using technology in work settings. [1, 2, 3]

Besides taking immediate steps to assure that technology is accessible and appropriately used by individuals with disabilities, there is a need for ongoing research to inform future practice. Recommendations for research areas to be addressed are included in the next section.

Research Recommendations

Further research is needed to identify best practices that assure that all individuals with disabilities 1) have *access to technology* that promotes positive academic and career outcomes; 2) learn to *use technology* in ways that contribute to positive outcomes; and 3) experience a *seamless transition* of availability of technology as they move through educational and career environments. It is recommended that future research explore the following issues (National Center for the Study of Postsecondary Educational Supports, 2001). The goals addressed by each suggestion are included in parentheses.

- Research is needed to study the extent to which the application of universal design principles reduces the need to provide students with special technology-related accommodations in precollege and postsecondary settings. [1]

- Studies should be undertaken to explore the relationship between degree of choice and degree of prescription or availability and effective use of technology for people with disabilities (i.e., the value of self-selection, self-determination as applied to technology). [1, 2]

- Longitudinal studies are needed to document the long range effectiveness of technology in helping students gain access to the general education curriculum and careers. Some research should focus on the value of early technology access and training for children with disabilities. Research is also needed to explore how technology can increase the success of students with learning disabilities. [2]

- Studies should explore the value of on-line peer and mentor support in increasing the academic and career success and the self-determination skills of individuals with disabilities. [2]

- There is a need to study state policies regarding how general technology funding initiatives address the needs of students with disabilities; how state policy impacts funding and decision-making at the local level; and the extent to which

it includes shared funding through interagency agreements and integration of service systems. [1, 3]

- Research is needed to explore the progression and cross-application of technology through stages from elementary to middle school and secondary education and how technology can best be integrated into instruction and transition planning to achieve positive postsecondary school and employment outcomes. [3]

- Exemplary practices need to be identified that increase collaboration among stakeholders to provide students with an integrated and seamless system of technology supports that facilitate transition to postsecondary and career settings. Information is needed about effective models that promote interagency collaboration in the transition process. [3]

- Research is needed to study effective approaches to the development of student knowledge and self-advocacy skills in the area of technology. For example, effective participation in the IEP process and effective strategies for "negotiating" with teachers and employers regarding the use of technology is needed. [1, 2, 3]

- There is a need for baseline data on the present knowledge and skills of key stakeholders that can be used in planning and implementing technology training. Targeted groups should include students with disabilities, parents preservice and inservice teachers, postsecondary instructors, educational support staff, service providers, librarians, and employers. [1, 2, 3]

- Research is needed regarding cost-effective uses of technology to help educators and others select devices and services that maximize opportunities for students with disabilities while minimizing costs and duplication of services. [1, 2, 3]

- Information is needed regarding effective training approaches for specific stakeholder groups. With regard to the training needs of students, age and interest-appropriate strategies should be identified. The potential use of Internet technologies (e.g., electronic mail, Web pages, discussion lists, bulletin boards) to train stakeholders should be explored. [1, 2, 3]

Conclusion

The use of electronic and information technology is ubiquitous – in education, employment, community service, and recreation. Computers, the Internet, and other technologies have the potential to promote positive postsecondary and career outcomes for students with disabilities. However, this potential will not be realized unless stakeholders secure funding; become more knowledgeable about accessible technolo-

gies and their appropriate use; understand and comply with legal mandates; and develop appropriate legislation, policies, standards, and procedures that result in maximizing the independence, participation and productivity of students with disabilities as they move toward college, careers, and self-determined lives. Ultimately, making all educational and employment opportunities accessible to people with disabilities will strengthen our economy and create a level playing field for everyone.

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