Assistive Technology Use by Students with Disabilities at UNT

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Abstract

This study gathered information on assistive technology use by students with physical disabilities, including visual and hearing impairments, at the University of North Texas through structured interviews of participants from the Office of Disability Accommodation (ODA). Interviews involved topics such as frequently used devices, services of the ODA in terms of technology, quality of students' training on devices, and their opinions on improving the current program. Implications of this study include the need for further research on the cost of maintaining an effective assistive technology program, programs that increase student independence and self-advocacy, as well as studies that examine the student perspective on the postsecondary institution assistive technology program.

Introduction

People with disabilities are no longer shunted into institutions as in the past. Today they are active and successful members of society in both the workplace and schools. More than ever, students with disabilities are pursuing postsecondary education in hopes of improving their career options. Enrollment of students with disabilities in undergraduate education has increased from 6% of undergraduate students reporting a disability in 1996 (Wehman &Yasuda, 2005) to 11.3% of undergraduate students reporting a disability in the 2003–2004 academic school year (U.S. Department of Education, 2005). Some students with disabilities require assistive technology in order to complete the same tasks as their peers without disabilities. The reported disabilities include learning disabilities, physical disabilities, speech disabilities, hearing impairments, visual impairments, and other health impairments. Since the mid-1990s, the most commonly reported disabilities by students in postsecondary institutions were learning disabilities, replacing visual impairments as the most common. Visual impairments are now the third most reported disability, at 16% of students with disabilities in 2000 (Wehman & Yasuda, 2005). Despite the fact that 72% of all postsecondary institutions in the United States in 1999 enrolled students with disabilities, only 52% of institutions provided technology and adaptive equipment as a type of support (Carlson & Ehrlich, 2005).

Assistive technology is defined as "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" (Scherer, 2002, p. 5–6). Essentially, assistive technology, when used by a person without a disability, makes an activity easier, but for a person with a disability, makes that same activity possible. Devices are available for a range of disabilities, activities, prices, and technology levels. The major activity

categories for which assistive technology is used include devices to help people with sense impairments such as hearing or vision, communication, personal care, mobility, and recreation. Devices can be "low-tech," an item as simple as a grip on a pencil, or "high tech," such as a computer program that reads text on a computer screen. Over 26,000 different devices are available on the market to people with disabilities. In the United States alone, over 15 million people use assistive technology on a daily basis (Carlson, Ehrlich, Berland, & Bailey, 2001).

Both secondary schools and postsecondary schools are held to Section 504 of the Rehabilitation Act of 1973 and Title II of the Americans with Disabilities Act of 1990 (U.S. Department of Education, 2007). Section 504 of the Rehabilitation Act of 1973 states that no person with a disability, who is otherwise qualified for a position, can be excluded from or discriminated against in any program or activity that receives funding or financial assistance from the government, such as public schools and many public and private postsecondary institutions, based on their disability (Mendelsohn & Fox, 2005). The Americans with Disabilities Act of 1990 (ADA) is considered the most important civil rights act for people with disabilities. ADA prohibits discrimination against people with disabilities by employers, public services of state and local governments, and private groups that provide public accommodations, such as businesses or stores. In addition, ADA requires these organizations to make reasonable accommodations for people with disabilities without causing unnecessary hardship to the organization. Although Title III is perhaps the most famous title of ADA, requiring ramps and other accessibility accommodations, it is Title II that "all public services and programs must be equally accessible to people with or without disabilities" (Mendelsohn & Fox, 2005, p. 22). According to the Rehabilitation Act, if a school receives money from the government, the school cannot deny a student with a disability admission if the student is otherwise qualified.

Additionally, Title II of ADA requires the school to provide reasonable accommodations at the request of the student, such as assistive technology, that would equalize competition in the classroom for that student and not cause the school monetary hardship.

Although both secondary and postsecondary institutions are subject to the Rehabilitation Act and ADA, disability accommodations, such as assistive technology, differ greatly between them. The Individuals with Disabilities Education Act of 1997 (IDEA), which ensures all children a free and appropriate education based on individual needs, is not applicable at the postsecondary level (Reilly & Davis, 2005). IDEA mirrors the Rehabilitation Act in many aspects; however, it does not replace the Rehabilitation Act (Mendelsohn & Fox, 2005). Rather, IDEA covers students who would have otherwise been excluded from the Rehabilitation Act. As a result, students with disabilities entering postsecondary education who were previously provided for through IDEA, must now personally search out accommodations they require in order to be successful in the classroom. Under ADA and the Rehabilitation Act, these services are required to be available to them, but only when students request the accommodations.

In 1998, President Clinton signed an act known as the Assistive Technology Act of 1998, establishing the importance of technology in improving the lives of people with disabilities (Mendelsohn & Fox, 2005). The act started device loan programs and a grant program for states to educate the public about assistive technology, as well as programs for training people on the devices. A goal of the act was to train professionals who work with people with disabilities, such as care providers, therapists, technology experts, and employers, on how to use assistive technology, as well as providing funding and other monetary aids to help with the cost of the devices (Assistive Technology Act of 1998). The Assistive Technology Act of 2004 renewed the 1998 version, allocating more funds to states for device programs and allowing states to use a

majority of federal funds to directly help individuals with disabilities obtain technology (Carlson & Ehrlich, 2005).

Despite legislation and governmental aid for cost, training, and education that are in place, assistive technology is still not being used to its full potential (Burgstahler, 2005). Purchasers and designers often forget about accessibility, so inaccessible devices are bought, and inaccessible hardware, software, and websites are designed. Also, teachers in primary and secondary schools tend to know little about assistive technology, which can lead to devices not being secured and being misused by students. Funding for devices is most readily available for students from kindergarten to twelfth grade. Once the student graduates, funding may not follow. The loss of funding, coupled with the transition from secondary to postsecondary education, often makes it difficult for a student to keep his or her device, if he or she even has one. In addition, the criteria for qualifying for a device in postsecondary education can be complicated, and students are often unaware of their rights as students with disabilities. As a result, students with disabilities at the postsecondary level may not be receiving the academic accommodations in the form of assistive technology they need to succeed.

Research Topic

The purpose of this study was to explore the use of assistive technology at the University of North Texas (UNT) by students with disabilities receiving services through the Office of Disability Accommodation (ODA). Structured interviews with staff of the ODA at the University of North Texas were conducted discussing the frequency of use of assistive technology as well as the type of technologies used most commonly by students with disabilities, including hearing impairments and visual impairments. The study also addressed the ability of UNT to provide assistive technology services adequate to meet the needs of students, the ability of students with

disabilities to use their devices in a classroom setting independently, and the training students received in the use of assistive technology devices prior to their enrollment.

<p style="text-align:center">Literature Reviewed</p>

A literature search found four studies that address postsecondary education institutions and their accommodations, including assistive technology, for students with disabilities. All studies indicated a lack of research on assistive technology and postsecondary education students, most likely due to the relatively new nature of these devices and their appearance in schools.

Chang, Jackson, Picklesimer, Roberts, and Stodden (2006) mailed surveys to 1,600 universities asking 23 questions concerning the university's ability to offer certain services to students with disabilities. The respondents were staff members of the universities' disability accommodation office, assistive technology specialists, and other related individuals. The surveys specifically questioned assistive technology evaluations, skill training for students on equipment, ability of students to borrow or purchase equipment and software from the university, assistive technology supports around campus such as in computer labs and libraries, adaptive furniture, and document conversion services for students who are visually impaired. Answers to survey questions were based on a scale from 0-4, and the surveys were mailed twice to each university over two years.

Chang et al. (2006) found that most universities did not offer assistive technologies. Only 41.5% of universities in their sample reported providing these services in the first survey and only 42.8%—a negligible increase—in the second survey. Universities were more likely to offer software to help students with disabilities adapt. In the first survey 66.4% of the universities offered adaptive software, increasing to 71.3% of the universities in the second survey.

Universities were most likely to offer adaptive furniture for use by students with disabilities. In the first survey, 77.1% offered this furniture, whereas 84.1% offered the furniture at the time of the second survey. The study indicated that assistive technology services were offered at a low to medium frequency at institutions in both mailings of the surveys. Every institution offered services in every category at some level and was improving on the quality of their services to students. Chang et al. (2006) also suggested that the data showed a "minimalist approach" by universities to accommodations in addition to a lack of funding for services.

Gajar, Long, Merchant, and Ofiesh (2002) mailed 366 surveys to institutions listed as an Association on Higher Education and Disability (AHEAD) member. AHEAD members are concerned with developing legislation regarding students with disabilities and dedicated to providing quality services to those students at the postsecondary level (Membership, 2007). Surveys were mailed out twice and asked respondents to identify devices used at their institution, as well as the type of disabilities of students who used them. Their study is patterned after previous research by Lance (1996). However, instead of lists, the researchers sent out open-ended questionnaires. The data received from respondents showed students use the most available devices most often. The most popular devices used are voice recognition software, reading machines, FM systems, and text enlargement. Voice recognition was often used across disabilities, followed by reading machines. If another group used a device, it was commonly students with learning disabilities or other health impairments.

A study conducted by Jackson, Michaels, Morabito, and Prezant (2002) discovered new information concerning: (1) awareness of assistive technology by disability accommodation staff and faculty of an institution; (2) any barriers or issues with assistive technology delivery, training, and access across campuses; (3) its integration in class instruction and coursework; (4)

the ability of campus departments to obtain technology; and (5) frequency of technology use and its effectiveness. Jackson et al. (2002) mailed two surveys to 1,500 members of AHEAD, requesting only professionals involved with postsecondary education respond. Jackson et al. (2002) found that a typical disability accommodation office had 6 staff members and served approximately 276 students, with the majority of those students (57%) having learning disabilities and/or attention deficit disorder. The next most common disability was physical disabilities and health impairments (18%).

With technology provision, Jackson et al. (2002) found the most limiting factor to be the cost of buying equipment and the upgrading of equipment as needed. The most helpful factor in regards to technology provision was knowledge of staff members, increasing knowledge and awareness of technology by the students themselves, and the ability of the institute's administration to fund the purchase of devices. The most common and most used devices on campus included scanners, screen or text reading software, screen magnification, and specialized tape recorders. The most useful devices were textbooks, real-time captioning, screen magnification, specialized tape recorders, and screen readers. The least available devices were those used for one group of student specifically, in this case, those with visual impairments. Jackson et al. (2002) felt the data from this study supported a need for offices to have training in devices, monetary support from administration, and support for students through assistive technology training.

Sharpe and Johnson (2001) examined the ability of different types of institutions to offer services to students with disabilities by conducting a secondary analysis on a survey already completed by the National Center for the Study of Postsecondary Educational Supports (NCSPES). The NCSPES sent surveys to 1,500 institutions, asking questions about the number

of students receiving supports, the availability of assistive technology, funding and staffing concerns, written policies, and outreach programs. The institutions were categorized based on their capacity to offer accommodations. To determine capacity, Sharpe and Johnson (2001) examined the data compiled for the upper and lower 20th percentiles of the institutions and compared the information gathered.

Sharpe and Johnson (2001) found that very few differences were recorded between the groups in terms of the types of supports and accommodations offered; however, assistive technology evaluations and staff were more available at the higher capacity institutions. The higher capacity institutions were also able to serve a more diverse population of students with disabilities, due to having more resources at hand. There was a statistically significant difference in capacity between the types of institutions as well as a large discrepancy in offerings of assistive technology evaluations, document conversion, study skills strategies, and other support types, most notably those accommodations offered at a particular institution more than 75% of the time. For both institution capacities, testing accommodations were offered most often, followed by counseling, advocacy services, and note takers and readers. These findings comprise the first section of a longitudinal study that will also analyze student satisfaction with services and devices as well as success with the devices in the classroom in regards to the institution they attend.

There is a lack of research examining the transition from secondary school to postsecondary institutions for students who utilize assistive technology as part of their education. As the reviewed studies were conducted through mailed surveys, this study intends to hold structured interviews with the faculty of the ODA of UNT in order to gather more in-depth information than can be obtained by surveys.

Method

A qualitative method was chosen for the research. Qualitative research is characterized by investigation of areas of society, such as perceptions and interests, and tends to be open-ended in questioning instead of attempting to control variables and produce numerical data (Holliday, 2002). Open-ended questioning allows for the gathering of personal opinions and experiences in relation to the topic of questioning. This method allows for more thorough answers and varying personal perspectives than can be obtained though a multiple-choice survey. A qualitative approach was chosen because the personal opinions of professionals concerning assistive technology were important to provide a complete picture of the assistive technology services and use of devices on the UNT campus.

Participants

Participants for this study were four professionals from the ODA at the University of North Texas who have experience with assistive technology and students with disabilities on campus. Participants were recruited through inquiries at the ODA for staff to participate in a study related to the use of assistive technology.

Procedure

Each participant was asked a series of eight questions in a structured interview lasting approximately 60 minutes. The questions dealt with topics concerning assistive technology use by students with hearing impairments, visual impairments, and physical disabilities. These topics included types of technology used most commonly at UNT, assistive technology services offered by the ODA, the ability of students to use technology independently without the help of a specialist, and the quality of students' technology training prior to entering UNT. Furthermore, the professional opinions of the participants on improving assistive technology services and

training for students with these disabilities were compiled. Interview questions were developed with the specific intent of obtaining reasons and explanations behind the actions of the ODA to attain a full picture of assistive technology on campus.

Before interviews commenced, human subjects training was completed and Institutional Review Board approval was granted. All interviews were completed in person. Participants' answers were transferred to typewritten transcripts of each interview, and each question was then examined to find the main categories addressed. Similar topics addressed by participants were grouped together to identify common themes and similar responses within the answers.

Results

Device Offerings and Use

Two locations on the UNT campus offer assistive technology to students: the ODA and an adaptive computer lab, located in one of the general access labs on campus. A wide range of devices and software are available to students for use in these locations or for checking out for a semester.

In the adaptive computer lab, there is a combination of machine equipment and computer programs for student use while working in the lab. The functions and disability population for each device can be found in Table 1.1, Table 1.2, and Table 1.3. Several work stations are equipped with hand cranks for students with physical disabilities to adjust stations to suit their needs. The lab provides an Epson Perfection 1250 scanner, a Tiger Embosser for Brailling purposes, screen readers, screen magnifiers, headphones, and a Sorenson Videophone that enables students with hearing impairments to conduct a long-distance sign language conversation.

The lab also provides a variety of computer software for a wide span of needs. All computers in the lab have Jaws 8.0 screen reader, magnifiers such as MAGic 10.0 and ZoomText 8.0, Dragon Naturally Speaking 8.0, Scientific Notebook/MathTalk 5.5, Duxburry Braille Translator 10.5, Tiger Viewer/Embosser, and Focus Braille Display Software. Other computer labs on campus have some computers equipped with screen readers and magnifiers, and tables with hand cranks. Table 2 explains the functions of each software program.

The ODA considers itself a consultant on accommodations for students and administrators with a goal to ensure students with disabilities are not at a disadvantage in the classroom and are given the aid they need for academic success. Although not a primary source of technology, ODA does have several technological services available for students. Some of the technology, however, is only for use in their testing rooms, such as closed circuit televisions and flat bed scanners. The office also has a Tiger Embosser and will provide Braille for students in English, French, and Spanish. Braille will also be available in Japanese next year. For students with visual impairments, document conversion for textbooks is provided, a service that allows students to bring in textbooks, and graduate assistants will scan the pages and convert picture files to audio files, while placing text descriptions behind images. The devices and software for these students are described in Table 3.1. Available for checkout are FM loop systems for students with hearing impairments, Opal readers, Eclipse magnifiers, Kerzwier 3000 readers, DAISY players, adapted computer keyboards, and padded furniture for students with physical disabilities unable to sit in the chairs and desks of classrooms. The devices and software for students with hearing impairments and physical disabilities are listed in Table 3.2 and Table 3.3.

Students use assistive technology to complete activities expected of any college student, such as writing papers and e-mails, reading textbooks, and completing work in class. The main

obstacles to completing activities include hearing the professor for students with hearing

impairments; reading and writing, especially on the computer, for students with visual

impairments; and typing for students with physical disabilities. Students with hearing

impairments use the FM loop systems most often, with seven or eight of the devices checked out

each semester. If needed, the ODA will arrange for a sign language interpreter. Students with

physical disabilities use Dragon Naturally Speaking most often, especially for writing papers.

Students with visual impairments use assistive technology most often, with the most commonly

used devices being Jaws screen reader, closed circuit televisions, and magnifiers, such as the

Opal reader, of which three to five are checked out each semester. Document conversion is often

used for students with visual impairments. Brailling services are used least, as many students no

longer read Braille. The only change in student needs over the course of postsecondary education

careers is upgrading to new devices and versions of software.

Effectiveness of Services

Overall, participants felt the assistive technology services on campus meet the needs of

students, especially since UNT recently spent a large sum of money securing new equipment and

the latest edition of many software programs. The ODA spends time carefully researching new

technology, as well as new devices and versions of programs entering the marketplace. The ODA

typically uses basic versions of software until an upgrade is absolutely necessary. The only

concern mentioned by participants is the lack of utilization by students, as many students own

their own equipment. As a result, students that do visit the ODA are typically uncomfortable

with the technology, do not own a specific piece of equipment, or are international students able

to use the technology, but unable to receive aid to own their own equipment without U.S.

citizenship. UNT's assistive technology program was mentioned as the premier program in the

north Texas area and is comparable to services of larger schools in Texas, such as the University

of Texas and Texas A&M.

Training and Independence

Most participants indicated that students began UNT with adequate training in using

assistive technology, especially if the student had a preexisting and long-term disability. It was

noted as extremely rare for such a student to not have training on devices prior to entry into a

postsecondary institution. In the adaptive computer lab, student workers are trained on the

devices and programs and are therefore able to help students experiencing trouble with a

program. Although the lab and ODA do not provide training for students directly, they are

available to help with troubleshooting and familiarizing students with new devices. For programs

such as Dragon Naturally Speaking or Jaws screen reader that students use most often, the office

will help students reach professionals who offer training services. The Texas Department of

Assistive and Rehabilitative Services (DARS), which is based out of Austin, Texas, is one

professional program that does offer training and often for free. In order to master a program and

use it efficiently, an intensive summer or an entire semester of training is often required.

Students are often unable or unwilling to attend an entire training session, in which case, the

ODA will aid the student as much as possible and encourage him or her to go to DARS for the

training. Often, the manufacturer of the device will offer installment and training services for a

new device.

Improvement Suggestions

Although participants felt overall that assistive technology provided through the ODA

and in the adaptive computer lab are effective and satisfactory in meeting the needs of students,

all noted the need to improve accessibility of services to students, as well as to help students

utilize their offices. One suggestion for improvement was to move the adaptive computer lab, as well as the ODA, to a location on the first floor of a building with outside doors leading directly to the rooms. Currently, the adaptive computer lab is located at the rear of the Science and Technology Library, which makes it not only difficult to find, but also difficult for someone with physical or visual impairments to be able to maneuver through the walkways and past obstacles. Participants noted that previous surveys of students by the ODA implied that the location of the computer lab is a major obstacle to using the lab. The ODA is located on the third floor of the University Union in a corner office on a side hallway. Although students seem to find this location with little difficulty, new locations for both offices on a first floor of an easy-to-reach building with outside doors would make their services more accessible.

Other areas of improvement could include the handling of student problems with assistive technology software. If a student encounters problems with a Windows program, troubleshooting services are available on campus by student workers in computer labs. For a student with a disability, however, there is rarely a worker able to help with an assistive technology program. If problems do occur with an assistive technology program, and it is after office hours for the ODA, students have to call the program manufacturer for help. Only in the adaptive computer lab are student workers trained to use its devices. The ODA plans to create ongoing training programs for student workers in all computer labs on campus for the various kinds of assistive technology software in order to allow student workers to troubleshoot the programs, therefore improving the technology services to the students with disabilities. Personnel in the Information Technology (IT) department have also taken a personal interest in increasing student worker training on assistive technology.

Also mentioned was the need for more accessible Web pages for students who are visually impaired. By law, all Web pages must be accessible, with text behind all images so that a screen reader can read the text to describe the image, rather than just mention the image's existence without providing an idea of what the image contains. All Web pages must be approved by the ODA and checked for accessibility, but people often fail to comply with this rule. As a result, many Web pages arrive as inaccessible, which is not only illegal, but also places students with visual impairments at a distinct disadvantage.

Whereas most participants felt students enter UNT with adequate training in assistive technology devices, some participants felt it would be helpful for incoming students to have a program for junior high and high school students during the summer for training on technology found at most postsecondary institutions. As some students enter UNT with no training on the technology, a program during the summer that exposes students to the technology and trains them on its uses would be helpful in transitioning between secondary and postsecondary institutions. It is hoped that students would return from the summer program and request the technology at their secondary institutions.

Interestingly, the most common suggestion by participants addressed student use of the ODA services. All participants mentioned a need for students to take initiative and be more independent in pursuing technology and technology training, especially because there is a pull for people with disabilities to be as self-sufficient as possible. In the workforce, students will not have many of the resources available to them that are available through university programs such as ODA. Self-advocacy is even more important for students who become accustomed in high school to legislations that required teachers to know beforehand accommodations needed for each student. As this legislation does not exist at postsecondary institutions, students need to be

proactive in ensuring they receive the help they need. Although many students already exemplify self-advocacy and independence in using technology, a fair number still enter postsecondary education with no self-advocacy experience and little independence. As a result, participants of this study wish to encourage students to be independent and self-advocating in order to prepare them for life after school.

Discussion

The results of this study show a variety of assistive technology services are available to students with visual impairments, hearing impairments, and physical disabilities at the University of North Texas from both an adaptive computer lab and the ODA. Technology is most often offered to and utilized by students with visual impairments because most of the devices and accompanying services are too expensive or impractical to be owned by the student themselves. Among this population, there is a large range of vision impairments, each category of which requires a different level of support. Fewer services are offered to students with physical disabilities. The majority of assistive technology devices used by students with physical disabilities, such as wheelchairs, fall under personal care, which students can acquire on their own. Personal care items are not considered academic accommodations, and therefore the ODA is not required by law to provide them.

Students with hearing impairments have fewer assistive technology devices available to them. Aside from personal hearing aids and FM systems, very little can be done for these students through actual technology devices. If a person has profound hearing loss, no amount of technology can replace the loss of hearing ability. FM loops send the instructor's voice directly to the students' hearing aids, which requires a certain amount of hearing ability in order for the

hearing aids to be effective. Although not technically a technology service, the ODA will arrange for note takers and sign language interpreters as needed and requested by students.

Students use a variety of voice recognition software, including Dragon Naturally Speaking, screen readers, screen magnifiers, and FM loops. As mentioned earlier, students with hearing impairments use FM loops most often. It is the only technology offered by the office for those students because it is the only way to transmit the professors' voice to students' hearing aids. (Devices are also available in the market for students with cochlear implants to hear only the professor, as well as a FM loop system that transmits directly to their implant [Kleineck, 2007]). As cochlear implants are a relatively new technology for the hearing impaired and the effectiveness of various systems in the classroom is currently under research, the ODA does not currently offer these versions of FM systems for student use. The hearing impaired, however, can expect to see this technology more readily available in upcoming years.

The main obstacle for students with physical disabilities to overcome when completing course activities is typing. Although the ODA does offer adaptive keyboards with different shapes and arrangements of keys into different numbers of groups on the board itself, fine motor control is often a major obstacle for students with physical disabilities, which can make the use of any keyboard a daunting task. Therefore, it is not a surprise that voice recognition systems, which allow a student to speak into a microphone sending his or her words through the computer software for transcription to a screen, are the most used devices for this population of students. With proper training in programming the device to recognize the individual student's voice, the software is highly accurate and effective. For completing academic tasks, from writing papers to researching on the Internet, voice recognition systems prove invaluable toward enhancing

students' independence. Students with visual impairments can also use this software to transcribe their words into a written document.

For students with visual impairments, the most popular devices are those that read computer screens aloud or simply magnify the screen or printed document. The majority of collegiate work demands the ability to read and write for evaluation purposes. Textbooks present major problems for the visually impaired, as textbooks are integral to success in college classes. Devices that make text accessible to students are very popular and necessary for students with visual impairments. As few students at UNT read Braille, devices that convert printed text into audio files, and their subsequent audio players, such as the DAISY player for the playing of audio textbooks, replace textbooks and allow these students to have the same resources as their peers with sight.

Recently, the underutilization of Braille, stemming from a lack of Braille education in schools, leaves many students with visual impairments relying solely on audio tapes of books in order to obtain information from print. This sole reliance on audio, however, is expected to reverse in upcoming years, as acts of legislation require students with disabilities to be placed in their least restrictive environment. For many students who are visually impaired, the least restrictive environment available would be in a general education classroom. In such a setting, the students would be expected to complete all the same tasks as their classmates with a few adaptations. In order for visually impaired students to have their own textbooks and be able to read them, more students are learning Braille, therefore increasing Braille literacy rate in students with visual impairments entering university in the coming years. The ability to read Braille would greatly increase students' independence, as document conversion requires 8 hours for a 500-page book, as well as someone to manually format and place text behind images for

programs to be able to describe those images. Document conversion also destroys the book, making it unsuitable to sell back to a bookstore. Textbooks, however, are available in Braille, and with the use of a screen reader and Brailling programs, a student can print directly from the computer into a format that he or she can read. The transition to using Braille, therefore, is in the student's best interest. The ODA and adaptive computer lab anticipate an increase in use of Braille services and intend to increase current Braille services to ensure students entering UNT in upcoming years receive the aid they require.

Students, especially those with preexisting disabilities, enter postsecondary school with a strong sense of independence and adequate training in the use of assistive technology devices. Most students with disabilities have already had assistive technology evaluations in secondary school or earlier, which confirms findings in Chang et al. (2006) that assistive technology evaluations were the least offered accommodation service offered by postsecondary schools. As a result, students rarely need training services from the ODA. When training services are required, the ODA will connect the student with organizations that will train the student in the use of devices. The ODA is not required by legislation to provide training services to students; they need only to make sure that accommodations, including technology, are available when requested. Training would require additional personnel and resources, as it is a very lengthy process to ensure full proficiency on a major device, like Jaws or Dragon Naturally Speaking. Ideally, a student would need to undergo training for a minimum of an entire semester, but under ADA rules, the accommodation cannot cause undue hardship to the university. Therefore, although the ODA itself does not provide major training, it does fulfill its ADA requirements by aiding students in reaching organizations that will help train them on devices. The office will also help with troubleshooting software programs during office hours and are available for

questions concerning unfamiliar devices. Proficiency on one of these devices does not require lengthy training on the program, but merely a brief orientation on operating the small device, or adjusting the device preferences.

The assistive technology program and services at UNT are considered effective because students have not complained of a lack of services, and the program received a large sum of money a year ago for the purchase of new devices. Professionals in the office consistently research new devices, updated versions to existing software and devices, as well as consider suggestions from students to provide effective and current services. A large amount of time, resources, and money is used to ensure the current program is up-to-date with current technology and accurate and reliable devices that meet the needs of students. The only area of questionable effectiveness of the ODA is the underutilization of particular devices and services by students. Students who do need and make use of its services, however, have a wide range of devices for use in the office or classroom, as well as a commitment by the professionals of the office to provide aid for any service a student may need.

In recent years, students have increased independence in attaining accommodations and devices they require; however, student responsibility is still considered an issue. Participants mentioned seeing students on campus who do not receive services from them, but obviously would be part of their clientele if the students came to the office. Three explanations for this exist. First, students do not require the help of the office because they already own technology devices needed and require no other accommodations. Second, students find it difficult to reach the office and computer lab. Third, students often rely on parents or guardians for help in acquiring the items needed. This third circumstance can create problems for the student at the university level and place them at a disadvantage when they become responsible for obtaining

services themselves. Without past experience, students may not know how be independent. All students undergo a transition when entering postsecondary education and living away from parents or guardians for the first time, but the process can be much more of a challenge for a student with a disability who does not know how to be a self-advocate.

Suggestions for improving the current program varied. A common theme expressed was increasing responsibility of students with disabilities on campus. Professionals in this study suggested creating programs to teach students how to be self-advocates and encourage independence in the academic world and in the workforce. A similar program for junior high and high school students with disabilities was suggested to provide more exposure to common devices found at upper-level learning institutions. These are all ways students can be empowered to be self-sufficient, which will help them in the workforce, where office services will not be made available to them.

Increased accessibility was also suggested, such as changing the location of the computer lab and the ODA so that students will be able to access the offices more easily, especially those with mobility challenges. When a location with services is easier to reach, more students are likely to use the services, whereas students will not bother to do so if it is difficult to reach the offices. Above all, students must take the initiative to find devices and services themselves in order to receive them, which confirms the main suggestion for improvement and encouragement for independence of students.

Previous studies suggested continuing research on effectiveness of assistive technology and accommodations for students with disabilities. In order to expand the research base and improve current studies, including institutions that are not AHEAD members would be prudent, as AHEAD members already have a commitment to provide good services to their students with

disabilities. Moreover, studies researching specific types of devices, software, and supports that are used most per disability category would provide further information concerning device use among disability categories. Such a survey would allow researchers to categorize commonly used devices and their usefulness across disability categories and determine the outstanding needs of any group in terms of access, training, and effectiveness.

Future surveys could include a wider number of institutions. Also, a study analyzing the ability of universities to service specific disabilities and the type of student they are best equipped to service would be useful. As cost appears to be a main limiting factor in the quality of programs, further research into the average cost of devices and expenses of quality assistive technology programs would add to the research base on the topic of assistive technology. In addition, a study that surveyed students' use of assistive technology would be useful to the research base, because all studies only surveyed professionals within disability accommodation offices. Surveying students would provide not only a different viewpoint, but additional information on their situation as people who depend on the devices for success.

Conclusion

In conclusion, the participants in the study from the University of North Texas ODA have described the assistive technology program for students with visual impairments, hearing impairments, and physical disabilities at UNT as current and effective. The program has recently grown due to the support of university administrators and a recent infusion of funds to purchase new assistive technology devices. A number of barriers to the use of services were noted, in addition to an underutilization of assistive technology. Questions were raised concerning students' training prior to arrival at UNT. Students have become more involved in self-advocacy and more independent than they were previously. The participants' suggestions centered

primarily on location of offices and continuing encouragement of students to be as independent

as possible. The implications of the study suggest the possibility of an increase in Braille use in

upcoming years by new university students, the need for funding if a university is to have a

strong assistive technology program, and a need to encourage students with disabilities to be

independent and self-advocating in obtaining the accommodations they need, including complete

independent use of assistive technology and acquisition of any necessary training on devices.

Table 1.1. Adaptive Computer Lab Devices for Students with Visual Impairments

Visual Impairments	
Device	**Function**
Screen Magnifier	Makes text on a computer screen larger and easier to read
Screen Reader	Reads aloud text on the computer screen, such as Word documents and Web pages
Tiger Embosser	Works like a printer, only prints words in Braille and can print raised and shaded graphs and diagrams
Epson Perfection 1250 Scanner	Allows students to scan in documents to have a screen magnifier enlarge it on the screen, a screen reader read the document, or have it printed in Braille
ProBraille Embosser	Functions just as a Tiger Embosser, but can also print out a text version of the same document at the same time
Headphones	Allows the student to listen to audio reading without disturbing others in the lab and also helps the student block out other noises and concentrate on the audio itself

Table 1.2. Adaptive Computer Lab Devices for Students with Hearing Impairments

Hearing Impairments	
Device	Function
Sorenson Videophone	Allows students to have a conversation in sign language through a video camera and television monitor

Table 1.3. Adaptive Computer Lab Devices for Students with Physical Disabilities

Physical Disabilities	
Device	Function
Hand Cranks	Allows for customization of the computer lab work stations to the specifications of a student to make it easier for them to reach the computer accessories

Table 2. Adaptive Computer Lab Software

Software	Function
Jaws 8.0	Reads text off of the computer screen and aids in computer system navigation
MAGic 10.0	Magnifies text on a computer screen and is compatible and often used with Jaws
ZoomText 8.0	Magnifies text on a computer screen and also reads the text with the same program
Dragon Naturally Speaking	A voice recognition system that allows students to speak into a microphone and have their words appear on the computer screen as text
Scientific Notebook/Mathtalk 5.5	Uses voice commands from Dragon Naturally Speaking to create graphics and solve mathematical equations
Duxburry Braille Translator 10.5	Translates and formats text documents into accurate Braille for printing
Tiger Viewer/Embosser	Associated program for translating text into Braille for the Tiger Embosser
Focus Braille Display Software	Similar to a keyboard but with keys that allow for typing in Braille, and attaches to a computer so the student can type in Braille, and navigate a computer, compatible and used with Jaws

Table 3.1. Office of Disability Accommodation Devices and Software for Students with Visual Impairments

Visual Impairments	
Device/Software	Function
Tiger Embosser	Works like a printer, only prints words in Braille and can print raised and shaded graphs and diagrams
Closed Circuit TV	Allows document magnification from a moveable scanning bed onto a monitor screen
Daisy Players	Plays special Daisy-formatted disks containing audio versions of books, allows for skipping to certain chapters or pages of the book, available only through the Recording for the Blind and Dyslexic
Jaws	Reads text off of the computer screen and aids in computer system navigation
Opal Reader	Portable text magnifier about the size of a small digital camera that magnifies text electronically and allows for a change of color scheme of the image
Document Conversion	Scans books and other documents and converts the jpeg files into audio files, requires a person to convert the files and place text behind any images in the document
Flat Bed Scanner	Allows students to scan in documents to have a screen magnifier enlarge it on the screen, a screen reader read the document, or have it printed in Braille
Eclipse Magnifier	LCD unit with a camera and monitor that is portable and allows for color scheme changes, a type of closed circuit TV
TV Magnifier	Magnifies paper documents on a moveable bed onto a computer screen up to 1,000-point font, type of closed circuit TV
Brailling in three languages	English, French, and Spanish currently; Japanese to be added for 2008

Table 3.2. Office of Disability Accommodation Devices for Students with Hearing Impairments

Hearing Impairments	
Device	**Function**
FM Loop System	Requires the professor to wear a small microphone, and sends the professor's voice directly to the hearing aid of the student

Table 3.3. Office of Disability Accommodation Devices for Students with Physical Disabilities

Physical Disabilities	
Device	Function
Padded Furniture	Alleviates discomfort for students who are unable to sit in the regular desks of the lecture halls and classrooms
Dragon Naturally Speaking	A voice recognition system that allows students to speak into a microphone and have their words appear on the computer screen as text, aids in computer system navigation
Adapted Computer Keyboards	"Qwerty" keyboards with different separation of keys and shapes of the board to help students to reach keys easier

References

Assistive Technology Act of 1998, Pub.L.No. 105-394, S.2432, § 2, Retrieved April 18, 2007, from http://www.section508.gov/docs/AT1998.html.

Burgstahler, S. (2005). The role of technology is preparing for college and careers. In Getzel, E.E., & Wehman, P. (Eds.), *Going to college: Expanding opportunities for people with disabilities* (pp. 179–198). Baltimore, Maryland: Paul H. Brookes Publishing Co.

Carlson, D., & Ehrlich, N. (2005). *Assistive technology and information technology use and need by persons with disabilities in the United States*. Retrieved May 2, 2007, from https://www.ed.gov/rschstat/research/pubs/at-use/index.html?exp=3.

Carlson, D., Ehrlich, N., Berland, B.J., & Bailey, N. (2001). *Assistive technology survey results: Continued benefits and needs reported by Americans with disabilities*. Retrieved May 2, 2007, from http://www.itemcoalition.org/press/AT_use.html.

Chang, C., Jackson, D., Picklesimer, T., Roberts, K.D., & Stodden, R.A. (2006). An analysis of assistive technology supports and services offered in postsecondary educational institutions [electronic version]. *Journal of Vocational Rehabilitation, 24,* 111–120.

Gajar, A.H., Long, E.M., Merchant, D.C., & Ofiesh, N.S. (2002). Service delivery for postsecondary students with disabilities: A survey of assistive technology use across disabilities. *College Student Journal, 36*(1)*,* 94–109.

Holliday, A. (2002). *Doing and writing qualitative research*. Thousand Oaks, California: SAGE Publications.

Jackson, K., Michaels, C.A., Morabito, S.M., & Prezant, F.P. (2002). Assistive and instructional technology for college students with disabilities: A national snapshot of postsecondary service providers [electronic version]. *Journal of Special Education, 17*(1)*,* 5–14.

Kleineck, M.P. (2007, April). *Can you hear me now? Benefits of frequency-modulated (FM) systems for adults and children using cochlear implants: A meta-analytic approach*. Paper presented at the meeting of the Great Plains Honors Council, Oklahoma City, OK.

Lance, G.D. (1996). Computer access in higher education: A national survey of services providers for students with disabilities. *Journal of College Student Development, 37,* 279–288.

Membership (2007). Retrieved April 29, 2007, from http://www.ahead.org/membership/index.htm.

Mendelsohn, S., & Fox, H.P. (2002). Evolving legislation and public policy related to disability and assistive technology. In M.J. Scherer (Ed.), *Assistive technology matching device and*

consumer for successful rehabilitation (pp. 17–28). Washington, DC: American Psychological Association.

Reilly V.J., & Davis, T. (2005). Understanding the regulatory environment. In Getzel, E.E., & Wehman, P. (Eds.), *Going to college: Expanding opportunities for people with disabilities* (pp. 25–46). Baltimore, Maryland: Paul H. Brookes Publishing Co.

Sharpe, M.N., & Johnson, D.R. (2001). A 20/20 analysis of postsecondary support characteristics [electronic version]. *Journal of Vocational Rehabilitation, (16),* 169–177.

Scherer, M.J. (2002). Introduction. In M.J. Scherer (Ed.), *Assistive technology matching device and consumer for successful rehabilitation* (pp. 3–13). Washington, DC: American Psychological Association.

U.S. Department of Education, National Center for Education Statistics. (2005). *National postsecondary student aid study*. Retrieved April 18 2007, from http://nces.ed.gov/quicktables/ result.asp?access=p&filter=0&getfields=qttitle.qtstatcat.qtsource.qtyear&output=xml_no _dtd&site=nces&ie=UTF8&client=quicktables&q=disability&requiredfields=keywords %3Aquicktable&start=0.

U.S. Department of Education, Office of Civil Rights. (2007). *Students with disabilities preparing for postsecondary education: Know your rights and responsibilities*. [Brochure] Washington, DC: Author.

Wehman, P., & Yasuda, S. (2005). The need and the challenges associated with going to college. In Getzel, E.E., & Wehman, P. (Eds.), *Going to college: Expanding opportunities for people with disabilities* (pp. 3–23). Baltimore, Maryland: Paul H. Brookes Publishing Co.