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An Instructional Manual for Implementation of Voice Recognition (VR) in Written Communication

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AN INSTRUCTIONAL MANUAL FOR

IMPLEMENTATION OF VOICE RECOGNITION (VR)

IN WRITTEN COMMUNICATION

By

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This project investigated the use of voice recognition for written communication. The literature review revealed a lack of research in using voice recognition with individuals with disabilities. An instructional manual consisting of a step-by-step process to guide students through the general training process and teaching students the additional features of the program to promote independent use of Dragon Naturally Speaking Version 5 for written communication. Field tests were completed with 3 students, two with physical disabilities and one with a learning disability.

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CHAPTER 1

FOCUS OF THE PROJECT

Introduction

The passage of the Expansion of Teaching in the Education of Mentally Retarded Children Act (1958) and the National Defense Education Act (1958) was one of the first legislative commitments which resulted in federal funding for educating children in the public schools (Yell, 1998). It was the Elementary and Secondary Education Act in 1965, which included additional federal funds for improving education for students with disabilities. In 1970, the Education of the Handicapped Act (EHA) replaced Title VI of the Elementary and Secondary Education Act of 1965, which became the basic framework for many of the legislative changes that followed (Yell, 1998). One of these changes was P.L. 94-142, Education for All Handicapped Children Act (EAHCA), which was signed into law in 1975 (Yell, 1998). The centerpiece of EAHCA asserts the right for students with disabilities to have a Free and Appropriate Public Education (FAPE) in the Least Restrictive Environment (LRE).

In 1990, P.L. 94-142, was amended and renamed the Individuals with Disabilities Education Act (IDEA) (PL 101-476). While

maintaining the integrity of PL 94-142, major changes ensued. One of the changes included replacing the term "handicapped student" to "child/student/individual with a disability" (Yell, 1998). Additional changes involved identification of students with autism and traumatic brain injury as a separate category. Another major change was the requirement to include a transition plan on every student's Individualized Education Program (IEP) by age 16 (Yell, 1998). As part of the amendment in 1990, definitions of assistive technology devices and assistive technology services were added to the IDEA (Yell, 1998). IDEA was again amended in 1997 and is currently implemented throughout the country today (Yell, 1998). The mandate to provide education to all children ages 3-21 has remained intact and has led to including children with significant physical and cognitive needs in public education. Consequently schools provide education and related services to severely involved students (e.g. transportation, school health services and assistive technology, etc.) (Yell, 1998). Related services are necessary supportive services that students require to benefit from their Individualized Education Program (IEP). Assistive technology is one type of related service which includes any device or item that can be used to

increase, maintain or improve the function of a student with a disability to participate in their educational program to ensure FAPE (Merbler, Hadadian, & Ulman, 1999)

Advances in medical technology have increased the survival rate of children who previously would not have lived and who are now in public schools (Wadsworth & Knight, 1993). Due to the availability of home care services and as medical equipment becomes more portable, children who are medically fragile are leaving the hospitals and returning to their homes and schools (Jones, Clatterbuck, Marquis, Turnbull & Moberly, 1996). These children, whose medical needs are complicated, are now commonly found in the public education system and pose enormous challenges for educators. As the physical and cognitive limitations of students' increase in severity, so does the challenge to find service personnel and instructional materials/curricula.

Typically, students who have severe physical limitations, but have little or no cognitive limitations, are placed in the general education classroom with adult assistance to address their educational needs (Wadsworth & Knight, 1993; Jones et al., 1996). One of these needs is writing. The requirement for students to produce written expression

demonstrates the level of understanding and their ideas about any subject content (McClellan-Teidt, 1989). For example, students with cerebral palsy, spinal cord injuries, and other conditions that result in an inability to use their hands may require the assistance of a classroom assistant for writing activities (a scribe). Progressive deteriorating conditions, such as muscular dystrophy, that affect strength and endurance may also impair the student's ability to keep up with written assignments, specifically their speed and quantity of writing. Besides using a scribe, there are other avenues by which a student can produce written assignments despite the inability to physically use a pen or pencil (Cavalier & Ferretti, 1996). An innovative alternative is technology. Technology in education, such as scanning and Morse code, enables students with physical disabilities and who are unable to use the traditional pen and paper or the standard keyboard to produce written expression and independently participate in their education (Cavalier & Ferretti, 1996). Independent participation in producing classroom assignments enables a student to accurately demonstrate the level of understanding in literacy and written language concepts without question

as to the level of input a scribe may have in a student's sritten work (Blavat, 1996; Icke et al., 2001).

Technology has allowed individuals with severe physical disabilities to use various switches with scanning options or Morse code to produce letters on the computer as if they are typing (Blavat, 1996). Crochetiere, Foulds, and Sterne (as cited in Blavat, 1996) claim that a skilled user would be able to type about five words per minute (wpm) using scanning. Scanning involves presenting choices to the individual one at a time and the individual selects a desired item by signaling at the proper time or activating a switch to make a selection (Blavat, 1996). Lights or cursors scan letters and symbols on an on-screen keyboard (DO-IT, 1994).

There are three types of scanning techniques used in assistive technology; automatic, step and inverse scanning (Cook & Hussey, 1995). With automatic scanning, items are presented continuously and the user can make a selection by activating a switch to stop the scan (Cook & Hussey, 1995). Step scanning requires the user to activate a switch once to move through the choices and a second switch or "acceptance times" are used to make the selection (Cook & Hussey, 1995). Inverse scanning requires the user to begin the scanning by

activating a switch, and the user must then keep the switch in the same position until the desired choice is presented (Cook & Hussey, 1995). Once the choice is highlighted or underlined, the user releases the switch to make the selection (Cook & Hussey, 1995). A student using scanning for written expression selects letters to form words from a list (letter scanning array) that appears on the computer screen (Lewis, 1993).

Morse code is an alternative access system, using one or two switches that allow a user to input a code consisting of dots and dashes (International Morse Code symbols) that represent a letter. Letters are then combined to produce words (Cook & Hussey, 1995; Lewis, 1993). For example, ._ (short-long) represents "a." Most persons are familiar with the pattern ... --- ..., the international signal for SOS. An example of using two switches for Morse code is having the user produce a dot by activating switch one and a dash by activating switch two. The combination of codes form letters, which are then joined to form words (Lewis, 1993). Unfortunately, scanning and Morse Code systems can be very fatiguing and time consuming (Blavat, 1996; Cook & Hussey, 1995). However, advancements in technology continue to improve. Physically

involved individuals are now able to communicate and record information with a new option, voice recognition technology (VRT).

It was the entertainment industry that displayed computers that to respond to voice commands made by a person (Pogue, 2000; Woods, 1999). Ever since Star Trek first aired in the 1960s, computer users have hoped that someday they could control their computer by talking to it rather than relying on keyboards and a mouse (Pogue, 2000). VRT is an application program that allows the user to control a computer by speaking to it (Goette & Marchewka, 1994; McNaughton, 1998; NCIP, 1999). Since its birth in the 1950s, VRT has continued to make major advances and improvements that include more accuracy in "understanding" human speech (Dalton & Peterson, 1997; Padilla, 1997). In the 1960s, computer manufacturers and software developers focused on VRT with the hope of providing computer access for individuals who cannot efficiently use the keyboard (McNaughton, 1998). Over the years, VRT has become easier to use, more accurate in interpreting human speech, and more affordable for the average computer user (Meisel, 1993; Padilla, 1997).

Today, VRT is widely used in business. For example, calling to find out airline flight arrival and departure times now requires the caller only to say the flight number and city rather than pressing keys on a phone pad. Another example of VRT is placing a call using a calling card or making person-to-person calls (Highland, 1997).

In an academic setting VRT enables the user to produce written work by dictating into a microphone (Cavalier & Ferretti, 1996; De La Paz, 1999; Higgins & Raskind, 1995). In these applications, the computer records the voice input, displays it on the screen, and sends the output to a printer. According to the National Center to Improve Practice in Special Education Through Technology, Media, and Materials [NCIP] (1999), the average rate for single word dictation for a typical adult ranges from 45 to 65 wpm. NCIP (1999) notes, however, that speed may be significantly less for students with disabilities. Despite the fact that speed may be less than 45 wpm for physically challenged individuals, VRT provides a significant communication improvement for a student who has to use such an alternative access for entry (Dalton & Peterson, 1997; Goette & Marchewka, 1994; Koester & Levine, 2000; NCIP, 1999; Stibbe, 2002), or for students with learning disabilities (LD) who struggle with

gettingtheir spoken ideas into print using a word processor (De La Paz, 1999; Higgins & Raskind, 1995; Kahn, 1998).

VRT have an additional benefit. They allow a student with a physical disability who has to depend on an adult to do their writing for them to become more independent in preparing written assignments (Highland, 1997; Meisel, 1993; Schmiedl, 2001). Because VRT also increases efficiency for a student who uses alternate access to produce written work, it can ultimately reduce physical fatigue and frustration (Dalton & Peterson, 1997; NCIP, 1999; Stibbe, 2002). As noted above, VRT can also increase efficiency and reduce frustration for students with learning disabilities who typically possess good oral language skills but are limited in transcribing ideas to a hard copy (De la Paz, 1999; Kahn, 1998; NCIP, 1999).

In 1988 Congress passed the Technology-Related Assistance for Individuals with Disabilities Act with the purpose of establishing a program of federal grants to states to encourage technology-related assistance to individuals with disabilities (Yell, 1998). One of the provisions of the Technology-Related Assistance for Individuals with Disabilities Act was to ensure that all qualifying students with disabilities received FAPE and

technology-related assistance when appropriate (Yell, 1998). This act eventually led to additional mandates in the IDEA regulations in 1997 to consider the need for assistive technology devices and/or services as part of a student's IEP (Merbler, et al., 1999). These changes resulted in requirements for Local Education Agencies (LEA) to provide equipment and training in the use of assistive technology to enable students with disabilities to benefit and participate in their educational program (Merbler, et al., 1999). Voice recognition is one technology that may be well suited to meet the needs of many students with special needs. Programs such as the technology training that is provided by Washington's Special Education Technology Center (SETC) were funded in response to the law (A. Black, personal communication, July 10, 2001).

All students eligible for special education services must have included, considerations for assistive technology to ensure a FAPE as mandated by IDEA (Merbler, et al., 1999). These must be a part of their IEP. As previously stated, students with special needs as previously stated typically qualify for reasonable accommodations, including technology-related assistance. VRT falls under technology-related assistance, therefore requiring the provision of necessary equipment and

services to teach the student how to use VRT. To assist in teaching students with special needs to use VRT, an instructional manual was developed with considerations for different learning stylesand physical limitations. This project focused on one VRT application, *Dragon Naturally Speaking Version 5* (2000).

Problem Statement

Advances in computer technology have become widespread within the business, professional and recreation markets (Highland, 1997). Within the educational setting, technology has shown promise for students with disabilities (Cavalier & Ferretti, 1996). As such, technology has the potential to increase independence in school participation by allowing students with physical or learning disabilities to produce classroom assignments that they may not have been able to in the past (Wetzel, 1991). Despite critics' claims that VRT requires very powerful computers and substantial time to "train" the computer to recognize peculiarities of one's own speech (Lima, 1999; Woods, 1999), improvements in VRT have made this techology easier to use and reduced the time to train the computer to recognize the user's voice (Machrone, 1999; McNaughton, 1998; Stibbe, 2002). For example, the latest

version of *Dragon Naturally Speaking* (2000) claims an average time of five minutes to train the computer to the user's voice (Stibbe, 2002). These critics have claimed that other difficulties with VRT include; misinterpreting words, using the wrong spelling (e.g., "two" for "too"), a need to move the cursor to insert words or make corrections, and confusion between commands and dictation (Stibbe, 2002; Woods, 1999). As with training time, however, technological improvements have addressed these facets of VRT programs.

Some writers contend that the success of using VRT is contingent on the user determination and the expertise of the trainer/teacher (Icke, Parella & Temple, 2001). The National Center to Improve Practice in Special Education Through Technology, Media and Materials has stated that proper training by a qualified teacher is critical to the success with VRT for all users regardless of skill or age (NCIP, 1999).

Providing special education produces more issues. Furthermore, training school-aged students differs from training adults (NCIP, 1999). Students with disabilities have a wide variety of needs that require special education teachers to individualize instruction. It is for this reason that the typical approach to training provided by current training protocols or

instructional manuals that accompany VRT products does not accommodate each individual student's specific physical and cognitive needs because these materials are designed to move typical functioning adults toward independence with the system software at a quick pace (NCIP, 1999). For example, a student with a physical disability who is unable to use their hands for standard keyboard operations and who will be fully dependent on voice commands may need additional training to master using voice commands to operate the software on a specific computer platform. A student who has difficulty with the reading level of a manual may need a special tutor and advanced exposure to the training scripts used to develop voice files prior to the training day as well as additional rehearsal opportunities after the content/procedures are introduced. Training goals and methods need to be redesigned and/or adapted for students. These adaptations may require a slower and incremental approach to promote success (NCIP, 1999). These types of accommodations are not typically included as part of the instructional manuals that are provided with VRT software.

Purpose of the Project

Teaching individuals with specific physical and learning needs in the use of *Dragon Naturally Speaking Version 5* (2000) may be a challenge using the manual that accompanies the product. Training protocols and manuals are typically designed for the average adult user and they do not provide accommodations for individual differences (NCIP, 1999). Students with learning disabilities may need accommodations like previewing the training scripts ahead of time to practice difficult words, or a broad area of hands on activities. Students with physical disabilities may need to have multiple practice opportunities or specialized breathing strategies prior to actually dictating information into the VRT program. Educational staff, such as teachers and classroom assistants, who will be training students to use VRT may not be aware of the accommodations that may be necessary for students to successfully train the computer to recognize their voices. In addition, teachers/staff need to develop the content knowledge to develop the student's expertise to interact with the VRT. While there are general suggestions for working with younger students, there does not seem to be anything available on the market that specifically addresses the needs of students with physical and/or

learning disabilities (NICP, 1999). The purpose of this project is to develop an instructional manual for teaching students with disabilities in the use of *Dragon Naturally Speaking Version 5* (2000) for written communication.

Limitations of the Project

Applications of the instructional manual were evaluated with three students with varying abilities and needs: two students with physical disabilities and one student with a learning disability in reading and written language. Two of the applications (first and second) were done with limited access to the VRT. On these two occasions, the VRT was on loan by the Washington Special Education Technology Center (SETC). Having to rely on SETC for the technology limits the amount of time equipment is on loan to a school district or an individual. The loan of the equipment was extended from the typical two weeks to one month. During the loan, the developer was required to learn the VRT, develop the manual and conduct the two applications to determine its' effectiveness and to make any necessary changes to the manual.

The third application was done using the VRT owned by the school district. However, by the time the VRT was ready for use, little time was

left until the end of the 2001-02 school year, which resulted in limited evaluation. The student in the third application was a high school senior whose teacher did not want the limited time the student had in school to be spent on training, but rather wanted the student to use the VRT system to complete all missing and incomplete school assignments before graduation.

Another limitation of the project relates to ongoing computer software product upgrades that are being produced at a rapid pace. By the time the instructional manual was developed and field-tested with all three students, the risk of an upgraded version of *Dragon Naturally Speaking* may be on the market. This could make the instructional manual obsolete for new versions of the software.

Because of time constraints, the modification of the entire instructional manual was not completed. Therefore the materials that were modified were limited to the general training, correction procedures, spelling and microphone commands segments of the manual.

Definition of Terms

Assistive technology. Any device or item that can be used to increase, maintain or improve the capabilities of individuals with disabilities (Merbler, et al., 1999).

Assistive technology device. WAC 392-172-070. "an assistive technology device means any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of special education students."

Assistive technology service. WAC 392-172-073. "any service that directly assist a special education student in the selection, acquisition, or use of an assistive technology device. The term includes:

1) The evaluation of the needs of a special education student, including a functional evaluation of the child in the student's customary environment.

2) Purchasing, leasing, or otherwise providing for the acquisition of assistive technology devices by special education students;

3) Selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing assistive technology devices;

4) Coordinating and using other therapies, interventions, or services with assistive technology devices, such as those associated with existing education and rehabilitation plans and programs;

5) Training or technical assistance for a special education student or, if appropriate, that sttudent's family; and

6) Training or technical assistance for professionals (including individuals providing education or rehabilitation services), employers, or other individuals who provide services to, employ, or are otherwise substantially involved in the major life functions of special education students."

EAHCA. Education for All Handicapped Children Act (1975), also known as Public Law 94-142, including the mandate for states to provide free and appropriate education to all students up to age 21, including students with disabilities (Yell, 1998).

EHA. Education of the Handicapped Act (1970), formally known as Title VI of the Elementary and Seconday Education Act (1965) (Yell, 1998).

FAPE. Free and Appropriate Public Education. WAC 392-172-035. "special education and related services which:

(a) Are provided at public expense, under local school district or other public agency supervision and direction, and without charge to parents;

(b) Meet the standards of the state educational agency and the state board of education, including the requirements of this chapter;

(c) Include preschool, elementary school, or secondary school education in the state; and

(d) Are provided in conformance with individualized education program (IEP) requirements of this chapter."

IDEA. Individuals with Disabilities Education Act (1997), formally known as EAHCA (Yell, 1998).

IEP. Individualized Education Program provided to students eligible for special education and designed by a team consisting of school personnel, parents, students and other community members as invited by the team.

LEA. Local Educational Agency. Local school district. Service agent in a community for providing public education.

LRE. Least Restrictive Environment, as mandated by IDEA, students with disabilities are educated with their peers without disabilities to the maximum extent appropriate (Yell, 1998).

Morse code. A coding system that consists of dots and dashes in a specific order to produce letters, numbers, and other computer functions.

PL 94-142. Public Law 94-142, Education for All Handicapped Children Act (1975), including the mandate for states to provide free and appropriate education to all students with disabilities up to age 21 (Yell, 1998).

PL 101-476. Public Law 101-476, Individuals with Disabilities Education Act, reauthorization of PL 94-142, Education for All Handicapped Children Act (1975), and added the definitions of assistive technology devices and assistive technology services (Yell, 1998).

Related Services. WAC 392-172-055. "transportation and such developmental, corrective, preventative and other supportive services as are required to assist a special education student to benefit from special education."

Scanning. A switch input method of making a selection from a series of choices. When the switch is activated it allows for scanning, when "off" the target symbol is able to be chosen.

Special education. WAC 392-172-045. "specially designed instruction provided to an eligible student as defined in WAC 392-172-035." "Specially designed instruction means organized and planned instructional activities which adapt, as appropriate, to the needs of eligible student under this chapter, the content, methodology or delivery of instruction."

Voice recognition technology (VRT). A technology that allows a user to use their voice as an input device to produce text or perform computer functions (NCIP, 1999).

CHAPTER 2

LITERATURE REVIEW

Introduction

Voice recognition technology is a computer application that allows people to control a computer or produce text by speaking (Goette & Marchewka, 1994; McNaughton, 1998; NCIP, 1999). Voice recognition is the ability of a machine to receive, process, interpret and execute commands that are entered by audible signals. The procedure is accomplished by the software program's ability to compare spoken words or phrases with a template housed in the system (Milheim, 1993). Although VRT has been in development since the 1950s (Dalton & Peterson, 1997), little research is available on its use by individuals with disabilities. The review of literature in this chapter covers different types of VRT, variables to evaluate when considering the use of VRT, training considerations, research support for VRT, and physical considerations for training students with special needs to use VRT in the educational environment.

Types of Voice Recognition Technolog

There are four different forms of VRT systems typically used; speaker-dependent, speaker-independent, discrete and continuous VRT (Goette & Marchewka, 1994). Each system varies in the requirement of having a user train the system to their voice, commonly referred to as the "enrollment process." Each system may also vary in the type of speech patterns that need to be used during dictation.

Speaker-dependent VRT systems require an individual to build a recognition template in the system (Cavalier & Ferretti, 1996). The user is required to train a vocabulary or list of specific words that are used by the system to interpret input (Goette, & Marchewka, 1994; Milheim, 1993). The computer makes a voice profile that attempts to match the users voice synthesizations (Padilla, 2000). In this system the computer takes a spoken word, compares it to a bank of words, and, finding a match, prints the word on the computer monitor. The more consistently the user vocalizes vocabulary items, the better the system's recognition rate (Cavalier & Ferretti, 1996). Recognition accuracy rates vary but can reach the 90th percentile or better depending if sound patterns of the user are consistent (Ruley, 1994). The advantage of a speaker-dependent system is that the user is able to train the system to

understand their pronunciations (Goette & Marchewka, 1994). *Dragon Naturally Speaking* (2000) is one form of this type of system.

Speaker-independent systems do not require users to train the system. Models for word recognition are built into the system (Goette, & Marchewka, 1994). An example of this type of system is what many airlines, telephone and banking companies are using (Milheim, 1993). When one calls the airlines for flight arrival and departures, the recording instructs the caller to say the flight number and city. The system is able to recognize the caller's words without the caller having to train the computer to their voice. Speaker-independent systems are valuable for situations when a large number of people use the same system (Cavalier & Ferretti, 1996). Because no voice-specific word training is necessary with this type of system, the system has a limited vocabulary, allowing for only specific sound combinations (e.g., yes, no, one, two) (Goette, & Marchewka, 1994).

Discrete VRT is similar to speaker-dependent systems. It differs in that it requires the user to pause between words so that the computer may distinguish the onset and the ending of each spoken word (Padilla, 1997). Computers are able to more easily recognize single word

utterances. The disadvantage of this system is that pausing between each word slows down the user's dictation and is an unnatural way of speaking. Pausing between each word can be distracting to the speaker who is trying to record ideas because the speaker must concentrate on including the pauses into their dictation (Ruley, 1994). However, despite the user having to slow down their dictation, it has been reported that it is possible to produce over 60 words per minute (wpm) using this method, the speed of an advanced typist (Padilla, 1997). McNaughton (1998) claimed that the average rate for typical adults after training is between 45-65 wpm.

For an individual with a physical limitation, being able to produce written text at a rate near 60 wpm, may prove to be more productive than the system they are currently using. Dalton and Peterson (1997) found that using VRT proved to be faster and more accurate than typing with a mouthstick for the subject who had a physical disability in their study. The subject in their study was able to type 13 wpm using a mouthstick, with 10 errors (95.4% accuracy) and dictate 20 word per minute with 3 errors (98.6 % accuracy). The researchers concluded that VRT may prove to be faster, more accurate and energy efficient for

individuals who currently access the computer in alternative ways (Dalton & Peterson, 1997).

Continuous VRT systems have been commercially available since 1997 (Speaking to Write, 1999). They allow the user to dictate information into the computer using normal, continuous, and conversational speech, without pauses between the words (McNaughton, 1998). Continuous speech is a more natural and faster way of speaking (Padilla, 1997). It allows the user to focus on the subject rather than how to speak (Ruley, 1994). Goette and Marchewka (1994) claimed that the ultimate goal of VRT is to have computers recognize speech similar to the way humans recognize speech vocabulary. The two most popular continuous VRT systems are the *Dragon Naturally Speaking* for the PC platform and the IBM *ViaVoice* for the Macintosh platform.

Currently, both systems require the user to teach the computer to recognize the user's voice through a combination of training procedures and ongoing usage adaptations. As the user speaks to the system, the software creates a user-specific voice file that contains information about the user's voice qualities and pronunciations (NCIP, 1999).

Improvements continue to make using VRT easier. Training time varies depending on the application that is being used. However, training time has decreased considerably since the early days of VRT (Woods, 1999). In addition, the cost of VRT software has become more affordable. The market for VRT, once dominated by individuals with disabilities, has recently found a niche among able-bodied consumers (Woods, 1999). Recognition accuracy has also improved. Recognition is possible with 90-95 percent accuracy, however, expecting 80-90 percent recognition accuracy is more realistic for the novel user (McNaughton, 1998).

Despite the improvements in VRT, some critics contend that there are still problems and that VRT continues to have a long way to go (Lima, 1999; Woods, 1999). This contention is largely due to VRT programs that continue to demonstrate difficulty with context, misinterpretations of technical terms, and difficulty with basic editing commands such as having the computer move the cursor in the text to insert words. For example, issuing a command to begin a new paragraph may result in the insertion of a sentence rather than performance of the spoken command (Woods, 1999). Lima (1999) found that dictation sometimes results in

undirected formatting of text. That is, in attempts to dictate a particular idea, users may not get a correctly punctuated or spelled end product.

Current literature available is limited to the opinions of abled-bodied individuals who have tried a VRT product and reported their experiences with the product on the internet (Highland, 1997; Lima, 2000; Machrone, 1999; Padilla, 1997; Stibbe, 2002; Woods, 1999). A handful of published studies that include the use of VRT by individuals with disabilities has developed (Cavalier & Ferretti, 1996). Very little of the published literature provides information on users' characteristics that would promote successful use of VRT. Knowing which characteristics to evaluate when considering the use of VRT is especially important for finding product traits that meet individual needs of students with specific needs who must rely on alternative modes of producing written composition. Given the limitations of current programs, the next section highlights considerations to be taken in selecting student candidates for using VRT.

Characteristics to Evaluate when Considering Use of Voice Recognition

The Speaking to Write (1999) and NCIP (1999) websites have posted guidelines for determining the potential for independent use of

VRT. The Speaking to Write website concluded that VRT is one endeavor in which success is a highly individual matter and that the final determination should be based on an individual evaluation and actual trials with VRT. The website also contends that although some individuals with specific weaknesses in one or more of the following areas, such as, cognition, reading, spelling, speech consistency, language, self-monitoring skills and perseverance, could potentially be successful in using VRT.

Cognitive Skills

Voice recognition requires many cognitive demands such as learning new procedures (i.e., how to operate the program and understanding the difference between spoken and written language) (Speaking to Write, 1999). Kahn (1998) refered to this as "meta-cognitive" ability, which is the ability to simultaneously think about what one wants to say and about how to use the VRT system to say it. According to the Fairfax County Public Schools Integrated Technology Services (ITS) for students using VRT, cognition, auditory and/or visual attending skills and problem-solving skills are all parts of the selection criteria (Icke et al., 2001).

Reading Skills

Kahn (1998) proposed that VRT is easiest to use for people who have reading skills at least at the second grade level. The Speaking to Write website (1999) recommended at least a grade-two word identification level, which frequently means that the student must be able to recognize words at a higher level. Some decoding ability (initial sound identification) is required according to ITS (Icke et al., 2001). This level of reading is required to monitor what appears on the screen as compared to what was said and to determine which words will need to be corrected (Speaking to Write, 1999).

Spelling Skills

Independence with VRT is increased by being able to spell well enough to identify the first two letters of words (Speaking to Write, 1999). Kahn (1998) recommended a second grade spelling level or better. Spelling ability is necessary for the user to identify when the system has not correctly recognized a word and to make corrections either by identifying the correct word on a list or spelling the word (Kahn, 1998). Correcting misrecognized words requires the user to supply the first and second letters of the word (Speaking to Write, 1999).

Speech Skills

Speech consistency is the ability to pronounce the same word in the same way each time. According to Kahn (1998) and Icke et al. (2001), consistency is more important than clarity. Kahn (1999) found that his voice consistency changed if he became tired, resulting in a decline of the system's accuracy. Continuous speech technology requires that the user enunciate each word within the continuous stream of speech with pertinent precision, which means they must pronounce words very clearly (NCIP, 1999).

Discrete VRT systems are generally much more forgiving than continuous VRT systems. Continuous VRT systems require the user to produce word sequences of more than one word at a time (the longer the better) with clear enunciation of each word in the sequence (Speaking to Write, 1999). Teachers of students with speech-language difficulties will need to keep this in mind.

Language Processing Skills

The Speaking to Write website (1999) suggested two aspects of language processing that may potentially impact the success of using VRT: verbal formulation and verbal "facility". Verbal formulation refers to the ability to formulate an idea in words that will then be spoken

(Speaking to Write, 1999). Success in using VRT requires the ability of the user to express their ideas with verbal language (Icke et al., 2001). Continuous VRT requires the user to produce longer sequences of words for better recognition. Should the user change his/her mind about what is currently being written/spoken, a reasonably complex sequence of internal evaluation and reformulation while in the process of dictating is required (NCIP, 1999). NCIP (1999) similarly indicated that continuous VRT prefers the user to speak in "chunks" of language, from phrases to whole sentences (the longer the better) (NCIP, 1999).

The other aspect of language processing is referred to as verbal "facility", which involves the user's ability to make "on-line" changes to what one wants to say and how they want to say it (Speaking to Write, 1999).

Self-monitoring Skills

Self-monitoring is the ability to understand the task one is trying to do, to evaluate one's performance in accomplishing that task, and to understand how to change that performance when it does not meet task needs. There is a strong developmental and cognitive component to these abilities (Speaking to Write, 1999). NCIP (1999) further suggested

that by the time the user is able to see the words at the beginning of their sentence appear on the computer screen, the user may be at the end of their sentence. This can be confusing to the user and add to the difficulty with monitoring one's performance (NCIP, 1999). It is important for the user to have adequate self-monitoring abilities in order to successfully use VRT (Icke et al., 2001).

Perseverance is the ability to "see the big picture" and an ability to handle frustration (Speaking to Write, 1999). Frustration is common during the beginning stages of learning to use VRT. If one is unable to tolerate some degree of frustration in an effort to achieve the end goal of being a more independent writer, then reconsideration of the use of VRT is recommended (Speaking to Write, 1999). Kahn (1998) advised that one of the prerequisites of learning to use VRT is patience. He implied that someone who is easily frustrated or who has attention deficit disorder may have more difficulty with the initial training process. Icke et al. (2001) similarly recommended the need for students to have some behavioral considerations such as frustration tolerance, perseverance, and motivation if they are to successfully use VRT.

The Speaking to Write website (1999) added the need for potential users of VRT to be invested in writing and that students have some interest in the possibility of becoming or seeing oneself as a writer. Icke et al. (2001) referred to this as motivation. McNaughton (1998) also reported that a key factor that influences the success of using VRT is the attitude of the user. If students have a positive attitude, despite the absence of having some of the recommended skills as previously mentioned, and are motivated to learn VRT, and to work on improving their writing skills, they may be able to successfully use VRT for written composition (NCIP, 1999).

Given these important characteristics associated with success, students may be unwilling to try VRT. It is suggested, though, that students have the opportunity to try VRT before ruling it out (NCIP, 1999). If a student demonstrates the skills that makes them a candidate for using VRT, the next step is to teach the student in the specific VRT program. In order to accomplish this, obtaining a computer that can efficiently run the software is necessary. The literature specified that the advantages of using VRT in special education depend on the characteristics of the student, the tasks that need to be performed, and

the capabilities and limitations of the VRT system (Icke, et al., 2001). Given the variety of classroom computer capabilities, this is a critical variable that teachers must evaluate. Some critics have claimed that despite having a computer system with the recommended minimum requirements (e.g., memory, hard drive, space, speech recognition card), VRT does not always run efficiently (Lima, 1999; Stibbe, 2002). Even if the minimum hardware requirements are exceeded, there is no guarantee that what is said is exactly what will appear on the screen (Lima, 1999). Thus, writers suggested that the trainer should ensure that the system is set up to perform at a high level of accuracy because slow computers, poor sound cards and improperly positioned microphones will reduce performance and lead to frustration (Koester & Levine, 2000; McNaughton, 1998; Stibbe, 2002). The quality of the microphone is a part of having an efficient computer system. Icke et al. (2001) suggested that students calibrate the microphone each time they begin using the VRT to ensure accuracy.

Teaching school-aged students is different from teaching adults (NCIP, 1999). Using the commercially available VRT for written composition or computer navigation requires some common procedures

that are consistent among the literature. First, the student will need to teach or train the computer on how he/she speaks. This is commonly referred to as the enrollment process (Cavalier & Ferretti, 1996). The consensus among authors is that the enrollment process is crucial to the accuracy and reliability of the VRT system (NCIP, 1999). Many of the studies used older discrete VRT software, which required a longer enrollment process (De la Paz, 1999; Higgins & Raskind, 1995; Wetzel, 1991). This included having the user develop voice templates (voice files) by speaking words into the computer (Cavalier & Ferretti, 1996; De La Paz, 1999). Today, the manufacturers claim that the enrollment process is significantly less time consuming. Current continuous VRT systems such as *Dragon Naturally Speaking* and *ViaVoice* require the user to read training scripts provided by the software developer. It is during this enrollment process that consistency in speech is crucial because recognition accuracy is dependent on the user having consistent patterns of pronunciation (De La Paz, 1999).

Writers recommended conducting the enrollment process in the environment that the VRT will ultimately be used (Cavalier & Brown, 1998; Cavalier & Ferretti, 1996). Others recommended that the initial

training should occur, if possible, in a quiet area so the student can focus on learning the VRT without distractions (Icke et al., 2001; Kahn, 1998). Lima (1999) proposed that VRT works best when there is little or no background noise in the room. Once the student becomes independent, use of the VRT should be integrated into the classroom environment (Icke et al., 2001).

To improve the recognition accuracy, it is recommended by VRT developers to correct misrecognized words (De La Paz, 1999). Therefore, as part of teaching the student in using VRT, training the students on making corrections to misrecognized words is the next step (Higgins & Raskind, 1995; NCIP, 1999).

Training Considerations

The literature includes a variety of guidelines for teaching students, especially those with special needs, how to use VRT. Icke et al. (2001) provided guidelines for teaching students with learning disabilities at the secondary level in using VRT. Their guidelines are designed with three stages. Stage I: Training the software includes setting up user "speech files", conducting general training, reading a simple story, using pre-

writing tools (graphic organizers, outlines, webbing), and using social writing prompts (journals, friendly letters and reading responses).

In Stage II, students move into the curriculum which encompasses dictating class notes/study guides for test preparation, spelling lists, spelling/vocabulary sentences, running "vocabulary builder" with previous written assignments, dictating the same written piece used for "vocabulary builder", and summarizing a reading passage. Stage III consists of integrating speech recognition with class assignments, discussion questions (i.e., history/science labs), free-writing, essays, current events, five paragraph writing prompts, dictating research notes from the Internet, and finally, completing a research paper.

The NCIP (1999) provided guidelines for training younger students on discrete VRT. The primary recommendation is that the process of teaching students to use VRT should be individualized to the student's learning needs and style. Step 1 involves having the student observe the trainer using the VRT, including word-by-word dictation, spelling to generate additional word choices, and making basic error corrections. In step 2, the student is guided through the enrollment process to develop his or her own initial voice file. Step 3 includes having the student

complete additional training to facilitate accurate dictation. Step 4 requires having the student dictate a single, simple sentence. The sentence is first dictated with the microphone off and followed by dictating the sentence with the microphone turned on. The student is asked to dictate the same sentence one or two more times. This process allows the student to experience greater level of fluency and the system to become familiar with the words. In step 5 the student and trainer decide on another sentence (with similar words as the previous sentence) to be dictated. The student dictates the new sentence and the preceding steps are repeated. Once the voice file has been developed, the student is taught to learn how to operate the system.

The NCIP recommended the following sequence of steps for introducing the student to learn how to operate the system. The sequence includes, dictation only, dictation plus selection of words from the list of alternatives, dictation and selection plus spelling to train new words or elicit the words from the background dictionary, dictation-selection-spelling plus error correction, and finally, dictation-selection-spelling-error correction plus customized training, such as voice commands.

The Speaking to Write Internet website (1999) provided training guidelines and strategies for teachers/trainers helping students learn to use *Dragon Dictate*, a discrete VRT program. During the first five hours of use, the trainer provides close monitoring and does all keyboard actions. The student gradually learns to control the microphone, begins to make corrections in the Choice List, begins to use [Oops], demonstrates awareness of strategic use of correction strategies and completes some of the *Quick Training*, which is optional. One of the methods of making corrections is using [Oops] which results in the [Oops] window to be displayed to allow the student to select a word from the choice list or begin spelling a word until it appears in the choice list using their voice. The next five hours of use may include the trainer monitoring about 50 percent of the time, the student learns to add new words and learns to make text macros, and the student complete the remainder of the *Dragon Dictate Quick Training.* Once the student is able to demonstrate the skills mentioned previously, the student might require only occasional monitoring by the trainer. The developers of the guidelines provide a list of skills that the student must acquire to become independent in using *Dragon Dictate*. The skills include the following:

students must be able to say each word and look at the screen to determine whether it is the target word or not. The student must look at the choice list to identify the target word if it is not generated. The student must be able to turn the microphone on and off using the hotkey or voice commands. The student must be able to select words from a choice list using [Choose] commands or by keystrokes. Students must also be able to begin spelling words by using the keyboard or using their voice and make a selection from the choice list. Finally, students must be able to use the [Oops] word history window. Recommendations for the training implementation suggest providing the initial five hours of training in short periods (approximately 30-45 minute sessions), three days per week.

Once the student has developed voice files (templates) and trained the computer to recognize their voice, it can be expected that recognition rates can reach 90-95% accuracy and the user can produce up to 80 wpm using continuous VRT (McNaughton, 1998). Recognition rates and wpm vary depending on the type of VRT software, the efficiency of the system and the individuality of the user. For example, IBM Voice Type (discrete type) claimed 96% recognition rates and with a

range of 70-100 wpm (de Sopena, 1995). Dabbagh and Damper (as cited in Koester & Levine, 2000) have reported 90% accuracy for a well-trained able-bodied individual using a discrete VRT system. Karl, Petty and Shneiderman (as cited in Koester & Levine, 2000) and Dalton and Peterson (1997) reported that other discrete VRT systems with large word vocabularies can achieve 94%-98% accuracy rates for well-trained individuals with and without severe upper extremity disabilities. Compared to discrete VRT systems, continuous VRT systems have the potential to result in dictation speed of up to 100 wpm and 95% recognition accuracy as reported by popular reviews (Koester & Levine, 2000).

One of the unexpected problems associated with the use of VRT is decreased recognition accuracy when the user is fatigued, has a cold, or is operating in a noisy environment (De La Paz, 1999; Milheim, 1993). Inconsistent recognition may be due to frequent changes in children's voices due to moods, medications and/or puberty (De Vincenzi, 1997). Possible solutions recommended in the literature include teaching students to retrain the computer through conducting the enrollment process when accuracy deteriorates (Cavalier & Brown, 1998; Cavalier &

Ferretti, 1996; Milheim, 1993); making recognition corrections on screen and saving voice files that demonstrate good recognition accuracy (McNaughton, 1998). Failing to correct misrecognized words led to "corrupted" voice files and will eventually result in decreased recognition accuracy in future software usage (Cavalier & Ferretti, 1996; McNaughton, 1998).

Once the enrollment process is complete, the user is required to learn how to make corrections to misrecognized words. Individuals who rely on VRT systems need to learn to use the spell mode and to give voice commands to operate the computer (McNaughton, 1998).

Teaching students with disabilities to use VRT may require further adaptations. Such as training will be likely to involve presenting the material in an incremental manner that is paced with the student's learning pace (McNaughton, 1998). Learning speech commands, mouse and keyboard operations will further challenge the VRT trainer who is working with students who are physically or cognitively challenged (De La Paz, 1999).

Research Support VRT

Few studies have evaluated VRT in education. This is due to the infancy of educational research on this topic. Few of these published works focus on VRT for individuals with learning disabilities.

Prior to VRT, evaluation of computer applications for writing compared dictation to handwriting and word processing for written composition of students with LD. Some studies evaluated dictation as a method to improve writing. For example, MacArthur and Graham (1987) found dictated stories to be significantly longer, of higher quality, and with less grammatical errors compared to both handwriting and word processing. The authors concluded that dictation had a clear impact on the fluency and quality of students with learning disabilities' written compositions. The results of their study also suggested that dictation may be a valuable educational tool for students with LD. Dictation may allow students to bypass the difficulties with the mechanics of writing and enable students with LD to concentrate on the higher level aspects of writing such as; planning and organization. VRT builds on this research.

Higgins and Raskind (1995) found VRT allows students with LD to compensate for their difficulties in written composition by allowing students to use their extensive vocabulary and attend to content

generation and the organizational aspect of composing. VRT eliminated the need for students to be overly concerned about spelling, which consequently decreased the mental distraction of constantly having to check and recheck their spelling.

There is further support for VRT's use with students with LD. Higgins and Zvi (as cited in Higgins & Raskind, 2000) revealed that the use of VRT improved the performance of learning disabled college students as compared to having human transcriber's assistance or with no assistance at all. Furthermore, long-term gains in reading were evidenced by scores on standardized tests, in overall academic achievement and overall better grades in courses and decreased drop out rates.

Wetzel (1996) conducted a single subject exploratory study using VRT as a written communication tool. The results revealed recognition accuracy improvement from 23-40% in the beginning of the training and 71%-74% at the end of the training. Despite the improvement in recognition accuracy, reservations exist for VRT. For example, Wetzel concluded that having to employ corrections 26% of the time is unacceptable for the average adult, and for students who have difficulty

with decoding and spelling, it is even less acceptable. Wetzel also revealed that added difficulties occurred as the student's frustration increased resulting in extraneous sounds which added unwanted words to the text on the screen. The author concluded that improvements in the VRT used for this study, Voice Type, would need to have increased recognition accuracy before further investigation is worth pursuing. He advised waiting for improvements in VRT before seriously considering it for students with LD.

De La Paz (1999) indicated that neither dictation nor speech recognition (VRT) is able to offset the challenges of writing, such as content generation and organizing, which some students with LD have in producing written composition. It was also recommended that VRT systems should also be used in conjunction with speech synthesis systems. Speech synthesis provides speech output along with the text on the screen. This auditory feedback procedure may help students during the revision process. The author concluded that advances in technology have made it possible to place greater emphasis on the use of dictation and VRT for producing written composition as a viable writing option for students with LD.

Higgins and Raskind (2000) conducted the most recent study on the effects of continuous versus discrete speech recognition systems (VRT) on the reading and spelling of children with LD. Students in this study ranged in age from 9-18. Their findings revealed that both types of VRT improved word recognition and reading comprehension. They also found improved spelling in the group of students who used the discrete VRT. A greater number of students in the continuous VRT group were not able to use the system and dropped out from the study. All four of the students that dropped out of the study were younger (9-11 year olds) and had high pitched voices. Each of these students was trained to use the discrete VRT despite not being able to successfully use the continuous VRT. The researchers concluded that both systems could be used effectively across a range of ages.

Some studies have been conducted with individuals with physical disabilities. These studies evaluated VRT's capacity for increasing independent or efficient access to computers and/or possibly reducing fatigue for producing written text (Cavailer & Ferretti, 1996). The available literature on using VRT with individuals with physical disabilities has yielded inconsistent results. For example, Cavalier and Brown (1998)

found that the subject in their study, a woman with severe disabilities learned to control devices using vocalization. This woman was able to produce five distinct vocal responses which she learned to use to express choices and preferences. Their study revealed that she exhibited more positive affect when exercising her newly acquired skill and independence. The research also found that the attitudes and expectations of individuals responsible for providing her care and training were also altered.

Cavlier and Ferretti (1996) discussed several educational and clinical research studies that include using VRT with individuals who have physical disabilities. Fried-Oken (as cited in Cavalier & Ferretti, 1996) reported using VRT with a 10 year-old boy with quadriplegia who was dependent on a respirator. Fried-Oken's findings showed that despite having 40%-60% recognition rates, the student demonstrated increased motivation to learn and a desire to continue using the VRT. Results also revealed recognition accuracy between 79%-96% with a 19 year-old man with a spinal cord and a head injury that resulted in difficulty with speech.

Other studies have added to the array of mixed results. Treviranus, Shein, Haataja, Parnes, and Milner (as cited in Cavalier & Ferretti, 1996) found that using VRT with a 12 year-old boy with cerebral palsy

decreased his efficiency in writing because of the adverse effects of the environmental noise on the VRT program in the study. Schmitt and Tobias (as cited in Cavalier & Ferretti, 1996) found that despite a low recognition rate of 54%, which was impacted by the level of frustration on pronunciation, for an 18 year-old woman with a severe physical disability, she demonstrated improved speech intelligibility as a result of using VRT.

A recent study was conducted by Dalton and Peterson (1997) with a 30 year old man who sustained a C-4 spinal cord injury at the age of 16 and who uses a mouthstick to access his computer keyboard. This case study revealed that the subject was faster and more accurate using VRT than typing with a mouthstick. He was able to dictate 20 wpm with 98.6% accuracy as compared with 13 wpm with 95.4 % accuracy using the mouthstick. The authors attributed success to high-level cognitive skills and voice consistency displayed by their subject. The authors concluded VRT to be a time-saving, energy efficient, and accurate tool for people who cannot access the computer keyboard with their hands.

Individuals who need to rely on their voice for both text generation and controlling the computer need to use their voices more often than

those who can also use the keyboard and mouse to control the computer. Despite the inconsistencies among the literature on user success with VRT, most writers contend that VRT is most beneficial for individuals who rely on alternative access for success in school. VRT can improve a physically disabled person's equitable access to education, communication and employment if the individual can use the software (Cavalier & Ferretti, 1996; Goette & Marchewka, 1994). It is also believed that a second group of individuals who could benefit from VRT are those who, because of a learning disability, have difficulty producing written composition (Kahn, 1998). Some assert that individuals with dyslexia would benefit greatly because the need to attend to spelling is eliminated ("Uses in rehabilitation," 2002).

Physical Considerations

Certain physical accommodations have been discussed related to VRT applications. Regardless of the disability, any individual using VRT has an increased risk for developing voice problems that can range from throat dryness and irritation that could be relieved by drinking fluids and taking rest periods (Kambeyanda, Singer, & Cronk, 1997). These symptoms may initially appear mild but they have the potential to lead to

moderate and severe voice problems such as loss of voice, loss of volume control, limited vocal endurance, and loss of speech (Kambeyanda et al., 1997). One would have a tendency to assume that the more frequent the user will have to use voice to operate the computer or produce text, the greater the risk of voice related symptoms. That would place individuals with physical disabilities who cannot control the computer through the keyboard and mouse at a higher risk.

Other problems associated with use of VRT have been documented in the literature. Some allege that dictation is tough on your throat (Machrone, 1999). Kambeyanda et al. (1997) found that using unnatural speech patterns commonly associated with discrete VRT systems may lead to moderate to severe voice problems. Time of continuous use without taking breaks was not a factor in the occurrence of voice problems in their study, which is in contrast to clinical studies that have reported severe episodes of voice loss after four hours of continuous use (Kambeyanda et al. 1997). The authors concluded that some individuals are more vulnerable to developing voice problems than others. For this reason they recommend the following: conducting warm-up and cool-down vocal exercises, avoiding clearing the throat, limit the amount of

time using VRT, develop alternate computer input access and monitor the user closely. Kambeyanda et al. (1997) proposed using continuous VRT systems may help to reduce the development of voice problems because continuous systems involve using a more natural speaking voice.

All of the studies presented reveal a variety of points to consider when teaching students to use VRT. The literature presented clearly reflects the inconsistencies of success students with disabilities have using VRT. However, the literature proposes factors to promote successful use of VRT. Among these factors are, the capacity of the computer system to run the VRT software, characteristics of the user/student to evaluate when considering the use of VRT, the importance of the "enrollment process", making corrections to misrecognized words for improved recognition accuracy, the environment of the training, and accommodations/modifications for teaching students with disabilities to use VRT. There is a need to compile all these recommendations into a manual to be used as a supplement to the manual that accompanies the VRT software. A manual with a culmination of all the factors presented in the literature would assist teachers and other educational staff to teach students with disabilities to use VRT.

CHAPTER 3

METHOD

Introduction

Candidates for using VRT in the educational environment are often students with disabilities and who have specific communication needs. They are not able to generate written expression in the traditional manner, using paper and pencil. As a result, these students are often in need of adaptations or modifications to their educational program. One of the provisions for adaptation or modification is assistive technology. Often, computers have been used to address the writing needs of these students with word processing programs that include spelling/grammar checkers, dictionaries and a thesaurus. However, students who require an alternate input method, other than the standard keyboard, may need instruction and training in specific computer software programs.

Typically, computer software products are accompanied by instructional manuals, which are designed to assist users to learn the products. The manuals are usually designed for an average user who has no physical or cognitive challenges, such as physical disabilities or learning disabilities. The purpose of this project is to augment an existing

instructional manual for *Dragon Naturally Speaking* (2000) for teachers and support personnel to use when teaching students with disabilities to use VRT. The intent of the instructional manual is to provide a step-by-step process of working with students. The material reflects the instructional implications discussed in chapter 2 of this project. It includes helpful hints and guidelines to address the unique needs of students with disabilities.

Scope of Project

Articles on VRT and its use with individuals with disabilities were researched, read, evaluated and summarized. Some of the research literature provided specific guidelines for training students in the use of VRT while others made reference to the general procedure. Most of the literature emphasized the importance of the initial training period, when students develop their voice files, the quality and position of the microphone, the importance of error correction, the environment, and the process of text production. The research also offers recommendations to evaluate when considering a student for the use of VRT. Once the student is determined to be a candidate for using VRT, system

characteristics need to be evaluated based on the suggestions presented in the research.

A laptop computer (IBM Sager) with *Dragon Naturally Speaking Version 5* (2000) was borrowed from the Special Education Technology Center for the first two applications. At that time, the instructional manual that accompanied the *Dragon Naturally Speaking Version 5* (2000) software was reviewed and evaluated based on recommendations made in the research literature. After learning how to use the equipment and the VRT software, an instructional manual was developed based on the findings. The manual developed further based on feedback from the implementations made with three students. Two applications of the instructional manual were used with students who had physical disabilities.

The third application of the manual was to teach a student with a learning disability in the use of *Dragon Naturally Speaking*. The application was conducted using the school district's computer (HP Pavilion, 4000 series) and *Dragon Naturally Speaking Preferred Version 6* (2002).

The three applications of the instructional manual were conducted with three students with varying disabilities and needs. Student A is an 11 year-old female in the fifth grade who has a C3-4 spinal cord injury resulting in quadriplegia and is unable to move any part of her body below her neck. Student A also has a tracheostomy and a phrenic nerve pacer, which stimulates her diaphragm for breathing. Student A receives resource room services for math. She reads at grade level. Student A was highly motivated to use VRT and is very familiar with technology. She is able to move about using a powered wheelchair and produces written work on the computer using a sip and puff switch. Student A has demonstrated excellent perseverance while learning to use the computer using a Morse code system with *CoWriter*. Based on the literature reviewed earlier, this student had many qualities that made her a likely candidate for VRT.

Application 1

Student A received four days of two-hour training sessions with *Dragon Naturally Speaking Version 5* (2000). Despite Student A's perseverance and the adaptations included in the manual, VRT did not prove to be an efficient method of producing written composition. The

computer inserted words such as "in" and "and" for Student A's breathing sounds produced by the phrenic nerve pacer. Additionally, during dictation, the computer incorrectly recognized words when Student A ran out of breath while continuing to dictate. It took an average of 30 minutes for Student A to make corrections for two sentences that she dictated in 90 seconds. Student A was more efficient with producing written composition using her current system. Benefits associated with this early experience included greater familiarity with the VRT program and adaptations that were made based on feedback from Student A.

Application 2

Student B is a 17 year old male with a medical diagnosis of Duchenne's Muscular Dystrophy. He is able to produce written assignments by writing and using the computer via the standard keyboard for longer assignments. Both writing and keyboarding are laborious and very fatiguing, however Student B receives resource room services for math and study skills to allow time for assignment completion. Student B is an avid reader. Student B has been very reluctant to use VRT but appeared to demonstrate an interest in trying this technology. Within 90 minutes, Student B was able to train the computer to his voice, dictate a

two-sentence passage reading from a book, dictate two more self-generated sentences and make corrections to the dictated sentences. Student B was able to use the VRT in combination with keyboard access to produce his writing and make corrections to misrecognized words. Student B was able to use the VRT software independently by the end of the session. Voice recognition technology was successful for Student B to produce more written expression than his typical method of writing or using the standard keyboard. The manual adaptation was unnecessary for Student B. Input, however, from this student provided meaningful feedback regarding the manual.

Application 3

Student C is an 18 year old male with a significant learning disability. Student C receives resource room services for academic needs and currently reads at the third grade level. Student C has been reluctant to use technology, such as a talking word processing program in conjunction with word prediction to assist with his writing for fear of appearing different. Student C's system was *Dragon Naturally Speaking Preferred Version 6.* Despite the version upgrade, the instructional manual was able to be used to train the student. Because of this

student's reading level, training scripts were provided ahead of time to allow the teacher and student to review and select the most appropriate training script to be used for the general training. This corresponds to suggestions noted in the literature. This also allowed the student to familiarize himself with the vocabulary and to identify difficult words. Student C was able to train the computer to his voice, and learned how to use the playback option and read option independently by the end of the first session. Student C demonstrated recognition accuracy at 75% after the first training session. He was able to make corrections to misrecognized words but was not able to identify punctuation errors. Student C continued to receive assistance to improve speech consistency, which was provided by the classroom assistant. Student C's recognition accuracy improved to 95% accuracy after several instructional sessions on working on speech consistency.

CHAPTER 4

An Instructional Manual

for

Implementation of Voice Recognition (VR)

In Written Communication

by

Lori Odagiri

July, 2002

AN INSTRUCTIONAL MANUAL FOR IMPLEMENTATION OF VOICE RECOGNITION (VR) IN WRITTEN COMMUNICATION

by

Lori Odagiri

July, 2002

TABLE OF CONTENTS

PREPARATION CHECKLIST/SET-UP

This preparation checklist/set-up is to provide the trainer with a quick reference to ensure a smooth process once the training process begins with the student. Some of the items should be completed prior to working with the student. Having all the items completed and available in-hand will eliminate the need to look for the items and disrupt the training process. The system requirements can be found in all software manuals.

A. "System requirements (Minimum*) Dragon Naturally Speaking Version 5*, Windows 98, 2000, Millennium, or Windows NT 4.0 (with Service Pack 6 or greater)

   266 MHz Processor

   64 MB RAM

   150 MB free disk space (Compact installation)

   CD-ROM for installation"

   (modified from *DNS 5* Users Guide)

Note: Keep in mind that although the minimum system requirements are met, the program may not rum as efficiently as expected, especially if more than one program will be used simultaneously. A system that does not run efficiently has the potential to frustrate the student when he/she has to wait for long periods for the dictated words to appear on the screen.

B. Student Criteria Checklist

C. Copy of Frequent Commands

D. Water

E. Copies of Training Scripts (available in Appendix B of this manual)-If training scripts were provided to the student prior to the training day, use the scripts that were used by the student. This can be used to provide verbal cues if needed.

Note: If the student has a reading level below grade 5, the training scripts, which can be found in Appendix B of this manual, should be provided to the student before working with the student.

F. Dragon Naturally Speaking Version 5 Quick Start Reference Guide

G. Dragon Naturally Speaking Version 5 Users Guide

STUDENT CRITERIA CHECKLIST

This student criteria checklist is a quick checklist to assist and provide information to the trainer on the necessary characteristics to consider when teaching a student in the use of voice recognition technology. This checklist may be used by trainers to modify the technique in which the student is trained.

- ☐ Spelling abilities-The student should be able to identify the first two letters of words. This is necessary for making corrections when the software's misrecognizes speech input. In order to make a correction, the student will need to provide the first two letters for the corrected word to appear.

- ☐ Speech abilities-The student should have consistent speech patterns; articulation and voice quality.

- ☐ Reading abilities-The student should have decoding skills at the 5th grade reading level. The student will need to monitor the accuracy of the text on the screen and what was said.

- ☐ Language Processing-The student should be able to self-generate an idea and develop the words that will then be dictated.

- ☐ Cognitive abilities-The student should understand the difference between spoken and written language. The student will also need to learn the process of how to operate the voice recognition software.

- ☐ Self-monitoring abilities-The student should be able to understand the task, evaluate their performance, and to be able to make changes to meet the task.

- ☐ Motivation & Perseverance-The student will need to handle some level of frustration in learning the program, especially in the beginning. It is also critical that the student sees voice recognition as a tool for writing and is willing to make the investment of time and effort to achieve the ultimate goal of becoming an independent writer.

- ☐ Other accommodations or technology used-Such as: *CoWriter*, AphaSmart, *Write Outloud*, etc. Using other methods of accommodations may help to determine whether the student knows how to use a computer. If box is checked, please specify accommodations and/or technology._____
  _____.

(Adapted from the Integrated Technology Services, Fairfax County Public Schools and the Speaking to Write Internet Website.)

HELPFUL HINTS

There are some strategies that can be used to increase the success of students with disabilities use of voice recognition. Some strategies can be done prior to the student training of the computer to recognize his/her speech. Other strategies can be used once the student has trained the computer to recognize his/her voice and is using the voice recognition software for dictation. The following suggestions address the areas of speech inconsistencies and reading challenges. Some hints should be done preceding working with the student, such as working on improving speech inconsistencies and having materials provided to the educational staff and student ahead of time to allow the student opportunities for practice (Option 1). Others may be done during the initial training session (Option 2).

SPEECH INCONSISTENCIES

If the student has speech inconsistencies, for example, habitual extraneous sounds like clicking of the tongue, sinus/nose clearing, etc., use of speech recognition software may not be possible. You may want to record a student's conversation and share it with the student to increase the student's awareness of the extraneous sounds prior to teaching the student to use the software. If the student receives speech and language services, working with the speech and language pathologist may assist in increasing the student's awareness of the extraneous sounds and reducing these sounds that may interfere with the success of using the voice recognition program. This process should be done preceding the day that is scheduled to teach the student to use the voice recognition program.

READING CHALLENGES (Below 5th grade)/YOUNG READERS

If the student is younger than 10 years old, or is reading below grade 5, the trainer will want to preview what needs to be read during the training phase (see appendix A). There are several options:

Option 1: This option should be done preceding the training day.

Have materials sent to the student's teacher ahead of time to allow the student to learn difficult words beyond his/her word recognition ability. This provides the student with opportunities for practice and gives the student a chance to become familiar with the passages that will need to be read during the period when the student will train the computer to recognize his/her voice.

As much as possible, have the student bring the hard copy of the appendix materials that are already highlighted.

Option 2: This option is done during the training day.

Have the student read the material out loud and highlight the words the student has difficulty with so that these words can be clarified before the student is in the process of training the computer to his/her voice.

The highlighted words may also provide the trainer with visual cues so that the trainer can whisper the difficult words into the student's ear while the student is training the computer to his/her voice. This will reduce the need to interrupt the student's dictation and improve the efficiency of the computer to recognize the student's voice.

NOTE: Have the student read the passage in short increments with the microphone in sleep or off mode and allow the student to rehearse the passage out loud as many times as needed for the student to feel comfortable with the reading.

"PLAYBACK" and "READ THAT" OPTIONS

Once the computer has been trained to the student's voice and the student is ready to begin dictating, these options are available to provide auditory feedback to the student of the text that was previously dictated.

"PLAYBACK" OPTION- The "Playback" option will allow the student to hear what was dictated in his or her own voice. However, the "Playback" option will not read the dictated words visible on the screen. If the student's reading level prevents him/her from being able to identify misrecognized words or to be able to read the contents of his/her writing, this option will not provide the student with what was said compared to what appears on the screen. In order for the student to hear what appears on the screen, the student will need to use the "Read That" option.

READ THAT OPTION-In order to hear the text that appears on the screen, the student can use the "Read That" option by highlighting the text to be read and selecting the "Read That" option.

HABITS FOR SUCCESS WITH DRAGON NATURALLY SPEAKING

There are factors that can result in the computer's efficiency that may reduce the computer's ability to accurately recognize the student's dictation. Decreased computer efficiency or high misrecognition rates can lead to student frustration and consequently result in reduced student motivation to use voice recognition as an alternate writing tool. The developers of the *DNS 5* software have suggestions to help increase the success of using this program. Following their suggestions, excluding individual differences, will maximize the student's success. Refer to chapters two and three of the *DNS 5* Users Guide.

1. Position the microphone correctly (Refer to the instructions provided by the microphone manufacturer). If the student is using the microphone that accompanies the *DNS 5* software, refer to the Quick Start Reference Guide. It is recommended that the student do a volume and audio quality check each time he/she starts using the voice recognition program.

2. "Speak properly to the computer:
   A. Speak naturally and continuously, but pronounce each word clearly.
   B. Avoid leaving out words and making extra sounds (like "um").
   C. Speak at your normal pace-talking slowly will not help.
   D. Speak in phrases-not one word at a time.
   E. Speak at your normal volume-don't whisper or speak too loudly. Shouting will not help."

3. "Prevent vocal strain
   A. Don't speak in a loud voice.
   B. Relax; stretch periodically, especially your arms, shoulders, neck and jaw.
   C. Drink water periodically. Use a straw to avoid moving the microphone.
   D. Take occasional breaks when dictating for long periods. Get up, move around and stretch."

4. Correct recognition mistakes. When the computer makes recognition mistakes, correcting the mistakes by providing the program with the correct word(s) teaches the program to not make the same mistakes in the future. Do not forget to save the student's speech files when corrections are made. The computer will prompt the student when the student quits the program. Refer to page 20 in this manual.

5. Add words to the vocabulary. Adding words to the vocabulary will minimize recognition mistakes. When a word is misrecognized by the computer, often the word is not in the program's vocabulary. Adding words to the vocabulary teaches the computer to recognize the word for future use. Refer to page 33 in the *DNS 5* Users Guide.

6. Train Dragon Naturally Speaking to recognize problem words. When a word requires correction over and over again, teaching the computer how the student pronounces the words is necessary. Refer to page 59 in the *DNS 5* Users Guide.

7. Run General Training more than once will improve the recognition accuracy. Reading additional training scripts will increase recognition accuracy. Running general training can be done as often as desired. Refer to page 10 in this manual.

8. Use the "Playback Option". Refer to page 6 in this manual.

9. Use the "Read That Option". Refer to page 6 in this manual..

THE MICROPHONE

The position and quality of the microphone is an important factor for recognition accuracy. Recognition accuracy is a key factor in the success of using voice recognition. *Dragon Naturally Speaking Version 5* comes with a headset microphone as part of the program's package. Directions for connecting the microphone to the computer can be found in the Quick Start Reference Guide.

POSITIONING THE MICROPHONE

POSITIONING A HEADSET MICROPHONE: Follow the directions that accompany the microphone. If no directions are available at the time, these are general guidelines from the *DNS 5* Quick Start Reference Guide for positioning the microphone.

1. "Position the microphone about a half-inch from the student's mouth and a little off to the side.

2. The microphone should not touch the student's mouth, but it can be almost touching their lips.

3. It is okay to touch the foam covering while adjusting the microphone, but the student should not touch the microphone while talking.

4. If the microphone needs to be moved out of the way, lift the "boom" up and over the student's head, rather than bending it out of position or removing the headset."

POSITIONING A HANDHELD MICROPHONE:

1. "The microphone should be held one to three inches from the mouth and a little off to the side.

2. If the volume display on the DragonBar turns red, have the student hold the microphone slightly farther from the mouth."

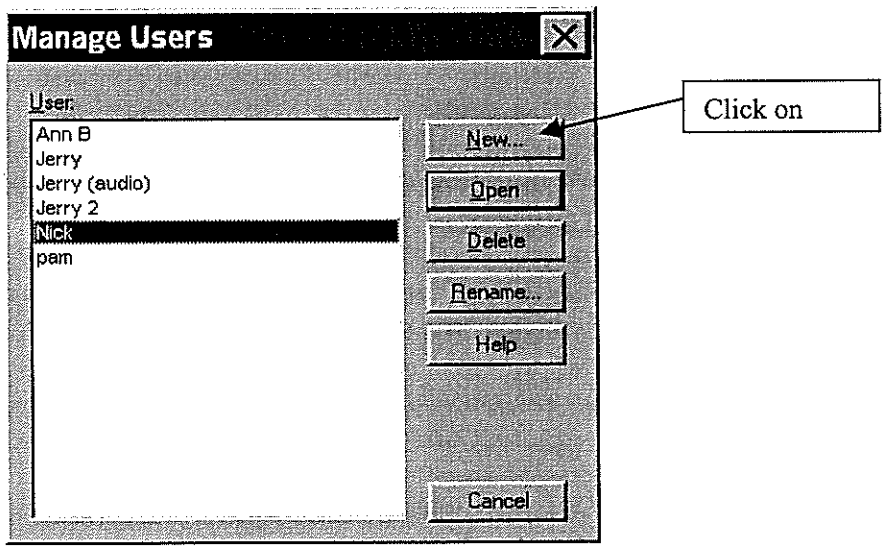
Note: For students with physical disabilities that limit the use of their hands or who have devices that assist in their breathing, microphone position can be limited by the breathing equipment. Keep in mind, students with limited breathing capacity impacted by their physical disability may not be able to vocalize loud enough if the microphone needs to be positioned far enough away so as to not pick up the sound of the equipment or extraneous sounds produced by their breathing.

GENERAL TRAINING

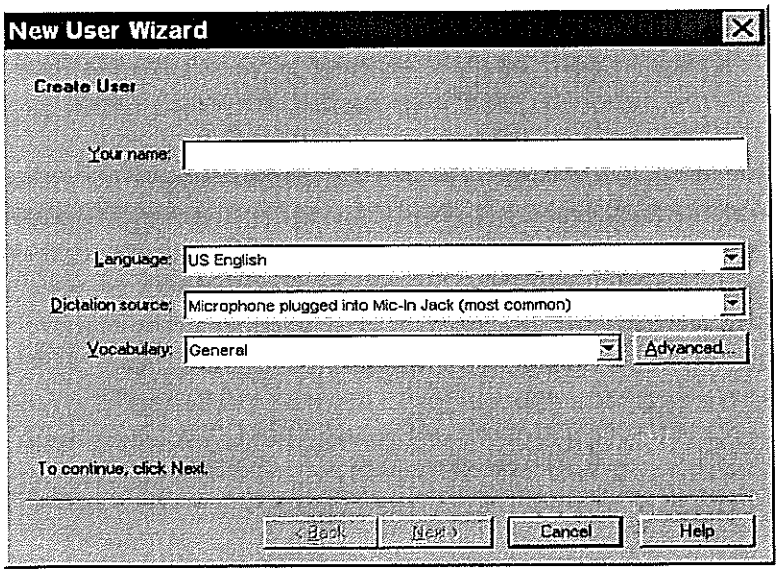
Teaching the program how the student speaks is the first step. This is accomplished by having the student build voice files by training the computer to recognize his/her voice. This requires the student to create a user voice file, check audio settings, and train *DNS 5* by reading training scripts. This process is considered the General Training aspect of the training process. Once the program has been opened, the first screen that will appear is shown below.

STEP 1:
CREATE A USER

1. Select New to create a new user by clicking on the New box.



2. Type in, or have the student type in their name in the Your name box.



3. Choose a language (dialect). Typically it will be US English. Choose the dialect that most closely matches the student's accent when they speak English. Have the student say something in English to determine the language (dialect).

4. Choose a dictation source. If the student will be dictating into a headset or handheld microphone connected to the computer, choose "Microphone plugged into Mic-In Jack."

5. Choose a vocabulary. Most adult users should use the default choice, "General". Younger speakers of U.S. English (aged 9-15) should select the "Teens" vocabulary.

STEP 2

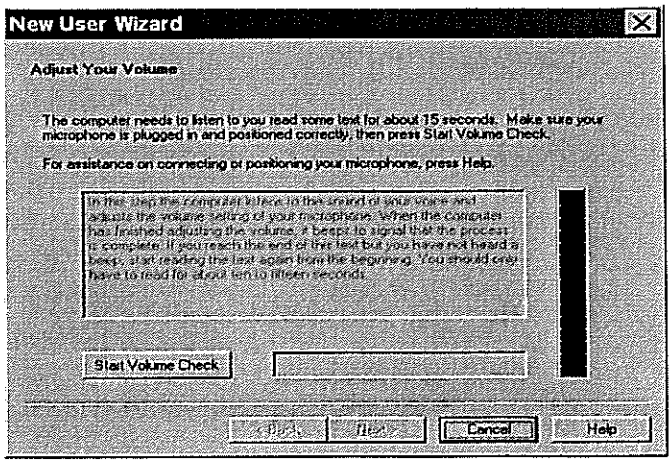
During this step, the student will need to read the text that appears on the screen, without the option of pausing between sentences for rehearsal opportunities.

CHECK AUDIO SETTINGS

1. If the student is below age 10 or reads below grade 5, copies of what will be required for the student to read should have been made available to the student prior to working with the student. If this was not completed, have the student read aloud the script in Appendix A, named Audio Settings with the microphone off. Highlight words that the student has difficulty with.

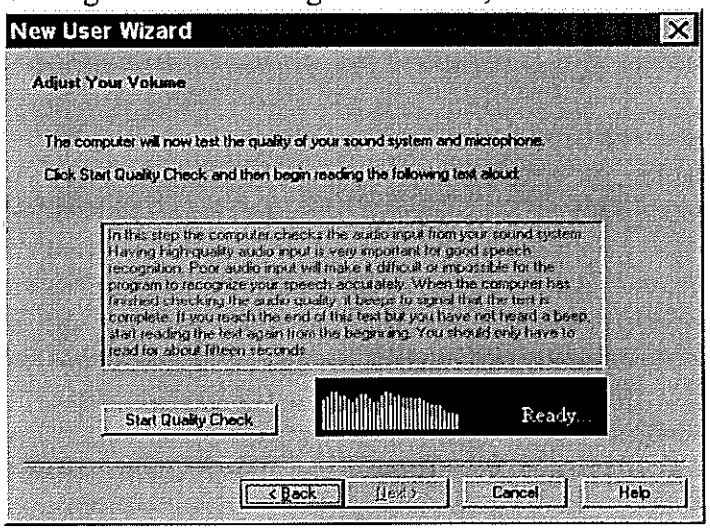
Note: Allow the student to rehearse all reading passages as often as needed for him/her to feel comfortable with the reading script.

2. Check the microphone volume by clicking on the Start Volume Check box and have the student read aloud the text in the box or the highlighted text in Appendix A. If verbal cues are needed, the trainer should sit on the side opposite of the microphone. The trainer can whisper the highlighted words into the student's ear during the reading. The trainer should try to position himself or herself so that the microphone does not pick up the trainer's voice. When the program beeps to indicate it has finished checking the volume, click Next.



3. Check the sound quality. Click on the Start Quality Check box. Have the student read the paragraph in the Audio Setting screen or he/she can use the copy of the paragraph labeled Adjust Volume located in Appendix A. Have the student read aloud the text in the box or the highlighted text. Follow number 2 in this step.

   When the program beeps to indicate it has finished checking the volume, a number will be displayed in the black box. The higher the number, the better the quality. Having 20 or greater is a target. Once the target is reached, click Next.



STEP 3

TRAIN DRAGON NATURALLY SPEAKING

This step requires the student to read scripts to train the program to the student's voice. The readings will develop a voice file so that the computer will be able to accurately recognize the student's voice during dictation.

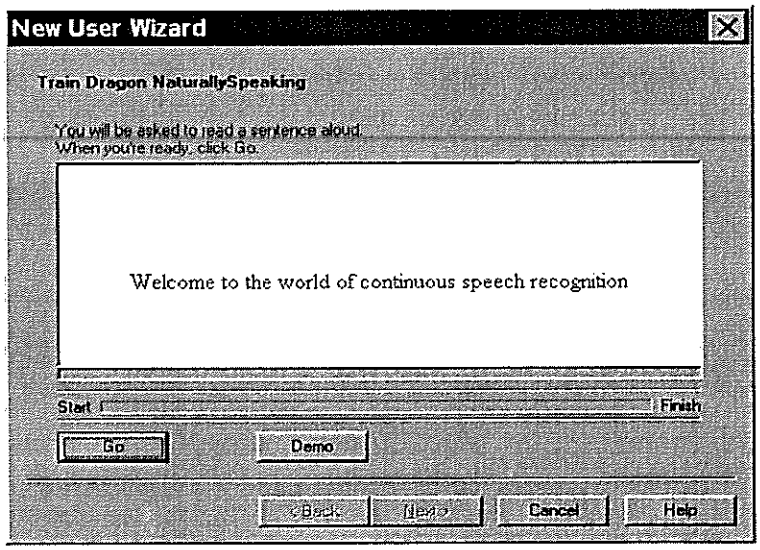
Keep in mind that students with disabilities will require frequent breaks and rehearsal opportunities to feel comfortable reading the scripts. Pausing between sentences to allow rehearsal is recommended for students that have difficulty with reading or endurance.

If the student is below age 10 or reads below grade 5, copies of what will be required for the student to read should have been made available to the student prior to working with the student. If this was not completed, have the student read aloud the selected passage in Appendix A. All scripts for *DNS 5* are available in Appendix A. Highlight all words that the student has difficulty with during the rehearsal period. This will cue the trainer to assist the student by whispering the highlighted word(s) into the student's ear.

1. A yellow arrow will appear above the word that needs to be read and shows where to start reading. Click Pause to take breaks.

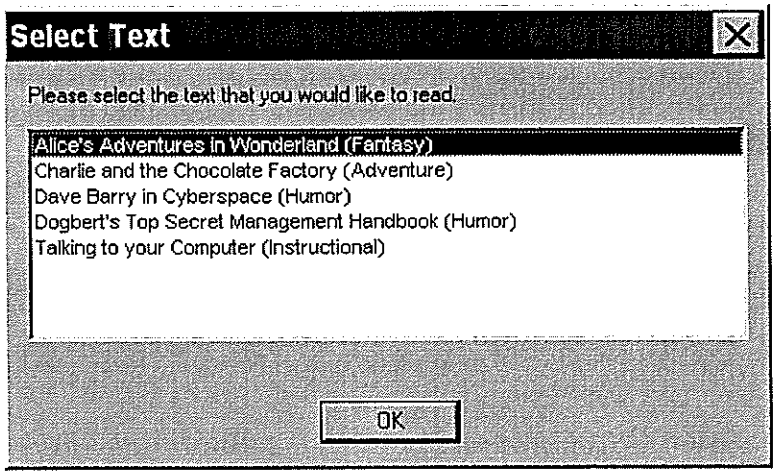
2. To advance through the first two screens, the student must say the sentences without pausing. For the rest of the screens, it is okay to pause in the middle of a sentence.

When the words turn black, it means the computer has heard and recognized them. If the student is required to read the same words, and the computer still doesn't recognize them, click on the Skip box.



3. When the student is ready click on Go. Have the student read the sentence aloud.

4. Click Next to continue.



5. Once the reading scripts appear on the screen the trainer or the student may click on Pause between sentences as needed to allow the student to rehearse the next sentence, have a drink of water, or rest.

6. A copy of the story script that the student selects should be available for the student to rehearse, highlight difficult words, etc. Copies can be made using the story scripts located in Appendix B of this training guide. This should be done prior to the training day. If it was not provided to the student prior to the general training. Have

the student read from the available hard copies of the training scripts and the trainer or the student should highlight difficult words.

7. Select, or have the student choose a text to read aloud. Sometimes, a new text will appear at the end of the one you chose, this is because the program needs a little more information about how you speak. Click on OK .

Note: During this general training process, keep in mind that frequent breaks may be necessary for students who have difficulty with reading or endurance. Avoid having students remove the microphone during the general training period to avoid having to check the audio settings.

8. When the student has completed reading all scripts that appear on the screen, general training is complete.

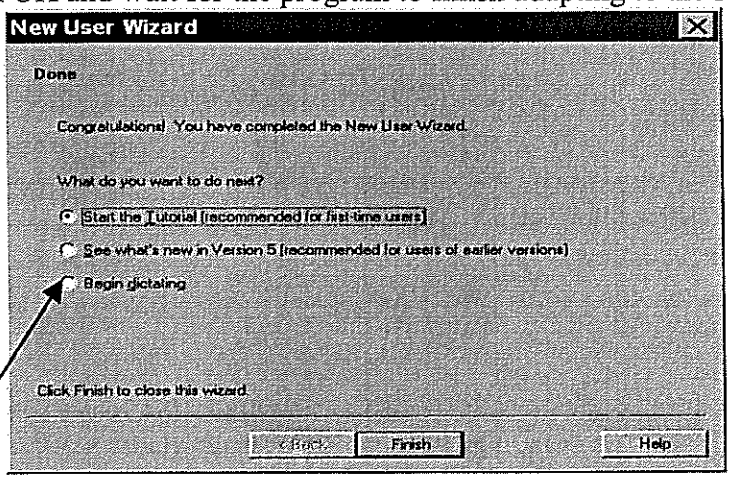
Note: There are two ways to dictate text. The first is to dictate using the DragonPad and the other is to dictate into a word processing program, such as; Microsoft Word. The first method will be used because using a word processing program will not allow the student to hear their dictation in their own voice that may be necessary to compare what was said to what appears as text on the screen. The comparison enables the student to identify words that the computer misrecognizes and allows the student to make the correction needed to improve their recognition accuracy.

STEP 4

CONGRATULATIONS! YOU'RE READY TO DICTATE

When the student has finished dictating, a message saying "Congratulations! You have finished the training" will appear. Click OK, and the program will spend a few minutes adapting and saving the student's speech files."

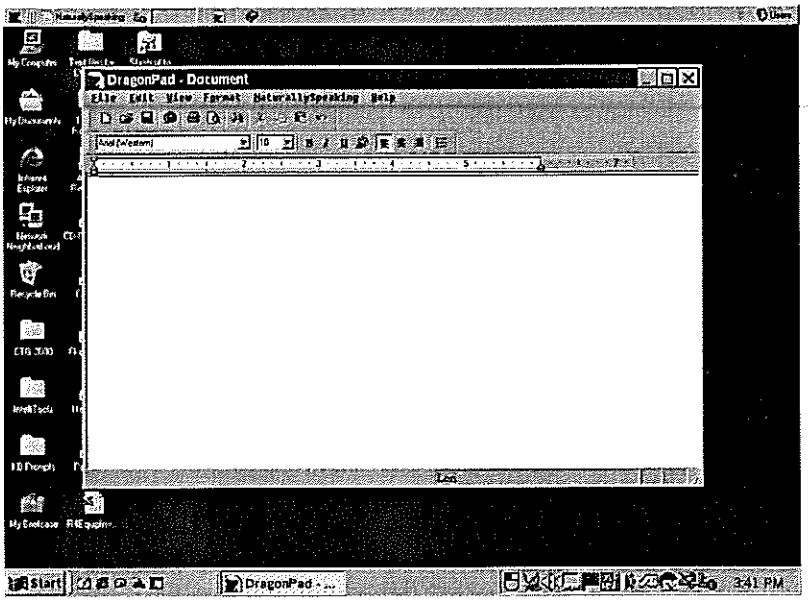
1. Click OK and wait for the program to finish adapting to the student's voice.



2. Once the program has finished saving the student's voice files, Click on Begin Dictating. The black dot will appear in the circle.

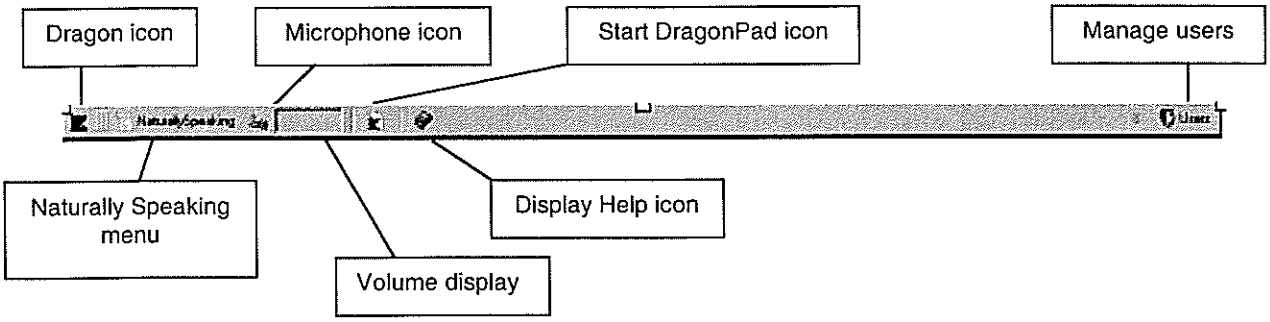
3. Click on Finish.

4. The DragonPad screen will appear: DragonPad is where the dictated text will appear as the student speaks. See below:



The DragonBar is located at the top of the computer screen. The DragonBar can be used to control the program.

5. The DragonBar.



- **Dragon icon:** "Click on the icon (or right-click anywhere on the DragonBar) to display a menu that controls how the DragonBar looks and acts on the screen."

- **Naturally Speaking menu:** "Contains all the menu commands that you can use while working in Dragon Naturally Speaking."

- **Microphone icon & volume display:** "To turn speech recognition on and off, click on the microphone icon."

- "The volume display indicates how well the program is hearing your voice. To the right of the microphone, a yellow bar fluctuates as the student speaks."

- **Start DragonPad icon:** "To open the DragonPad (Dragon Naturally Speaking built-in word processor)."

- **Display Help icon:** "This is to open the Dragon Naturally Speaking online Help."

- **Manage users:** "To display a menu that contains a list of the users, and a command that opens the Manage Users dialog box."

The following sections are designed to teach the student on the features to increase their independence using *DNS 5*. This section is arranged by approximate days to complete the training. The 3 days of instruction is only an estimate. The time needed for the student to accomplish learning the following features depends on the amount of time the trainer has to work with the student and the speed at which the student is able to learn new tasks. Following the sequence of teaching each feature at the student's pace is recommended. Teaching may require repeating each section as often as needed for the student to have more practice opportunities to learn a new feature. Changing the order of teaching the student new features should depend on the student's needs. For example, a student who must rely on verbal commands to control the microphone would likely need to learn how to control the microphone rather than learning how to use the Playback or Read That options.

If it becomes evident that the student demonstrates difficulty generating his/her own thoughts to dictate after sufficient opportunities for practice, perhaps DNS 5 is not an appropriate solution to produce written text for the student.

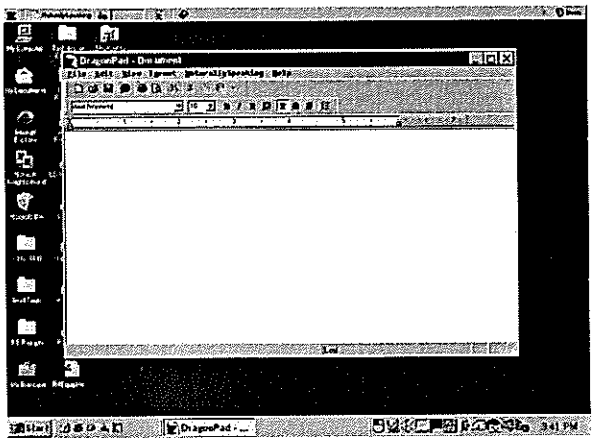
DAY 1

The first dictation is typically done by having the student read a few sentences or a paragraph from a book that the student is able to read with ease. This will enable the student to compare what is said to what appears on the screen. The next step is to have the student dictate 1-2 sentences that they generate themselves. Some assistance may be necessary to help the student with topics they may want to write about.

Note: If the student needs a break, keep in mind that a volume and quality check of the microphone will need to be completed before beginning the next steps. Go to Step 2, Check Audio Settings.

STEP 1: DICTATING A READING PASSAGE.

1. Have a copy of the Commands List (located in Appendix C of this manual or in the *DNS 5* Quick Reference Guide) and a book at the level the student is able to read.



2. Select a reading passage of approximately two sentences. Avoid selecting sentences with commas, quotes or apostrophes.

Note: This will allow the student to compare recognition accuracy of what the student said to what appears on the computer screen.

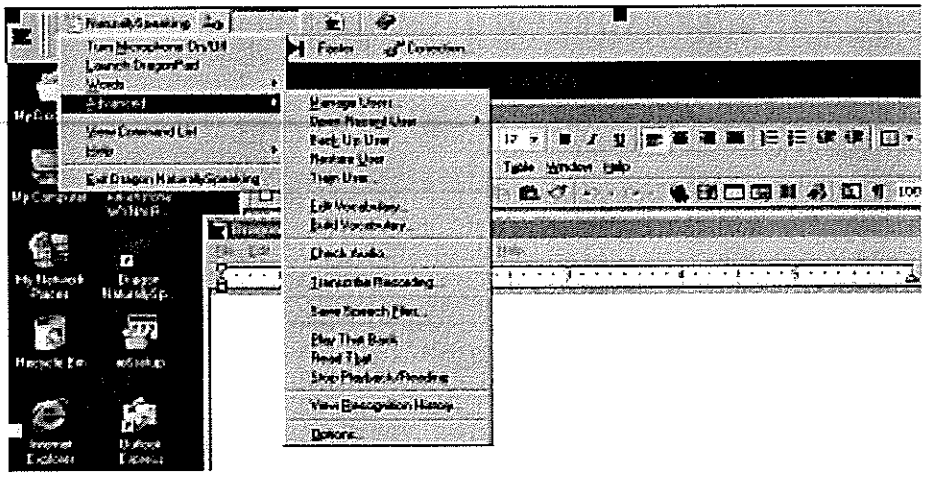
3. Have the student dictate/read the selected sentences (microphone on).

Note: Prompt the student to say "period" after the dictated sentences.

4. Have the student compare the sentences from the source (book, magazine, etc.) and what appears in the Dragon Pad.

5. After highlighting the text and using the DragonBar, have the student click on the Naturally Speaking icon, scroll to Advanced, and scroll to Play That Back. The student will be able to hear what was said.

6. Using the DragonBar, have the student click on the Naturally Speaking icon, scroll to Advanced, and scroll to Read That.



Note: For students who are unable to use a mouse to select menu items, he trainer should do numbers 5 & 6 for the student.

6. If corrections are needed: Go to page 20 of his manual.

7. If sentences are 100% accurate, Go to Step 2.

STEP 2: DICTATING SELF GENERATED SENTENCES.

1. Have the student rehearse 1-2 self-generated sentences out loud (microphone off).

Note: Some students may need some help with ideas, topics, etc.

2. Have the student dictate the previously rehearsed sentences (microphone on).

3. After highlighting the text and using the DragonBar, have the student click on the Naturally Speaking icon, scroll to Advanced, and scroll to Play That Back. The student will be able to hear what was said.

4. Using the DragonBar, have the student click on the Naturally Speaking icon, scroll to Advanced, and scroll to Read That.

5. If corrections are needed: Go to page 20 of this manual.

6. If no corrections are needed, have the student dictate the same sentences with a few incorrect words.

7. Go to page 20 and follow the steps for Correcting Recognition Mistakes.

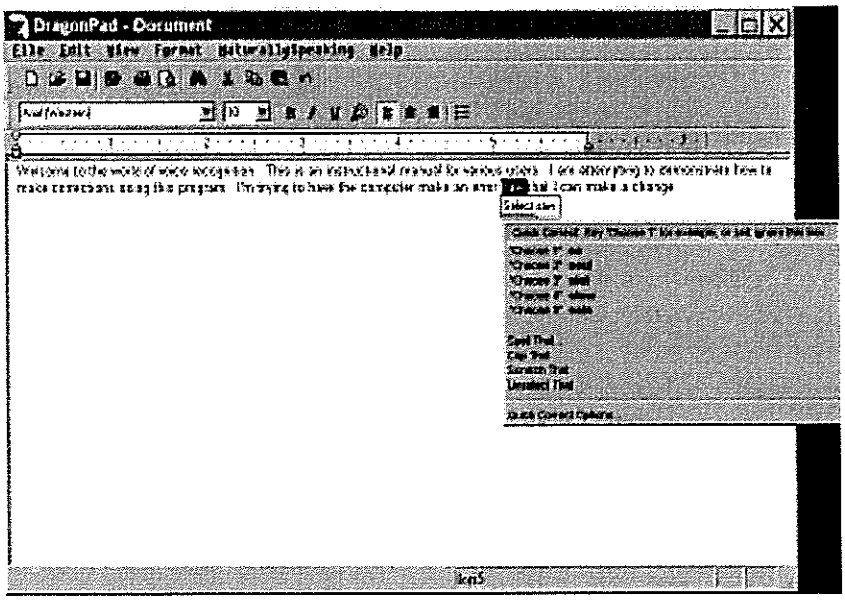
CORRECTING RECOGNITION MISTAKES

There are two options to correct recognition mistakes. Option 1 is the Quick correct process that requires the student to select, by highlighting, the misrecognized word, which leads to the Quick Correct List to appear on the screen. The student then makes a choice by selecting the word using the mouse if the word the student wants appears as one of the 5 choices on the list. If the word the student wants does not apear on the screen, the student will need to begin spelling the word for other choices to appear on the list.

Option 2 uses the correction dialog box, which teaches the computer how the word is spoken. This option will reduce the likelihood that mistakes will occur again.

OPTION 1: Quick Correct

1. Have the student say: "select misrecognized word". The Quick Correct list will appear. See below.



2. Have the student choose the correct word from the Quick Correct list by saying "Choose 1,2,3,4, or 5". If the word, the student said or want, does not appear on the list, have the student say, "Spell That" or "Correct That" and have the student begin to spell the word. If the word appears on the list, have the student say "Choose 1,2,3,4, or 5".

Note: If the student is able to use the keyboard, you can have the student begin typing in the word.

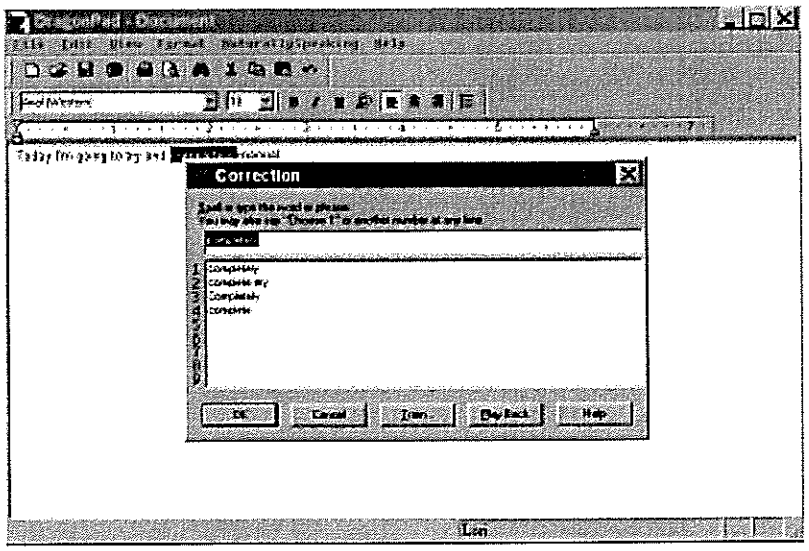
OPTION 2: Correction Dialog Box

Note: Using the correction dialog box will reduce the likelihood that the misrecognized word will occur again.

1. Have the student say "Select misrecognized word(s) or phrase".

2. Have the student say "Spell That" or "Correct That".

3. When the Correction Dialog Box appears on the screen, if the correct word or phrase is in the list of choices, have the student say "Choose 1,2,3,4 …".



4. If the correct choice is not on the list, have the student begin to enter the correct text by spelling the correct the correct word or phrase. If the student is able to use the keyboard, have the student begin to type in the correct word or phrase. If the correct word or phrase then appears on the list of choices, have the student say "Choose 1,2,3…) or continue to spell or type until the word or phrase is completed.

5. If the student is unable to read the text on the screen, have the computer read back the text on the screen. After highlighting the text and using the DragonBar, have the student click on the Naturally Speaking icon, scroll to Advanced, and scroll to Read That.

Note: If the student is able to use the keyboard, you can have the student begin typing in the word.

5. Have the student dictate the same sentences again.

6. Have the student check the text for any recognition mistakes. If recognition mistakes are present, have the student make any correction using options 1 or 2.

7. Allow the student to use the Playback Option and Speech-to-text option by following steps 3 & 4 in the Dictating Self-generated Sentences section.

If the student is able to make corrections without assistance, have the student dictate another 2-3 self-generated sentences and allow the student to make corrections as needed (page 22).

If the student is unable to make corrections without assistance, have the student dictate a new sentence and work on making corrections using options 1 or 2 with assistance by the trainer or allow the student to use the keyboard to make any corrections (page20).

Students with physical limitations who are unable to use the keyboard will need to continue to practice making corrections using options 1 or 2.

DAY 2

Day 2 will consist of having the student review the correction procedures, learn how to control the microphone using voice commands, dictating punctuation, special characters and numbers.

REVIEWING CORRECTION PROCEDURES

Have the student dictate 2-3 sentences and make corrections using Option 1 or 2. If the student is unable to make the corrections without assistance, follow the Correcting Recognition Mistakes section. Continue to work on corrections until the student is able to make corrections without assistance using voice commands (Option 1 or 2) or using the keyboard. Follow procedures from pages 18-22.

CONTROLLING THE MICROPHONE

The microphone can be controlled using voice commands or using the DragonBar.

1. Have the student turn on the microphone, using the DragonBar, by clicking on the microphone icon.

2. Have the student say "Go to sleep". The microphone icon will change from a 45 degree angle to a horizontal position. The microphone stops listening temporarily.

3. Have Student a say "Wake up". The microphone icon will change from a horizontal position to a 45 degree angle.

4. Have the student repeat numbers 2 & 3 several times.

5. Have the student say "Microphone off". This command turns off the microphone. The student will not be able to reactivate the microphone through voice commands. The microphone can only be reactivated by clicking on the microphone icon.

DICTATING PUNCTUATION AND SPECIAL CHARACTERS

1. Instruct the student to generate a question.

2. Have the student dictate the question ending the dictation by saying "Question mark".

3. Have the student dictate another sentence and ending the dictation by saying "Exclamation point or Exclamation mark".

4. Using the *DNS 5* Quick Reference Guide, have the student dictate other punctuation and special characters.

DICTATING NUMBERS

Using the *DNS 5* Quick Reference Guide, have the student dictate numbers in the Entering Numbers Section of the Guide.

DAY 3

Day 3 will consist of teaching the student to add new lines and paragraphs, erasing and undoing, and using the number mode. The *DNS 5* Quick Reference Guide can be used to instruct the student with the exception of using the numbers mode.

ADDING NEW LINES AND PARAGRAPHS

1. Have the student dictate a sentence or number.

2. Have the student say "New line". The cursor will move to the next line. Have the student dictate a sentence.

3. Have the student say "New paragraph". The cursor will move as if the enter key was pressed twice. Have the student dictate a sentence.

Note: Have the student make any corrections if needed during any dictation.

ERASING AND UNDOING

1. Have the student dictate a sentence.

2. Have the student say "Scratch that". This command will erase the last thing that was said. "Scratch that" can be said up to 10 times to keep erasing previous words or phrases. Have the student finish the sentence as desired.

3. Have the student dictate another sentence.

4. Have the student say "Undo that". The computer will undo the last action that was done.

USING THE NUMBERS MODE

The numbers mode allows the student to dictate numbers and control whether the computer recognizes the dictation as words or numbers. With the numbers mode on, the computer will recognize it as numbers and not words. With the numbers mode off, dictated numbers will appear as words. There are two ways to turn the numbers mode on or off; using the DragonBar or using voice commands.

1. Have the student use the DragonBar to turn the numbers mode off. Have the student click on the Naturally Speaking Menu, scroll to Words, and then to the Numbers Mode.

2. Have the student dictate a three digit number. The dictation should appear as words on the screen if the numbers mode was turned off.

3. Have the student say "Numbers mode on" or "Start numbers mode" followed by a three digit number. The dictation should appear as numbers if the numbers mode was turned on.

4. Have the student say "Numbers mode off" or "Stop numbers mode" followed by a 3 digit number. The dictation should appear as words on the screen if the numbers mode was turned off.

Once you have completed the instruction up to this point the trainer should assess the level of independence the student demonstrates when producing written composition. The trainer should also assess recognition accuracy and determine whether running general training again is necessary to improve recognition accuracy.

If the student has a physical disability that limits his/her ability to use his/her hands, general training may take longer and teaching each feature may also require additional practice. The trainer will also need to determine the extent of further instruction so that the student will be able to independently navigate through the *DNS 5* program. This would require teaching the student how to use voice commands to navigate through the menu and transporting text from the DragonPad to a word processing program. Instruction in these areas can be accomplished using the *DNS 5* Quick Start Reference Guide.

If the trainer feels that additional training on other features that are not covered in this instructional manual are necessary, the trainer can refer to the *DNS 5* Users Guide for instructions.

APPENDIX A

Appendix A contains the training scripts for the audio settings, the volume check, and the first two sentences for the training *DNS 5* to recognize the student's voice. The scripts are presented word for word as they will appear on the computer screen.

FIRST TWO SENTENCES AND AUDIO SETTINGS

First Two Sentences for Step 3

"Welcome to the world of continuous speech recognition."

"Training is about to begin."

Audio Settings

Volume Check

"In this step the computer listens to the sound of your voice and adjusts the volume setting of your microphone. When the computer has finished adjusting the volume, it beeps to signal that the process is complete. If you reach the end of this text but you have not heard a beep. Start reading the text again from the beginning. You should only have to read for about ten to fifteen seconds."

Quality

"In this step the computer checks the audio input from your sound system. Having high quality audio input is very important for good speech recognition. Poor audio input will make it difficult or impossible for the program to recognize your speech accurately. When the computer has finished checking the audio quality, it beeps to signal that the test is complete. If you reach the end of this text but you have not heard a beep, start reading the text again from the beginning. You should only have to read about fifteen seconds."

APPENDIX B

Appendix B contains the training story scripts the student will need to read during the general training process. The following story scripts appear exactly as they will appear on the computer screen. These scripts should be copied and provided to the educational staff and the student if the student does not meet the reading or spelling criteria on the student criteria checklist. Provision of these story scripts will enable the student to have practice opportunities to learn difficult words prior to working with the student. It is recommended students highlight difficult words and to have the highlighted copy available on the day the trainer will work with the student.

TRAINING STORY SCRIPTS

Alice's Adventures in Wonderland

"Alice's Adventures in Wonderland by Lewis Carroll

Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do: once or twice she had peeped into the book her sister was reading, but it had no pictures or conversations in it, and what is the use of a book, thought Alice without pictures of conversation?

So she was considering in her own mind (as well as she could, for the hot day made her feel very sleepy and stupid), whether the pleasure of making a daisy-chain would be worth the trouble of getting up and picking the daisies, when suddenly a White Rabbit with pink eyes ran close by her.

There was nothing so VERY remarkable in that, nor did Alice think it so VERY much out of the way to hear the Rabbit say to itself, "Oh dear! Oh dear! I shall be late!" (when she thought it over afterwards, it occurred to her that she ought to have wondered at this, but at the time it all seemed quite natural);

But when the Rabbit actually TOOK A WATCH OUT OF ITS WAISTCOAT-POCKET, and looked at it, and then hurried on, Alice started to her feet, for it flashed across her mind that she had never before seen a rabbit with either a waistcoat-pocket, or a watch to take out of it, and burning with curiosity, she ran across the field after it, and fortunately was just in time to see it pop down a large rabbit-hole under the hedge.

In another moment down went Alice after it, never once considering how in the world she was to get out again.

The rabbit-hole went straight on like a tunnel for some way, and then dipped suddenly down, so suddenly that Alice had not a moment to think about stopping herself before she found herself falling down a very deep well.

Either the well was very deep, or she fell very slowly, for she had plenty of time as she went down to look about her and to wonder what was going to happen next.

First, she tried to look down and make out what she was coming to, but it was too dark to see anything, then she looked at the sides of the well, and noticed that they were filled with cupboards and bookshelves; here and there she saw maps and pictures hung upon pegs.

She took down a jar from one of the shelves as she passed; it was labeled 'ORANGE MARMALADE', but to her great disappointment it was empty: she did not like to drop the jar for fear of killing somebody, so managed to put it into one of the cupboards as she fell past it.

'Well !' thought Alice to herself, 'after such a fall as this, I shall think nothing of tumbling down stairs! How brave they'll all think me at home! Why, I wouldn't say anything about it, even if I fell off the top of the house (Which was very likely true.)

Down, down, down. Would the fall NEVER come to an end! 'I wonder how many miles I've fallen by this time?' she said aloud. 'I must be getting somewhere near the center of the earth.

Let me see: that would be four thousand miles down, I think—'(for, you see, Alice had learnt several things of this sort in her lessons in the schoolroom, and though this was not a VERY good opportunity for showing off her knowledge, as there was no one to listen to her, still it was good practice to say it over)

'—yes, that's about the right distance—but then I wonder what Latitude or Longitude I've got to?' (Alice had no idea what Latitude was, or Longitude either, but thought they were nice grand words to say.)"

Charlie and the Chocolate Factory (Adventure)

"Dragon Systems is pleased to acknowledge Roald Dahl and the David Higham Agency for their permission to use selections from Roald Dahl's novel, "Charlie and the Chocolate Factory," in this training program.

If after reading the following chapters, you want to find out what happens, you can purchase the book, published by Alfred A. Knopf, Inc. and Penguin Books, at your local bookstore.

Chapter 10: The family Begins to Starve

Dave Barry in Cyberspace (Humor)

"Dragon Systems is pleased to acknowledge Dave Barry and Crown Publishers for their permission to use selections from Dave Barry's book, "Dave Barry in Cyberspace," in this training program.

Dogbert's Top Secret Management Handbook (humor)

"Dragon Systems is pleased to acknowledge Scott Adams and Harper Business, a division of Harper Collins Publishers, for their own permission to use excerpts in this training program from Scott Adams' book, DOGBERT'S TOP SECREAT MANAGEMENT HANDBOOK, as told to Scott Adams, author of The Dilbert Principle.

Background

INTRODUCTION

Talking to Your Computer (Instructional)

"We'd like you to read aloud for a few minutes while the computer listens and learns how you speak. When you've finished reading, we'll make some adjustments, and then you'll be able to talk to your computer and see the works appear on your screen. In the meantime, we'd like to explain why talking to a computer is not the same as talking to a person and then give you a few tips about how to speak when dictating.

Understanding spoken language is something that people often take for granted. Most of us develop the ability to recognize speech when we're very young. We're already experts at speech recognition by the age of three or so.

When people first start using speech-recognition software, they might be surprised that the computer makes mistakes. Maybe unconsciously we compare the computer to another person. But the computer is not like a person. What the computer does when it listens to speech is different from what a person does.

The first challenge in speech recognition is to identify what is speech and what is just noise. People can filter out noise fairly easily, which lets us talk to each other almost anywhere. We have conversations in busy train stations, across the dance floor, and in crowded restaurants. It would be very dull if we had to sit in a quiet room every time we wanted to talk to each other!

Unlike people, computers need help separating speech sounds from other sounds. When you speak to a computer, you should be in a place without too much noise. Then you must speak clearly into a microphone that has been placed in the right position. If you do this, the computer will hear you just fine, and not get confused by the other noises around you.

A second challenge is to recognize speech from more than one speaker. People do this very naturally. We have no problem chatting one moment with Aunt Grace, who has a high, thin voice, and the next moment with Cousin Paul, who has a voice like a foghorn. People easily adjust to the unique characteristics of every voice.

Speech-recognition software, on the other hand, works best when the computer has a chance to adjust to each new speaker. The process of teaching the computer to recognize your voice is called "training." And it's what you're doing right now.

The training process takes only a few minutes for most people. For a small percentage of speakers, extra training can significantly improve results. If, after you begin using the program, you find that the computer is making more mistakes than you expect, additional training may help.

Another challenge is how to distinguish between two or more phrases that sound alike. People use common sense and context—knowledge of the topic being talked about—to decide whether a speaker said "ice cream" or "I scream."

Speech-recognition programs don't understand what words mean, so they can't use common sense the way people do. Instead, they keep track of how frequently words occur by themselves and in the context of other words. This information helps the computer choose the most likely word or phrase from among several possibilities.

Finally, people sometimes mumble, slur their words, or leave out altogether. They assume, usually correctly, that their listeners will be able to fill in the gaps. Unfortunately, computers won't understand mumbled speech or missing words. They only understand what was actually spoken and don't know enough to fill in the gaps by guessing what was meant.

To understand what it means to speak both clearly and naturally, listen to the way newscasters read the news. If you copy this style when you use Dragon Naturally Speaking, the program should successfully recognize what you say.

One of the most effective ways to make speech recognition work better is to practice speaking clearly and evenly when you dictate. Try thinking about what you want to say before you start to speak. This will help you speak in longer, more natural phrases."

APPENDIX C

Appendix C is a list of commands to be used to control the *DNS 5* software. The commands list can be copied and/or enlarged to meet the student's needs. The commands list is especially helpful for students who must use voice commands because they are not able to access the keyboard with their hands. Having the list available can help to reduce extraneous sounds that can be caused by talking to the student. Keep in mind that students must be able to read each command in order for the commands list to be useful.

Place the commands list in a location where it is completely visible to the student. The list is to be used to reduce the amount of verbal cues to the student. The trainer is encouraged to point to a command for the student to say rather than talking to the student.

COMMANDS LIST

Go to sleep	Cut that
Wake up	Delete that
Select_____	Unselect that
Select again	Insert after _____
Correct _____	Insert before _____
Spell…	Cap _____
Choose _____	Backspace
Scratch that	Go to bottom

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CHAPTER 5

Summary and Conclusions

Summary

An adaptation of a training manual was developed for this project. The intent of the instructional manual was to provide trainers with a step-by-step process for teaching students with disabilities to use VRT software, *Dragon Naturally Speaking.* The manual was designed for use as a supplement to the *Dragon Naturally Speaking* manual that is provided by the software developer. The user criteria checklist was based on the recommendations listed in the research literature on characteristics to evaluate when considering students in the use of VRT. It was developed to assist the trainer in determining whether a student would be a candidate for VRT and to provide the trainer with student specific information on the type of modifications that will be needed while teaching the student with disabilities to use VRT.

The application opportunities to evaluate the instructional manual, did not allow instruction in all the areas included in the manual. In four sessions working with Student A, instruction included; completing general training, correcting recognition mistakes, and controlling the microphone

using voice commands. Extraneous sounds made by the student's phrenic nerve pacer produced many unintended words that required numerous corrections. It was decided that the student's current system (i.e. Morse code) was more efficient. Training was discontinued.

Student B was able to operate the software independently after the first training session. It was evident that Student B would be able to follow the directions in the User's Guide that accompanies the software program without any special adaptations.

Student C required further instruction on speech consistency after the first training session. At the teacher's request, no further instruction was conducted with Student C. Student C was seen towards the later part of his senior year and time was a constraint. Student C's teacher felt that he knew enough to be able to produce his written assignments before graduation. Student C's teacher indicated that since Student C has been exposed to VRT, he would be able to obtain the software if he is interested in using VRT in the future. Training was discontinued.

Changes to the manualwere made spontaneously during the training due to each student's needs. For example, student C needed to learn the "Read that" option to listen to the text on the screen to compensate for

his reading limitation. Student A required voice commands to operate the microphone due to her physical limitations that does not allow her to use her hands. The modifications contributed to the final adaptation of the manual.

Conclusions

Anyone choosing to teach students to use VRT should seriously consider the length of time that would be available for access to the VRT, such as the loan period for adaptive technology products from the SETC.

The design of the instructional manual was done in a manner that would provide a step-by-step process for working with students with disabilities in the use of VRT. Despite the three day design, it is evident that the order in which specific sections are taught can be changed depending on the needs of the student.

Components of the instructional manual, such as, the sequence of steps during the general training process, some of the training story scripts in Appendix B, the correction procedures, and the use of the commands list in Appendix C appear to be applicable with the upgrade in the *Dragon Naturally Speaking* software. Although the some of the training story scripts may no longer be the same for upgraded versions of

the software, the student criteria checklist, preparation checklist/set-up, helpful hints, and the process of instructing students to learn how to operate the software many continue to be useful.

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