Assistive Technology Use by Students with Disabilities at UNT

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Abstract

The 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. Interviews involved topics such as frequently used devices, services of the Office 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 examines the student perspective on the postsecondary institution assistive technology program.
Introduction

People with disabilities are no longer shunted into institutions for the rest of their lives, as has happened in the past. Today, they are active and successful members of society in the workplace and schools. More students with disabilities are pursuing postsecondary education in order to have the chance of a better job than before. 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 disabilities included 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, which are now the third most reported disability, at 16% of students with disabilities in 2000 (Wehman & Yasuda, 2005). However, 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, for communication, personal care, such as a grip on a fork, 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 in the market to people with disabilities. In the United States, 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 as it prohibits discrimination against people with disabilities by employers, public services of state and local governments, and private groups who provide public accommodations, such as businesses or stores. In addition, it requires these groups to make reasonable accommodations for people with disabilities without causing unnecessary hardship to the organization. Title III, which requires wheelchair ramps and other accessibility accommodations, is perhaps the most famous title of ADA; however, Title II, which applies to postsecondary education as well, states that "all public services and programs must be equally accessible to people with or without disabilities" (Mendelsohn & Fox, 2005, p. 22). Therefore, according to
the Rehabilitation Act, if the school receives money from the government, the school cannot
deny a student with a disability admission if the student is otherwise qualified and, according to
Title II of ADA, must also 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.

However, while subject to both the Rehabilitation Act and ADA, disability
accommodations, such as assistive technology, differ from secondary schools to postsecondary
institutions, since the Individuals with Disabilities Education Act of 1997 (IDEA), which ensures
all children a free and appropriate education based on their individual needs is not applicable at
the postsecondary level (Reilly & Davis, 2005). IDEA mirrors the Rehabilitation Act in many
aspects in regard to ensuring children are not discriminated against the best placement, also
known as the least restrictive environment; 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 and vice versa. As a result, students with disabilities
entering postsecondary education must actively search out any accommodations they require in
order to be successful in the classroom, since with IDEA, the services are readily available to
them without their specific request. Under ADA and the Rehabilitation Act, these services are
required to be available to them, but only when the students ask for the accommodations.

In 1998, President Clinton signed an act known as the Assistive Technology Act of 1998,
which established the importance of technology in improving the lives of people with disabilities
(Mendelsohn & Fox, 2005). The act started device loan programs, as well as a grant program to
states to educate the public about assistive technology and programs for training people on the
devices. It also set out to train professionals who work with people with disabilities on how to
use assistive technology, such as care providers, therapists, technology experts, and employers, and to set up 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 and allocated more funds to states for their device programs, meaning states use a majority of federal funds to directly help individuals with disabilities obtain technology (Carlson & Ehrlich, 2005).

Yet, despite the legislation and governmental aid for cost, training, and education that are beginning to take place, assistive technology is 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 leads to the devices not being secured for and used by their students. Funding for devices is most often available for students in kindergarten to twelfth grade; however, once the student graduates, the funding may not follow, and this fact, combined 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 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 regard to the 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) for students with disabilities receiving services through the Office of Disability Accommodation (ODA). Structured interviews with staff of the UNT Office of Disability Accommodation were done about 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 had in the use of assistive technology devices prior to their enrollment.

**Literature Reviewed**

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 base with 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, & Stodden (2006) mailed surveys to 1,600 universities asking 23 questions about 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 such individuals. The surveys specifically asked about 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. The answers to the questions were based on a scale from 0-4, and the surveys were sent out twice with two years between the surveys.

Chang, et al., (2006) found the least offered service was assistive technology evaluations, consistently rating as "not offered" both times, at 58.5% and 57.2% not offered. first
survey and second survey respectively. The next least offered accommodation was equipment and software being provided to the students by the university at 34.6% and 28.7% not offered, first and second survey respectively. Adaptive furniture was offered the most often, at 22.9% and 15.9%, first and second survey respectively. All universities improved in the offering of all services between their first and second surveys, though the general comparison of the accommodations remained the same, excepting campus wide assistive technology support which was offered the most during the second survey rather than the adaptive furniture. The study indicated that assistive technology services were offered at a low to medium frequency at the institutions in both mailings of the surveys; however, every institution offered services in every category at some level and was improving in the quality of their services to their students. Chang, et al., (2006) also suggested that the data showed a “minimalist approach” by universities to accommodations as well as a lack of funding for services.

Gajar, Long, Merchant, & 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). The surveys were mailed out twice and asked questions that asked respondents to identify devices used at their institution, as well as the type of disabilities of the 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 showed students use the most available devices the most often, and the most popular devices used are voice recognition software, reading machines, FM systems, and text enlargement. Voice recognition was also often used
Assistive Technology Use

across disabilities, followed by reading machines. If another group used a device, it was commonly the students with learning disabilities and students with other health impairments.

A study conducted by Jackson, Michaels, Morabito, & Prezant (2002) discovered new information about the amount of awareness of assistive technology by disability accommodation staff and the faculty of the institution, any barriers or issues with assistive technology delivery, training and access across campuses, its integration in class instruction and coursework, and the ability of campus departments to obtain technology, as well as frequency of technology use and its effectiveness. Jackson, et al., (2002) mailed two surveys to 1,500 members of AHEAD and asked that only professionals involved with postsecondary education respond. Through demographic information, they found that the typical disability accommodation office had 6 staff members and served about 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 that the most likely limiting factor was the cost of buying the equipment and then upgrading it as needed. The factor with the most helpful impact on provision was the knowledge of the staff members, more 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 found to be recorded textbooks, real-time captioning, screen magnification, specialized tape recorders, and screen readers, although all devices were listed as useful. The least available devices were those used for one groups of student specifically, in this case, those with visual impairments. Jackson, et al., (2002) felt the
data from this study supports a need for offices to have training in devices, monetary support from administration, and the ability to support the students by offering assistive technology training to them as well.

Sharpe & 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, which 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 & Johnson (2001) examined the data compiled for the upper and lower 20\textsuperscript{th} percentiles of the institutions and compared the information gathered.

Sharpe & 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, as 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, especially with the accommodations being offered at the institution more than 75\% of the time. For both institution capacities, testing accommodations were offered the most often, followed by counseling, advocacy services, and notetakers and readers. This is the first part 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. Since the studies were conducted through mailed surveys, this study intends to hold structured interviews with the faculty of the Office of Disability Accommodation of UNT in order to gather more in depth information than surveys.

Method

A qualitative method was chosen to conduct 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 with the topic of questioning, which provides deeper answers and varying personal perspectives than a survey that requires choosing one of several pre-written answers and gives no room for explanations, personal insights, or experiences. As the personal opinions of professionals about assistive technology is important in providing a picture of the assistive technology services and use of devices on the UNT campus, a qualitative approach was chosen over a more quantitative one.

Participants

Participants for this study were four professionals from the Office of Disability Accommodation at the University of North Texas with experience who have assistive technology and students with disabilities on campus. They were recruited through inquiries at the Office of
Disability Accommodation 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 sixty minutes. The questions dealt with topics concerning assistive technology use by students with hearing impairments, visual impairments, and physical disabilities, such as types of technology used most commonly at UNT, services offered to the students in way of assistive technology by the Office of Disability Accommodation, the ability of the students to use their technology independently without the help of a specialist, and the quality of their technology training prior to entering UNT. Furthermore, the professional opinions of the participants on how to better improve assistive technology services and training for students with these disabilities were compiled. The interview questions were developed with the specific intent of obtaining reasons and explanations behind the actions of the ODA, so as to attain a complete picture of assistive technology on campus.

All the interviews were completed in person. Participants’ answers were transferred to typewritten transcripts of each interview, and each question was examined to find the main categories addressed. Similar main topics from each question across the interviews were grouped together to identify common themes and similar responses within the answers.

Results

Device offerings and use

Two locations on the UNT campus were found to offer assistive technology to students: the Office of Disability Accommodation itself and an adaptive computer lab, located in one of
the general access labs on campus. A great variety of devices and software is available to students for use in these locations and for checking out for a semester.

In the adaptive computer lab, there is a combination of machine equipment and computer programs for students to 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 the station to suit their needs. The lab also boasts 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 have a long-distance sign language conversation.

Also in the lab is 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, Duxbury Braille Translator 10.5, Tiger Viewer/Embosser, and Focus Braille Display Software. In other computer labs on campus, some computers are equipped with screen readers and magnifiers, and some tables have hand cranks. Table 2 explains the functions of each software program.

While the Office of Disability Accommodation considers itself a consultant on accommodations for students and administrators with a goal to ensure that students with disabilities are not at a disadvantage in the classroom and are given the aid they need for academic success, rather than a primary source of technology, they do have several services available with technology for students. Some of the technology is only for use in their testing rooms, such as closed circuit televisions and flat bed scanners. They also have a Tiger Embosser in the office and will provide Braille for students in English, French, and Spanish; starting next year, Braille will also be available in Japanese. For students with visual impairments, document
conversion for textbooks is provided, where students bring in their textbooks, and two graduate assistants scan the pages and convert the 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 who are unable to sit in the chairs and desks of the 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 emails, reading textbooks, and completing work in class. The main obstacles within these 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 the 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 the most often, especially for writing papers. Students with visual impairments use assistive technology the most often, with the most common devices in use 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 also used often for students with visual impairments; however, Brailling services are used the least, as many students no longer read Braille, a trend on the reverse. The only change in student needs over the course of their postsecondary education careers is their desire to have the latest devices and newest versions of software, which they use for the same activities.
**Effectiveness of services**

Overall, all participants felt that the assistive technology services on campus meet the needs of the students, since UNT recently spent a large amount of money securing new equipment and the latest edition of many software programs. Also, the ODA spends time carefully researching new technology, such as when a student requests a device he or she used in secondary school, or as new devices and versions of programs enter the marketplace. However, they tend to lean towards using the basic versions of software until an upgrade is absolutely necessary. The only concern mentioned is the lack of utilization by the students themselves, since many students have their own equipment. As a result, the students that come to them the most often are those who are either not as comfortable with the technology, do not have that specific piece of equipment themselves, or are international students who can use the technology, but are unable to receive aid in having their own equipment without U.S. citizenship. UNT’s assistive technology program was mentioned as the premier program in the north Texas area and as being at the same level as the larger schools in Texas, such as the University of Texas and Texas A&M, after whose programs the UNT program was fashioned.

**Training and Independence**

Most participants indicated that students came to UNT with adequate training in the use of the assistive technology they require, especially if the student had a pre-existing and long term disability. It was noted as extremely rare for such a student to not have training on devices prior to entry in a postsecondary institution. In the adaptive computer lab, student workers are trained on the devices and programs and are therefore able to help students having trouble with a program. However, the lab and the ODA do not provide training directly out of their offices on devices under continual use by the students. They are available for help such as troubleshooting
or solving minor problems revolving around a new device that the student has never used before, but, for items such as Dragon Naturally Speaking or Jaws screen reader that a student will use constantly at the university and in the workforce, they will help the student reach professionals who do offer training services, most often the Texas Department of Assistive and Rehabilitative Services (DARS), which is based out of Austin, Texas, and will very often perform training for free. In order to be able to completely master the program and use it efficiently, training often requires an intensive summer or an entire semester, which students may often be unable or unwilling to do, 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 as soon as possible. Also, the manufacturer of the device will at times perform installment and training services themselves.

Improvement Suggestions

While participants felt overall that assistive technology provided through the Office of Disability Accommodation and in the adaptive computer lab are effective and satisfactory toward meeting the needs of students, all noted that there is always room for improvement to make their services more accessible to students, as well as to help students utilize their offices.

For example, one suggestion was to move the adaptive computer lab, as well as the Office of Disability Accommodation, 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 difficult to find, and, with the arrangement of the library, difficult for someone with physical or visual impairments to be able to maneuver through the walkways and past the obstacles. Participants noted that previous surveys of students by the Office of Disability Accommodation implied that the location of the computer lab is the main obstacle to students using the lab. Also, the Office of Disability Accommodation itself is
located on the third floor of the University Union in a corner office on a side hallway. While 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.

Another area of difficulty for students that can be alleviated is when students encounter problems with their assistive technology software. If a student encounters problems with a Windows program, troubleshooting services are available on campus by student workers in the computer labs. However, for a student with a disability with a computer program for assistive technology, that option is not available. If something happens with a program, such as Jaws or Dragon Naturally Speaking, and it is after office hours for the Office of Disability Accommodation, the student must call the program manufacturer for help. In the adaptive computer lab, student workers are trained to use its devices, and several employees have taken personal interests in learning about the various programs and devices in use. The Office of Disability Accommodation intends to creating ongoing training programs for student workers in all the computer labs on campus for the various assistive technology software in order to allow the student workers to troubleshoot the programs, therefore improving the technology services to the students with disabilities. Additionally, personnel in the IT department on campus have also taken personal interests in increasing student worker training on the 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 Office of Disability Accommodation and checked for accessibility, but people sometimes forget the rule or are not aware of it. 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 if they utilize a screen reader.

While most participants felt overall that students do come to UNT with adequate training in the use of the assistive technology devices they would be using for their academic work, some participants felt that it would be helpful to incoming students to have a program in place for junior high and high school students during the summer for training on the technology found at most postsecondary institutions. Since there are students who enter UNT with no training on the technology, as well as students who were never given an opportunity to use technology, a program during the summer that exposes students to the technology and trains them on its use would be helpful in transitions between secondary and postsecondary institutions, since it is hoped that students would return to their schools and demand the technology there, enabling them to have more years of experience on the devices.

Interestingly, the most commonly offered suggestion by participants dealt not with the university or services offered, but with the students who use the services of the ODA. All participants mentioned a need for students to take the initiative to be more independent in pursuing technology, technology training, and their desires for academic success, especially since 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 from offices like the Office of Disability Accommodation as they do at universities. Also, more self-advocacy is needed by the students, who in high schools became accustomed to legislation that allowed all the teachers to know beforehand the accommodations needed for each student. Such legislation does not exist at postsecondary institutions, so students need to be proactive in ensuring they receive any help they need. While many students are very good about self-advocacy and
independence in using their technology, a fair number still enter postsecondary education with no self-advocacy experience and little independence; therefore, the participants 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 that a variety of assistive technology services is 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 Office of Disability Accommodation. Technology is most often offered to and utilized by students with visual impairments, most likely because many of the devices and accompanying services, such as a Braille or document conversion services, are too expensive or impractical to be owned by the student themselves, and amongst this population, there is a very large range of vision, each category of which requires a different level of support. Less is offered to students with physical disabilities, since the majority of assistive technology they use, such as wheelchairs, falls under personal care, which the students acquire on their own. As personal care items are not considered academic accommodations, the Office of Disability Accommodation is not required by any law to provide them.

Students with hearing impairments have the least offered to them in ways of assistive technology since aside from personal hearing aids and FM systems, very little can be done for these students in ways of 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 in the first place. While not technically a technology
service, the Office of Disability Accommodation will arrange for note takers and sign language interpreters as needed and requested by students.

Students, depending on their disability, use voice recognition software, such as Dragon Naturally Speaking, screen readers, such as Jaws, screen magnifiers, and FM loops the most often, a finding that matches the findings of Gajar, et al., (2002). This stands to reason, especially when examining which students use which devices. As mentioned above regarding students with hearing impairments, FM loops are the most commonly used device and the only technology offered by the office for those students, since their main obstacle in the classroom is the actual hearing of the professor and lectures, and it is the only way to transmit the professors’ voice to the 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). However, as cochlear implants are relatively new technology for the Deaf and the effectiveness of various systems in the classroom is currently under research, the Office of Disability Accommodation does not currently have these versions of FM systems in their office for student use, though one may expect in the upcoming years that this technology will be found more commonly in use.

The main obstacle for students with physical disabilities to overcome in terms of completing activities for their courses at UNT is typing. While the Office of Disability Accommodation 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 large 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 the student to speak into a microphone that sends his or her words through the computer software and transcribes
them on the screen, are the most used devices for this population of students. Once time has been taken to train the program to recognize the individual student’s voice, the software is highly accurate and effective. For completing academic tasks, such as writing papers, and even everyday tasks, like writing emails and using the Internet and computers in general, voice recognition systems prove invaluable towards enhancing these students’ independence. Another implication of this software is that students with visual impairments can use it to get their words onto the computer, and then use a screen reader to read what they wrote.

For students with visual impairments, the most popular devices are those that will read computer screens aloud or simply magnify the screen or a printed document. The majority of collegiate work demands the ability to read and write for evaluation purposes, such as exams, projects, presentations, and writing papers. Textbooks present a large problem for this population of students, since textbooks are integral to success in college classes, so devices that make the text accessible to students would be very popular and necessary for students with visual impairments. Since currently very few students at UNT read Braille, the devices that turn printed text into audio files, such as document conversion, which is both costly and time consuming, and the subsequent audio players, such as the DAISY player for the playing of the audio textbooks, replace the textbooks and allow these students to have the same resources as their peers with sight.

In regard to Braille, the underutilization of Braille services results from the fact that for many years, Braille was not being taught in schools, leaving students with visual impairments to rely on audio tapes of books and student readers in order to obtain information in print. However, this trend is expected to reverse in the upcoming years due to acts of legislation which require students with disabilities to be placed in their least restrictive environment. For many students
who are visually impaired, this placement 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 these students to have their own textbooks and be able to read them, more students are learning Braille, therefore increasing the Braille literacy rate in students with visual impairments who will be entering the university in the coming years. The ability to read Braille would greatly increase students' independence in their learning, since document conversion requires eight hours for a 500 page book and a person to manually format and place text behind images for programs to be able to describe the 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 off the computer into a format that he or she can read. Therefore, the transition to using Braille more often is in the student’s best interests. The Office of Disability Accommodation and adaptive computer lab anticipate an increase in use of their Braille services and intend on ensuring that those students entering UNT in the next few years receive the aid they require by increasing their Braille services.

Students, especially those with pre-existing disabilities, come to postsecondary school with a strong sense of independence and a decent amount of training in the use of assistive technology devices. Students have already had assistive technology evaluations in secondary school or earlier, which explains the 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 of the Office of Disability Accommodation; however, in the case that training services are required, the ODA will connect the student with organizations that will train the student in the use of devices. The Office of Disability
Accommodation 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, since 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 an entire semester at the very least, and under ADA rules, the accommodation cannot cause undue hardship. Therefore, even though the ODA itself does not provide major training, most likely due to the fact that it would cost a large amount of money and resources or undue hardship, it does fulfill its ADA requirements by aiding students in reaching organizations who will help train them on devices. The Office will also help with troubleshooting software programs during their office hours and are available for questions students may have about a minor device they have never used before, such as how to use one of the DAISY players or the Opal reader. Proficiency on one of these devices does not require lengthy training on the program, but merely a brief orientation of how to work the small device, unlike the software programs, which require training to the student's voice, as with Dragon Naturally Speaking, or adjusting the reading voice on Jaws to the preference of the student.

The assistive technology program and services at UNT are considered effective since students have not complained of a lack of services, and the program received a large amount of money a year ago for the purchase of new devices. Professionals in the Office consistently research new devices and the latest versions of devices and software they already own as well as any suggestions brought in by the students themselves, in order to be able to provide strong and current services to students. A large amount of time, resources, and money is used to ensure that the current program is up-to-date with current technology and accurate and reliable devices that meet the needs of the students. The only issue revolving around the effectiveness of the program
is the underutilization by the students; however, for the students who do need and make use of its services, there is a wide range of devices to choose from for use in the Office or in the classroom, as well as a commitment by the professionals of the Office to provide aid for any service a student may need, be it contacting training services, evaluation services, or the possibility of using a different device than what the Office offers.

Students of recent years have increased in their independence towards attaining the 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 since they already have the technology devices they need and require no other accommodations; second, students find it difficult to reach the Office and computer lab; third, students often rely on their parents or guardians for help in acquiring the items they need. 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 the services themselves. Without past experience, they may not know how to go about being independent. All students undergo a transition along these lines when they enter postsecondary education and live away from their parents or guardians for the first time, but for most students, the transition will not potentially damage their chances at academic success as much as it can for a student with a disability who does not know how to be a self-advocate.

Suggestions for improving the current program varied; however, the common theme among most of them was placing more responsibility and power in the hands of the students with disabilities on campus. Professionals suggested creating programs to teach students how to be
self-advocates and encourage their independence in the academic world, which will then carry on into the workforce as they graduate. Also, a similar program for junior high and high school students with disabilities was suggested in order to provide more exposure to the common devices found at upper level learning institutions and to encourage students to return to their schools after the sessions and demand the devices for themselves. In these ways, students would 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 Office of Disability Accommodation to where students will be able to reach the offices easier, especially those with mobility challenges. When a location with services is easier to reach, more students are likely to search out the services, whereas students will not bother to do so if they know it is difficult to reach the offices. But once again, students must take the initiative to find the devices and services themselves in order to receive them, which ties back into the main suggestion for improvement, that of encouragement for independence of the students.

All the previous studies suggested continuing research on the effectiveness of assistive technology and accommodations for students with disabilities. In order to expand the research base and improve current studies, including institutions who 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 the most in general and per disability category would provide further information about device use amongst disability categories. Such a survey would also allow for
researchers to categorize commonly used devices and their usefulness across disability categories and determine the outstanding needs of any group in ways of access, training, and effectiveness.

Sharpe and Johnson (2001) analyzed the same percentiles of institutions, but other surveys could be done in order to attain a wider number of institutions for the sample. Also, a study that analyzed a university’s ability to service specific disabilities would also prove interesting and helpful if it searched for large discrepancies between the percentiles and the type of student they are best equipped to service. Since cost appears to be a large limiting factor in the quality of programs, further research into the area of the average cost of devices and expenses of strong assistive technology programs, as well as a student viewpoint on assistive technology at their universities, would add to the research base on the topic of assistive technology. In addition, a study that surveyed the students using the assistive technology would be useful to the research base, since all studies only surveyed professionals within disability accommodation offices. Students would provide not only a different viewpoint, but also 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 Office of Disability Accommodation 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 grown due to the support of university administrators and a recent infusion of funds to purchase of new assistive technology devices. A number of barriers to the use of services was noted, in addition to an underutilization of assistive technology. Questions were also raised about the students’ training prior to their arrival at UNT. Students have become more involved in self-advocacy and more independent in general. The participants’ suggestions
centered primarily on the location of the offices and the 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 the 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 regard to their disabilities and the accommodations they need, including complete independent use of assistive technology and the acquisition of any necessary training on devices.
Table 1.1. Adaptive Computer Lab Devices for Students with Visual Impairments

<table>
<thead>
<tr>
<th>Visual Impairments</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen Magnifier</td>
<td>Makes text on a computer screen larger and easier to read</td>
</tr>
<tr>
<td>Screen Reader</td>
<td>Reads aloud text on the computer screen, such as Word documents and web pages</td>
</tr>
<tr>
<td>Tiger Embosser</td>
<td>Works like a printer, only prints words in Braille and can print raised and shaded graphs and diagrams</td>
</tr>
<tr>
<td>Epson Perfection 1250 Scanner</td>
<td>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</td>
</tr>
<tr>
<td>ProBraille Embosser</td>
<td>Functions just as a Tiger Embosser, but can also print out a text version of the same document at the same time</td>
</tr>
<tr>
<td>Headphones</td>
<td>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</td>
</tr>
</tbody>
</table>
Table 1.2. Adaptive Computer Lab Devices for Students with Hearing Impairments

<table>
<thead>
<tr>
<th>Hearing Impairments</th>
<th>Device</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sorenson Videophone</td>
<td>Allows students to have a conversation in sign language through a video camera and television monitor</td>
</tr>
</tbody>
</table>
Table 1.3. *Adaptive Computer Lab Devices for Students with Physical Disabilities*

<table>
<thead>
<tr>
<th>Physical Disabilities</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand Cranks</td>
<td>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</td>
</tr>
</tbody>
</table>
**Table 2. Adaptive Computer Lab Software**

<table>
<thead>
<tr>
<th>Software</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jaws 8.0</td>
<td>Reads text off of the computer screen and aids in computer system navigation</td>
</tr>
<tr>
<td>MAGic 10.0</td>
<td>Magnifies text on a computer screen and is compatible and often used with Jaws</td>
</tr>
<tr>
<td>ZoomText 8.0</td>
<td>Magnifies text on a computer screen and also reads the text with the same program</td>
</tr>
<tr>
<td>Dragon Naturally Speaking</td>
<td>A voice recognition system that allows students to speak into a microphone and have their words appear on the computer screen as text</td>
</tr>
<tr>
<td>Scientific Notebook/ Mathtalk 5.5</td>
<td>Uses voice commands from Dragon Naturally Speaking to create graphics and solve mathematical equations</td>
</tr>
<tr>
<td>Duxbury Braille Translator 10.5</td>
<td>Translates and formats text documents into accurate Braille for printing</td>
</tr>
<tr>
<td>Tiger Viewer/Embossor</td>
<td>Associated program for translating text into Braille for the Tiger Embosser</td>
</tr>
<tr>
<td>Focus Braille Display Software</td>
<td>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</td>
</tr>
</tbody>
</table>
Table 3.1. *Office of Disability Accommodation Devices and Software for Students with Visual Impairments*

<table>
<thead>
<tr>
<th>Device/Software</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tiger Embosser</td>
<td>Works like a printer, only prints words in Braille and can print raised and shaded graphs and diagrams</td>
</tr>
<tr>
<td>Closed Circuit TV</td>
<td>Allows document magnification from a moveable scanning bed onto a monitor screen</td>
</tr>
<tr>
<td>Daisy Players</td>
<td>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</td>
</tr>
<tr>
<td>Jaws</td>
<td>Reads text off of the computer screen and aids in computer system navigation</td>
</tr>
<tr>
<td>Opal Reader</td>
<td>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</td>
</tr>
<tr>
<td>Document Conversion</td>
<td>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</td>
</tr>
<tr>
<td>Flat Bed Scanner</td>
<td>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</td>
</tr>
<tr>
<td>Eclipse Magnifier</td>
<td>LCD unit with a camera and monitor that is portable and allows for color scheme changes, a type of closed circuit tv</td>
</tr>
<tr>
<td>TV Magnifier</td>
<td>Magnifies paper documents on a moveable bed onto a computer screen up to 1000 point font, type of closed circuit tv</td>
</tr>
<tr>
<td>Brailling in three languages</td>
<td>English, French, and Spanish currently; Japanese to be added for 2008</td>
</tr>
</tbody>
</table>
Table 3.2. *Office of Disability Accommodation Devices for Students with Hearing Impairments*

<table>
<thead>
<tr>
<th>Hearing Impairments</th>
<th>Device</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FM Loop System</td>
<td>Requires the professor to wear a small microphone, and sends the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>professor's voice directly to the hearing aid of the student</td>
</tr>
</tbody>
</table>
### Table 3.3. Office of Disability Accommodation Devices for Students with Physical Disabilities

<table>
<thead>
<tr>
<th>Physical Disabilities</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Padded Furniture</td>
<td>Alleviates discomfort for students who are unable to sit in the regular desks of the lecture halls and classrooms</td>
</tr>
<tr>
<td>Dragon Naturally Speaking</td>
<td>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</td>
</tr>
<tr>
<td>Adapted Computer Keyboards</td>
<td>&quot;Qwerty&quot; keyboards with different separation of keys and shapes of the board to help students to reach keys easier</td>
</tr>
</tbody>
</table>
Works Cited


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


