

Integrating Assistive Technology in the Vocational Evaluation Process for Individuals with Severe Multiple Disabilities – Understanding Adapted Access

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Abstract

Technological advancements have meant increased independence for many individuals with severe physical disabilities. Students in Fairfax County Public Schools in Virginia, as well as in other school districts, have access to a variety of assistive technology resources to permit more independent participation in the education curriculum, school programs, vocational evaluation, and career and transition programs.

Adapted access can be as simple and non-restrictive as using keyboard commands for a variety of functions or customizing a computer through the accessibility features of Windows, to more restrictive approaches such as scanning and switch access.

Individuals referred for vocational evaluation services may already be using an alternative or adapted computer access. In this case, it is important for the evaluator to be familiar with the access and how it might allow the individual to complete work tasks. Others referred for vocational evaluation services may not have had the opportunity to experience any form of alternative access. In these cases, it is important for the evaluator to be aware of the possibilities and what assistive technology will work most effectively for the individual. This paper discusses the many alternative and adapted computer access options available as well as why and when specific options should be applied.

Introduction

The advent of computers as well as on-going technological advancements has meant increased independence for individuals with severe multiple disabilities, including physical, sensory, and cognitive limitations. Adapted computer access provides ways in which these individuals can perform more activities independently, whether these activities relate to school, work, or home. Students in Fairfax County Public Schools in Virginia, as well as in other school districts, have access to assistive technology resources to permit more independent and successful participation in the education curriculum and school programs. Increased participation in school career and transition programs is another benefit resulting from creative use of assistive technology and adapted computer access.

Assistive Technology (AT) as defined by the Technology-Related Assistance for Individuals with Disabilities Act of 1994 (PL 103-218) is “any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized,

that is used to increase, maintain, or improve functional capacities of individuals with disabilities” (VECAP, 1997). AT can be as simple and non-limiting as using the accessibility features of Microsoft Windows, or include more restrictive approaches such as scanning and switch access. This paper will discuss ways to adapt computer access according to an individual’s strengths and needs. Special attention is paid to preparing students with severe multiple disabilities for transition from high school to career activities.

Adapted Access: The Concept of Least Restrictive to Most Restrictive

Adapted access as discussed in this paper refers to any alternative means or special device that allows access to the computer when standard access is barred due to disability. Adapted access can include a variety of approaches including alternative keyboards, trackball mouse, keyboard mouse functions, infrared mouse, augmentative/alternative communication (AAC) devices, switch/scanning, speech recognition software, pointing devices, virtual keyboards, alternative key layouts, and screen readers.

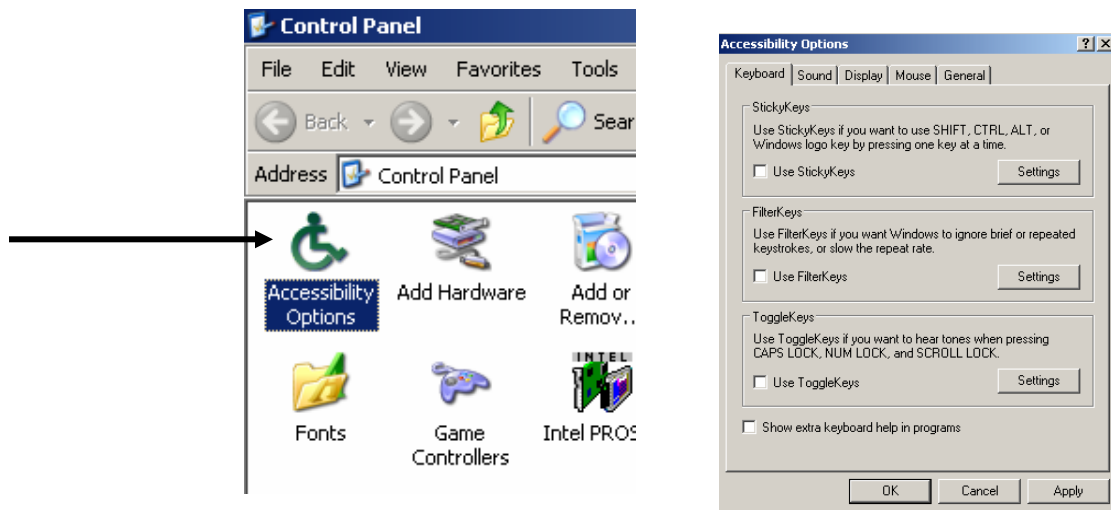
The concept of least restrictive to most restrictive is basically one of common sense. The desire is to have the student access the computer in the most ordinary manner possible, thus eliminating the need to purchase specialized equipment. For example, it would be most desirable for the student to use a standard QWERTY keyboard with a mild adaptation such as “sticky keys”, a Windows feature that eliminates having to physically hold down keys simultaneously to activate commands (example: ctrl, alt, delete), or a key guard to help ensure only the desired key is depressed. It is important to strive for the computer access that will require the least accommodation and job modification on a work site. The more extraordinary the adaptations, the more likely that issues may arise related to career assessment, work site placement, staff and student training, and potential malfunctions. This is not to say that necessary adaptations should be avoided for those who need it.

In order to determine the most appropriate computer access for an individual several issues need to be considered including motor movements. What is the student’s range of motion? Can he or she reach all four corners as well as the top and bottom of a standard keyboard? Can the student point with any of his or her fingers and if not, can he or she point using a hand held pointer, head stick, or light pointer (Infrared). Are these movements done independently, or with some preparation such as positioning? If the answer to all of these questions is no, then a more restrictive type of computer access would be necessary, such as scanning and switch use. Other factors to consider are the student’s cognitive abilities and sensory skills. Some computer access tools and strategies are more complex than others. Adjustments for auditory feedback are generally possible as are adjustments for visual difficulties. It is extremely important to remember that it may take months and even years for the student to use an adapted access optimally. The more complicated the access is, the more training and time are required in order to achieve success.

Direct Selection Access

Direct selection refers to the method where individuals physically select the keys to be pressed. Brown, et al (1989) state that keyboard access falls into two general categories: direct selection and scanning. Scanning systems will be discussed later in the paper. The following adaptations described in this section are based on direct selection options.

Accessibility Features of Windows: There are several keyboard modifications that can be made through the Windows accessibility features or through other features in the operating system. Each new version of the Windows operating system seems to offer more in terms of access capability. Common features for those individuals with impacting motor issues are the Sticky Keys and Filter Keys. When activated, Sticky Keys will perform the key commands that require more than one key to be pressed simultaneously, without having to hold down each key in the sequence. Filter Keys will slow down or eliminate the repeat rate when a key is held down. Both of these options are found in the Control Panel under Accessibility Options.



Other computer accessibility features found in the Accessibility Options include adjusting the thickness and blinking rate of your on-screen cursor, changing the contrast of fonts and backgrounds for easier reading, and using Mouse Keys to control the pointer. The latter feature allows use of the numeric keypad, rather than the mouse, to control the movements and direction of the pointer on the screen.

Key Guards: Key guards fit over the keyboard and are made of thick clear plastic or sometimes metal. They are made from a template of the keyboard and have

individual cut-outs for each key. This permits individuals with very limited motor control to press the desired key without inadvertently pressing other keys. Key guards are often available from the manufacturers of specialty keyboards.

Alternative Keyboards: There are several alternatives in terms of keyboards. Some keyboards are manufactured specifically for individuals with disabilities; others have been marketed as having better ergonomic attributes or functionality for the general population. This paper presents only a handful of the assistive technology tools available on the market to increase computer access for people with disabilities. An Internet search related to specific keyboard, mouse, and computer needs will yield many more options and information regarding computer access adaptations.





Table 1 lists several keyboard options, keeping in line with the concept of least restrictive to most restrictive. *Table 2* provides some examples of the various keyboards.

Keyboard	Description	When Appropriate
Compact keyboards	Keys are standard size but keyboard itself is more compact	Individuals with use of one hand; individuals with limited range of motion
Large key keyboards	Keys are approximately 1 square inch with ½ inch letters; QWERTY or ABC layout	Individuals with poor motor control; low vision
Alternative key layout	ABC layout – keys are arranged in alphabetical order	Individuals who will not become proficient at two-hand touch typing because of finger and manual dexterity issues and who are well versed in the alphabet but unfamiliar with the QWERTY layout
	Dvorak – layout was intended to be simpler to learn, less fatiguing, and more efficient than the standard QWERTY keyboard; layout of keys is based on the most commonly used letter combinations; there are Dvorak layouts for two or one handed typists	<ol style="list-style-type: none"> 1) Individuals who use two hands to type but may be prone to rapid fatigue 2) Individuals with use of one hand or who use a pointer/wand to select keys
Membrane keyboards	Keyboard has a flat surface and requires little pressure to select keys; many membrane keyboards are enlarged and use overlays for various key arrangements	Individuals with significant physical, visual or cognitive difficulties
	Tash Mini-keyboard -membrane keys are akin to standard key size and are closely spaced for easy access; keyboard surface is very sensitive and requires only light pressure to select keys; comes in standard QWERTY or frequency of use key layouts; can control both key and mouse functions from keyboard	Individuals with weak hand strength and limited range of motion but fairly good motor control

Table 1

Keyboard	Description	When Appropriate
On-screen keyboards	Software programs that provide on-screen keyboards for use with any pointing device (mouse, trackball, pointer); Users point and click on a virtual keyboard on the computer screen; these work with any application	Individuals with very limited motor control but ability to use pointer or trackball mouse
	Fitaly – On-screen keyboard; Layout of keys is based on letters used most frequently in the English language; two large space keys are provided to minimize distance from any letter to the space bar; finger and hand travel is minimized; designed for use on PDAs but onscreen version is available for Windows	Individuals with very limited motor control but ability to use pointer or trackball mouse; Individuals with use of one hand with good motor control

Table 2

Compact keyboards	 <p><i>Datalux keyboard by Datalux Corp.</i> <i>Alphasmart 3000 by Alphasmart</i></p>
Large key keyboards	 <p><i>Bigkeys</i></p>
Alternative layout: ABC	 <p><i>Bigkeys</i></p>
Alternative layout: Dvorak	 <p>Dvorak Keyboard Layout</p>

Membrane keyboard



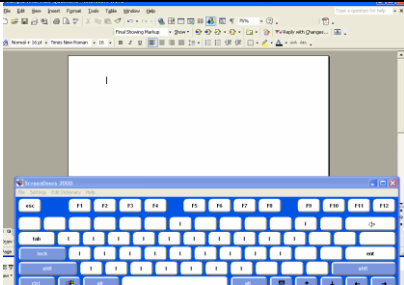
Intellikeys by Intellitools

Membrane keyboard



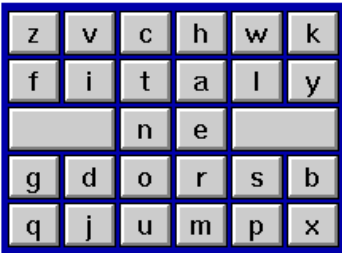
Tash Mini by Tash, Inc.

On-Screen keyboards



Screendoors by Madentec

On-Screen Keyboard:





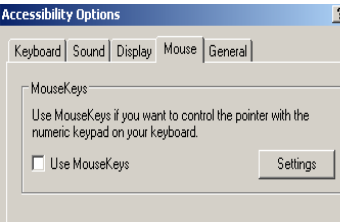

Fitaly

Each of these keyboards has its own advantages and disadvantages. In regard to the key layout, the QWERTY design is considered the standard and most students are familiar with it to some degree. Past studies have shown little to no advantage of other

layouts over the QWERTY in terms of typing speed for two handed touch typists. However, studies have shown that the DVORAK layout does significantly reduce required finger and hand movements when typing (Buzing, 2003). This could be an advantage for those individuals who will not be fast two-handed touch typists due to motor considerations. An advantage of the *Fitaly* and other “frequency of use” virtual keyboard layouts is that they were designed specifically for input using a pointer device such as a stylus. Keyboarding speed studies significantly favor the optimal or “frequency of use” layout over a QWERTY layout when using a stylus or pen for key selection on a virtual keyboard (Buzing, 2003). Other factors to consider when deciding which keyboard will produce the best performance include student feedback regarding preference, level of familiarity with standard QWERTY layout, cognitive abilities in regard to learning an unfamiliar layout, and the tasks to be performed. For example, for an individual with limited cognitive abilities and significant motor considerations, one might customize a membrane keyboard overlay, including only the necessary keys for a particular activity to increase productivity or access, even though that individual may have been exposed largely to the QWERTY layout during their school career.

Speech recognition technology is another alternative means of computer access. This technology allows spoken words to be recognized by the computer and transformed into text and commands. Speech recognition is available now with Microsoft Office 2000 or Office XP. You must be running Windows 2000 with Service Pack 3 or a version of Windows XP. Microsoft Office speech recognition will work with all Office applications although it is not intended as a sole, hands-free computer access. There are speech recognition programs on the market. Although these programs have been developed and marketed to the general population and business sector, the applications of this software for individuals with disabilities have been beneficial. For example, the Dragon Naturally Speaking program is used in Fairfax County Public Schools with selected students who are physically unable to access the computer by traditional means, but have good clarity of speech and breath support. Dragon Naturally Speaking provides a viable computer access that allows individuals to control the Windows environment and dictate into any Windows application, including Microsoft Word, Access, etc. It can also be used as a computer access enhancement for individuals with good speech capabilities and limited direct select capabilities. In other words, it is optimal to have some degree of direct keyboard access in conjunction with using this program, but not absolutely necessary.

Mouse Options and Pointer Options: There are several mouse and pointer options. Table 3 describes just some of the mouse alternatives that can improve computer access for individuals with severe, multiple disabilities.

Device	Example	Advantages
Trackball mouse - movement of the mouse cursor is controlled by the ball rather than moving the entire mouse around	 <p style="text-align: center;"><i>Turbo Mouse by Kensington</i></p>	Many have more than the standard two click buttons; all buttons can be programmed to complete a variety of functions; has click and drag feature; good for limited range of motion, strength, and unstable hand movements
Joystick – functions like standard joy stick with separate buttons for clicking and clicking and dragging	 <p style="text-align: center;"><i>Joystick Plus by Don Johnston</i></p>	Improves accuracy and provides access for those with limited range of motion, limited strength who fatigue easily; and those with unstable hand movements
Mouse keys – software or accessibility options in the Windows operating system that allows the numeric keypad to function as the mouse		Can use key guard for improved accuracy; can be advantageous for those with very unstable hand movements
Mouse emulator – head pointers are electronic and move the cursor in response to head movements; the cursor moves in the same direction as the user's head movements; mouse clicks are activated by a separate switch or by holding the mouse position for a certain length of time (dwell mode); . However, the user needs to have good head control	 <p style="text-align: center;"><i>Headmouse by Prentke-Romich</i></p>	For users with no control over movements other than head – must have good head control

Scanning and Switch Access

When individuals do not demonstrate sufficient motor skills (range of motion, muscle tone, discreet pointing) or the visual skills to utilize any of the direct selection means described in the previous section, then scanning might be a viable option. Students who have progressive muscular deterioration may also be good candidates for scanning and switch computer access. Brown et al (1989) describes scanning systems as moving a selection indicator from one character to the next on a keyboard emulator or virtual keyboard on the computer screen. Selections are made when the selector rests on desired letter or symbol, and the user activates the switch. Therefore, successful scanning and switch access is dependent on the student having the ability to initiate a motor movement independently, whether it is a head movement, arm movement, or another anatomical part. Students who do not demonstrate an understanding of cause/effect

relationships by the time transition options are being considered, will not be able to effectively use a scanning and switch access.

There are numerous switch types, some activated by applying very light or moderate pressure, and others by movement or voice. There are puff/sip switches which are activated according to slight changes in mouth pressure. The positioning and type of switch access is highly individualized according to student needs.

A keyboard emulator is any device or software that has the potential to function as the input interface with the computer. This could be a dynamic display communication device such as the Dynavox. By selecting the serial keys accessibility feature in the Windows control panel, the Dynavox or similar tool can then be attached to the computer via the serial port and function as the input device. In addition, there is scanning software on the market that provides onscreen keyboards to be used with switch access. These products often come with on-screen set ups for use with specific programs such as Microsoft Word, Word Perfect, or the Internet, as well as other educational programs and applications. Some programs allow users to customize onscreen set-ups according to needs. This is a great advantage when adapting vocational tasks to allow completion by individuals with severe, multiple disabilities. For example, on-screen set-ups or keyboards can be customized to eliminate the keys that are not required for a particular data entry task, thus hastening the scanning process by having fewer items to scan. Most of these programs provide options for auditory output for individuals with visual difficulties as well as word prediction to aid in the scanning process.

Role of the Vocational Evaluator in Assessing AT Needs

The goal of the school-based vocational assessment is to identify transition goals, such as job training options and appropriate job accommodations. Students with severe multiple disabilities are being referred for vocational assessment more often than in the past. These students provide a challenge to the vocational evaluator who must adapt work samples and create appropriate activities to address the multiple needs of this population. Assistive technology provides an avenue for determining these students' aptitudes by providing access to tasks that they may not have had before.

A vocational evaluator may find him or herself in one of two situations when asked to provide vocational evaluation services for individuals with severe, multiple disabilities. In situation one, the individual referred is already using assistive technology to access the computer, communicate with others, or access his or her environment. In this case, it is important for the evaluator to understand how that technology can be applied to allow the individual access the assessment. In order to do that, the evaluator must understand how the technology works, or have access to someone who understands how the technology works, before and during the evaluation. In situation two, the individual referred for a vocational evaluation has multiple disabilities that prevent him or her from participating in an evaluation using the standard assessments and methods and he or she is not using any assistive technology. In this situation, the evaluator must have knowledge of and access to assistive technology resources in order to explore

alternatives to the traditional methods of task completion. In either situation, the role of the vocational evaluator is vital in applying assistive technology in the vocational evaluation process.

The degree of expertise in the use of adaptive devices related to computer access, controls and augmentative communication technology varies among practitioners. Many evaluators have acquired competencies through staff development courses, university courses, and other training, but may find the application of the technology and the time involved in preparation challenging. The frequency of these types of vocational evaluations will impact the practitioner's expertise with these techniques. Thus, continued effort needs to be invested in maintaining, acquiring, and developing skills. In all instances, it is essential prior to the assessment, that the evaluator determines the technology the student has been using and is familiar with.

Conclusion

Adapted access refers to any alternative means or special device that allows access to the computer when standard access is barred due to disability. In order to determine the most appropriate access it is important to evaluate the student's motor capabilities, range of motion, cognitive abilities, and sensory skills. It is desirable to strive for the computer access that will require the least accommodation and job task modification, while striving for the best access according to individual needs.

There are many options and tools to consider when adapting computer access. These include simple adjustments through the Windows accessibility features, alternative keyboards and mouse types, on-screen keyboards, alternative key layouts, speech recognition and scanning software, and switches.

The goal of school based vocational assessment is to identify transition goals. Students with severe multiple disabilities provide a challenge to the vocational evaluator who must adapt work samples and create appropriate activities to determine aptitudes and skills. Assistive technology provides an avenue for determining the student's aptitudes by providing access to tasks that he or she may not have had before.

It is important for the vocational evaluator to understand how assistive technology can be applied to allow severely involved students access to the assessment. The evaluator must understand how the technology works, or have access to someone who does before and during the evaluation. Many evaluators have acquired competencies in assistive technology through related training but may find the application of this technology challenging. Continued effort needs to be invested in acquiring and maintaining skills.

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