The Role of Technology in the Transition to Postsecondary Education of Students with Learning Disabilities

A Review of the Literature

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This article summarizes findings regarding the use of technology in helping students with learning disabilities succeed in postsecondary education settings. The primary purposes of this article are to (a) identify the specific technology recommendations found in the literature, (b) identify issues related to using these recommendations in the transition to postsecondary education, and (c) provide recommendations for planning for the transition to postsecondary education.

In recent years there has been an increasing interest in programs and services for students with learning disabilities who are attending postsecondary institutions (Ganschow, Coyne, Parks, & Antonoff, 1999; Mangrum & Strichart, 1992; National Center for Education Statistics, 1999; Norlander, Shaw, & McGuire, 1990; Vogel & Adelman, 1993). In 1986, 29% of persons 16 years of age or older with a disability had enrolled in postsecondary education; by contrast, in 1994 it had risen to 45% (Office of Special Education and Rehabilitative Services, 1996; Thomas, 2000). In 1996, 6% to 9% of all undergraduate students reported having a disability (Henderson, 1998; National Center for Education Statistics, 1996), with learning disability as the most prevalent (29%-35% of those reporting a disability). Vogel et al. (1998) found that the proportion of students with learning disabilities in postsecondary institutions ranged from .5% to almost 10%.

Students with learning disabilities, however, are still less likely than their nondisabled peers to attend college (Greenbaum, Graham, & Scales, 1995; Murray, Goldstein, Nourse, & Edgar, 2000; National Joint Committee on Learning Disabilities, 1994, 1999; Vogel & Adelman, 1993). A number of adult adjustment studies have supported this finding (Blackorby & Wagner, 1996; Fairweather & Shaver, 1991; Levine & Nourse, 1998; National Center for Education Statistics, 1994b; Sitlington, Frank, & Carson, 1992; Wagner, D'Amico, Marder, Newman, & Blackorby, 1992).

Once students with learning disabilities have been admitted into college, they often need assistance to stay in school and to graduate (Blackorby & Wagner, 1996; Brinckerhoff, Shaw, & McGuire, 1993; Murray et al., 2000; National Center for Education Statistics, 1994a; Vogel & Adelman, 1993). The skills required for success at the postsecondary level are often those very skills with which students with learning disabilities have difficulty (Anderson-Inman, Knox-Quinn, & Szymanski, 1999). In addition, specific coping skills or strategies that appear to have been learned by students in high school often are not maintained over time (Gerber & Reiff, 1994; see Note).

Legislation Addressing Assistive Technology

Assistive technology may be one of the ways to help adults with learning disabilities compensate for their difficulties in a variety of academic areas. This type of technology was introduced as a component of rehabilitation during the late 1950s, as a result of improved prosthetics developed for soldiers returning from war. From 1954 to 1965, a number of federal initiatives related to technology were passed, including the Vocational Rehabilitation Act Amendments of 1954 and the Social Security Act Amendments of 1956 and 1965 (Wallace, Flippo, Barcus, & Behrmann, 1995). The Rehabilitation Act of 1973 (Sections 503 and 504) and the Education for All Handicapped Children Act of 1975 helped to create the opportunity for the provision of assistive technology to all students with disabilities by establishing the concepts of "reasonable accommodation" and "least restrictive environment" (Judith

Address: Patricia L. Sitlington, Department of Special Education, University of Northern Iowa, Cedar Falls, IA 50614-0601; e-mail: Sitlington@uni.edu Fein National Institute on Disability and Rehabilitation Research, 1996).

The first legislation that specifically addressed assistive technology was the Technology Related Assistance for Individuals with Disabilities Act of 1988 (the Tech Act), which was amended in 1994. The Individuals with Disabilities Education Act of 1990 (IDEA) and its 1997 Amendments established transition planning and services as a component of a student's Individualized Education Program (IEP), beginning at age 14. These same amendments also mandated that the student's assistive technology needs be considered in the IEP (Fisher, 1999; Fisher & Gardner, 1999; Galvin & Wobschall, 1996; Lahm & Nickels, 1999). The IDEA Amendments adopted the language of the Tech Act for the definition of an assistive technology device, as follows: "Any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of a child with a disability" (Federal Register, March 12, 1999, p. 12421).

The Americans with Disabilities Act of 1990 (ADA) reinforced the provisions of the Rehabilitation Act of 1973 and extended civil rights protection to students with disabilities attending institutions that do not receive federal assistance (Day & Edwards, 1996; Galvin & Wobschall, 1996; Wallace et al., 1995). The ADA did not specifically define or address assistive technology, but its definition of "auxiliary aids and services" includes assistive technology as a form of support. The 1992 Amendments to the Rehabilitation Act emphasized transition goals for students with disabilities and the provision of assistive technology in helping students reach those goals. The 1998 Amendments maintained the essential definition of an assistive technology device contained in the Tech Act of 1988.

Purpose of This Review

This article (a) identifies the specific technology recommendations found in the literature, (b) identifies issues related to using these recommendations in the transition to postsecondary education, and (c) provides recommendations for planning for the transition to postsecondary education.

The studies reported in this review initially were located by searching the ERIC database from 1966 to 2000 for references addressing technology and transition. The 1966 beginning date was chosen because the period from 1954 to 1965 has been referred to as the "Golden Age of Rehabilitation" (Wallace et al., 1995, p. 12). Thus, we believe that the initial inroads into assistive technology should have been made by 1966.

The descriptors used to identify articles were as follows: assistive technology, auxiliary aids, adaptive technology, technological accommodations, and transition or postsecondary education. These descriptors were searched for in the descriptor fields, abstract, and title. In addition, reference lists from identified articles and books were searched for additional sources. Finally, a hand search was conducted in the areas of transition, technology, and postsecondary education for the following journals: Career Development for Exceptional Individuals, Exceptional Children, Journal of Learning Disabilities, Journal of Special Education Technology, Learning Disabilities Research, and Teaching Exceptional Children.

Specific Technology Recommendations in the Literature

Before the issues related to assistive technology and transition to postsecondary education can be addressed, the specific recommendations found in the literature need to be examined. Table 1 presents the specific assistive technology recommendations that were found for each area of disability. The table also provides the source in which each recommendation was found. The areas of disability receiving the most focus were written language and reading, followed by spelling and organization and memory. This is not surprising, because these are the areas on which there is the most focus for students with learning disabilities. These are also the areas in which the most demands are placed on students, particularly at the postsecondary level. It was surprising, however, that assistive technology related to mathematics was addressed in only one article.

The literature also addressed areas of disability not typically associated with assistive technology, such as listening, poor ability to speak with fluency and/or sometimes to understand others, and problems with concentration. Finally, technology itself has fostered the need for assistance, in that two of the articles (Cunningham & Coombs, 1997; Thompson, Bethea, Rizer, & Hutto, 1997) addressed difficulty finding the place on the screen.

Probably most encouraging, however, is the fact that the vast majority of technology recommendations are readily available—often at a low cost. In implementing any of these assistive technology recommendations, however, the nature of the demands that are being placed on the student, the nature of the student's disability, and the personal resources available to the student must be considered. In addition, it is important to understand the external supports available to assist the student's response to technology (Blackhurst, 1997).

Issues Involving Assistive Technology and Transition

Although specific technology recommendations are available, instructors and students have identified issues and barriers that prevent the general use of technological accommodations by students with identified learning disabilities in postsecondary settings. We have divided these issues into five areas, based upon the common themes found in the literature:

TABLE 1. Specific Technology Recommendations

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(Table 1 continued)

Area of disability	Author	Recommendations
	Thompson et al., 1997	Copy holder with line grades Change monitor foreground/background color -
Organization and memory	Anderson-Inman, 1999	Electronic outlining Concept mapping
· · · ·	Cunningham & Coombs, 1997	Use outlining software Word processor with word expansion
	Raskind, 1994	Outlining programs Personal data manager Free-form database software Outline software Personal data organizers
Time management	Anderson-Inman, 1999 Blackhurst, 1999	Organize and manage time Tape-record paced cues Electronic calendar
	Cunningham & Coombs, 1997 Raskind, 1994 Thompson et al., 1997	Online calendars and planners Personal data manager Computer software that promotes organization of work
Listening	Brinkerhoff et al., 1993 Raskind, 1994	Speech synthesizer Variable speech-control tape recorder Personal frequency modulation system Talking calculator Personal FM listening system
Problem with concentration	Thompson et al., 1997	Noise-blocking headset Table top dividers
Poor ability to speak with fluency and/or sometimes to understand others	Thompson et al., 1997	Scanner with optical character recognition Speech synthesizer Talking and large-print word processors Talking dictionary
Math	Raskind, 1994	Talking calculator

- the use of assistive technology in the role of "cognitive prosthesis" (Cavalier, Ferretti, & Okolo, 1994) versus "cognitive partner" (Chandler, Czerlinsky, & Wehman, 1993; Day & Edwards, 1996; Margolis & Michaels, 1994; Raskind, 1994);
- the availability and high cost of assistive technology;
- 3. abandonment by students of purchased assistive technology devices;
- training needs related to the use of technology and assistive devices; and
- 5. eligibility questions.

In the role of cognitive prosthesis, the technology replaces or circumvents an ability that is absent or impaired (Cavalier et al., 1994). The purpose of the technology becomes similar to that of any prosthesis—it corrects one or more specific impairments. For example, a computer that speaks can help a student with a reading disability translate text into meaningful information. Voice recognition software can assist a student who cannot access a keyboard to input text. The use of assistive technology in the role of cognitive prosthesis can facilitate the student's move to independence by reducing his or her dependence on others to perform tasks such as reading, writing, listening, and organizing (Anderson-Inman et al., 1999).

At other times, assistive technology serves in the role of cognitive partner, as described by a number of authors (Chandler et al., 1993; Day & Edwards, 1996; Margolis & Michaels, 1994; Raskind, 1994). In this role, assistive technology supports the student's efforts to accomplish a task by assisting in learning specific material or in performing specific tasks. At present, a variety of software titles provide immediate feedback to a learner's response. This type of software also offers a learning environment that is individualized to fit the learner while at the same time measuring the student's progress in terms of performance objectives (Margolis & Michaels, 1994).

The second issue—the availability and high cost of assistive technology—is a primary concern of postsecondary institutions that are legally required to provide services for students with learning disabilities. During the past few years, the demands for computer technology and assistive devices have been increasing drastically, but availability has not increased at the same level. In addition, funding for the provision of technology devices at those institutions is a persistent problem (Anderson-Inman, 1999; Cunningham & Coombs, 1997; Galvin & Wobschall, 1996).

Third, because assistive technology can be expensive and because it is important to maximize educational gains, students must use the equipment as it is intended to be used. Nearly one third of all purchased assistive technology devices are abandoned by students (Todis, 1996). Research has indicated a variety of reasons for abandonment: (a) the device did not improve the student's independent functioning, (b) the device was too difficult and expensive to repair, (c) the equipment made the individual stand out in a group, (d) the equipment required too much assistance from another person, (e) the equipment was too difficult for the student to use, (f) the program required a long or complicated series of commands, (g) the device failed to function as intended, (h) the technology was not always reliable, or (i) the computer-based solutions did not always address the actual demands of the curriculum (Anderson-Inman, 1999; Chandler et al., 1993; Cunningham & Coombs, 1997; Raskind & Scott, 1993; Sherer, 1998; Todis, 1996). In many instances, the key issue was student indecision about whether the assistive device was helping or creating more work. The student must believe that there is a problem that needs to be solved and that the proposed technology-based solution is effective (Anderson-Inman et al., 1999).

Preventing this abandonment involves making decisions based upon assessment, diagnosis, and evaluation of the student's needs and the demands of the postsecondary environment (Todis, 1996). Roessler and Kirk (1998) found that a majority of their study participants reported that they were introduced to technology that did not meet their needs. The authors also emphasized that students often did not participate in an evaluation of their technology needs. Assistive technology recommendations must be carefully evaluated, or the technology may turn into a frustrating barrier for the individual, defeating its intended purpose (Roessler & Kirk, 1998). Fourth, the training of both students and their instructors is crucial to the proper use of technology as an assistive device to maximize educational gains (Anderson-Inman, 1999; Blackhurst, 1999; Chandler et al., 1993; Cunningham & Coombs, 1997; Day & Edwards, 1996; Kroeger & Schuck, 1993; Raskind, 1994; Roessler & Kirk, 1998; Sherer, 1998). Often because of lack of training and support, students reported they

were unprepared to benefit from the available technology (Roessler & Kirk, 1998). In addition, if students have to spend an inordinate amount of time learning to use the technology, they may consider it a matter of "diminishing returns" and go back to doing things in their traditional manner (Raskind, 1994).

Training is also critical for the professionals working with these students at both the secondary and postsecondary levels. The university faculty who are preparing teachers and other professionals presently lack the skills and knowledge to teach their students about available technology or to model the appropriate use of that technology (Smith & Jones, 1999). Few preservice training programs or classes related to assistive technology application and issues are available to teachers (Todis, 1996). The successful integration of computer technology and assistive technology into special education depends on the training of the professionals required to use it, and they cannot be expected to teach students how to use the technology if they themselves have not been properly taught its use.

A final issue centers on the question of eligibility for assistive technology. Anderson-Inman, Knox-Quinn, and Horney (1997) found that approximately half of the students with learning disabilities in high school who were participating in their 2-year study were no longer considered eligible for special education services. With sufficient access to assistive technology and instruction on how to use it, the students were able to achieve at their grade-level expectations. This finding raises questions for further research and discussion. If the students are successful in school, do they still have a learning disability? If they are no longer eligible for the support services and the accommodations that assisted their success at the secondary level, will they be able to meet the more rigorous demands of postsecondary education (Scott, 1991)?

Recommendations for Planning for Transition to Postsecondary Education

All of these issues hold implications for planning for the transition of individuals with learning disabilities to postsecondary education. The groundwork must be laid at the secondary level so that students are prepared to identify and use the assistive technology devices they need to succeed in postsecondary education. Based upon our comprehensive review of literature, we make the following recommendations:

1. Due to the expense of assistive technology and the challenges institutions and individuals face in obtaining funding, the transition process must include an identification of funding sources for the assistive technology needed by the student in postsecondary education. This identification should occur early enough that the appropriate device can be located and the student can be appropriately trained in its use.

- 2. Selection of the specific assistive technology approach should be based upon the assessment of the student's needs and the demands of the postsecondary education environment. This assessment must include the student. It also requires that the student and the secondary- and postsecondary-level professionals be aware of the demands of the student's targeted postsecondary education environment. These steps should decrease the high level of abandonment of assistive technology devices by the student.
- 3. Students must be trained in the proper use of the assistive technology device to maximize their educational gains and to decrease the high level of abandonment. This training should be conducted before the student transitions to postsecondary education.
- 4. Professionals working with the student at the secondary level must carefully consider the impact of removing the student from eligibility for special education services—especially in terms of the services the student will need at the postsecondary level. Removal of this label may remove the eligibility of the student to receive reasonable accommodations—including assistive technology services and devices—at the postsecondary level (Scott, 1991).

These recommendations should be implemented while the student is still in high school, so that he or she is prepared for the transition to postsecondary education. They should also be enacted with the cooperation of the student and professionals at both the secondary and postsecondary levels. The use of assistive technology has been identified in the IDEA Amendments as a critical component of the transition process. Assistive technology needs to be incorporated into the transition process if students with learning disabilities are going to make a successful move to postsecondary education programs—and graduate from these programs.

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NOTE

The Association on Higher Education and Disability (AHEAD) is the professional organization of postsecondary disability service providers, and its members have written a number of publications in this area (see http://www.ahead.org).

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