

Chapter 4 – Assistive Technology for Access to Computers

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Access to Computers for Students with Physical Disabilities

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A student with a physical disability often cannot manipulate traditional classroom tools like pencils, markers, books, and paper. Access to computer-based tools may also be difficult. Fortunately, there are many hardware and software products that assist students with challenges to use computers at school and at home. These tools support individuals with physical disabilities, learning disabilities, and sensory challenges. This chapter will not address in detail computer access for students who are blind or have low vision. Please refer to Chapter 12 on Assistive Technology for Students who are Blind or have Low Vision for more information.

Computers have become an integral tool in all of our lives, making things easier, faster, and more convenient. If we didn't have our computers, we might be inconvenienced, but we would have alternatives. We'd go back to handwriting or typing, using the library, phonebook, maps, writing letters and talking on the phone, etc. But for a student with a disability, the ability to access a computer may be their only way to learn new skills, participate in classroom activities, demonstrate their knowledge, and interact with other people. Use of the computer is essential for students with disabilities, and finding a reliable access method is the key to opening many doors for learning and developing.

Using the SETT process and Decision Making Guide

It is intended that you use this as a guide. The Decision Making Guide follows the SETT (Student, Environment, Task, and Tool) format with a subcategory of Sensory Considerations included with Student and Environment. Additional categories include:

- Narrowing the Focus to help identify a specific task in order to select appropriate assistive technologies.
- Implementation Plan to assign trials, dates, responsibilities and data collection.
- Follow-Up Plan to set a date for the team to reconvene and review the student's progress.

Again, this is intended as a guide; during the actual assessment process, each topic should be written in large print where everyone can see (i.e., on a flip chart or board). Information should then be transferred to paper for distribution, filing, and future reference. For more information about using the SETT process, please refer to Chapter 1 of this manual.

The questions posed in the guide are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and ultimately try appropriate assistive technology tools and strategies for their students.

WATI Assistive Technology Decision Making Guide

Area of Concern: Access to the Computer

PROBLEM IDENTIFICATION

Student's Abilities/Difficulties	Environmental Considerations	Tasks
What are the student's abilities & difficulties related to computer access? - Review Student Information Guide- Chapter 1, page 28 - Current computer access method(s) - Motor skills/ROM - Vision - Fatigue/strength - Attention - Behavior - Cognition - Computer skills - Other challenges/concerns?	What environmental considerations impact the student's use of the computer? - Number of classrooms - Ratio of students to adults - Workstation/desk - Computer operating system - Software available - Power source - Sound - Lighting - Teacher expectation - Other challenges/concerns	What computer task(s) do you want the student to do? - Access educational/special software - Complete written work (reports, worksheets) - Navigate the Internet - Take tests - Math tasks - Take notes
Sensory Considerations		Narrowing the Focus
What sensory challenges does the student have that impacts computer use? (i.e., visual, auditory, tactile)		Specific computer task(s) identified for solution generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Refer to Computer Access Continuum Brainstorming Only No Decision	Use a Feature Match Process to Discuss & Select Idea(s) from Solution Generation	AT Trials/Services Needed: - Date - Length - Training - Data collection - Person(s) Responsible
		Follow-Up Plan Who & When Set specific date

Important: It is intended that you use this as a guide. Each category should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Student's Abilities and Difficulties

As a team, discuss what the student's abilities and difficulties are related to computer access. Please complete and review Section 3 of the WATI Student Information Guide (Chapter 1, page 28).

Consider the following questions:

- Does the student have experience using a computer? If so, for what?
- How does the student currently access the computer? Is the current method acceptable in terms of speed and accuracy?
- Is the student in an optimal position for accessing the computer (chair, wheelchair, etc.)?
- Can the student keyboard with two hands?
- Can the student isolate and point with one finger?
- Does the student have uncontrolled movements that reduce their accuracy?
- Does the student need any additional supports (keyguard, wrist support, pointing tools) to access the computer?
- Does the student have the range of motion to reach all areas of a keyboard, or move a mouse?
- Does the student have low or high muscle tone that may interfere with access?
- Is the student's speech clear and consistent?
- What is the student's most consistent, voluntary movement? Be specific (press down with right index finger, lateral movement with left elbow).
- Does the student fatigue easily during an activity, or get more fatigued throughout the day?
- Does the student have any visual issues (acuity, tracking, nystagmus)? Hearing issues?
- If the student is not able to direct select, have they tried scanning? If so, where was the switch placed for activation and what types of switches were tried?
- Does the student have the necessary cognitive skills to understand the purpose of using the computer? Do they understand the scanning process?
- At what level is the student reading and writing?
- Does the student maintain their attention to the computer long enough to complete a task? Are they visually interested in what's happening on the screen?
- Does the student have any behavior issues that may interfere with computer use?
- Is the student motivated to use a computer to complete their tasks?

Sensory Considerations

Some students are adversely affected by environmental stimulation that others can filter out or ignore. Some common factors that can impact a student's learning and focus include hypersensitivity or hyposensitivity to stimuli such as:

- Visual clutter
- Fluorescent lighting versus full spectrum lighting
- Classroom and background noise
- Tactile stimulation
- Awareness of physical space
- Other individual specific sensitivities

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Although these factors are not directly related to computer access, they impact the student's ability to focus on instruction and learning so should always be considered.

Other Considerations

Each individual student has specific skills and areas of concern. Be certain to address those as you capture the particular traits of the student in this part of the SETT process.

Environmental Considerations

As a team, discuss and write on chart paper any environmental considerations that might impact the student's ability to access the computer such as auditory or visual distracters, placement in the classroom, number of different environments in which the computer is to be used, or any other environmental impacts.

Important things to consider include:

- Will the student have a specific computer dedicated to their use, or will they use several computers throughout the school and home?
- What operating system is on the computer(s)?
- Will the computer(s) be laptop or desktop?
- What software programs will the student need to access?
- If special software is to be used, will it be on a network, or only installed on specific computer(s)?
- If the access method requires set up, is someone available to assist?
- Where in the room is the computer located? Can the student see the teacher from that location?
- What position(s)/equipment will the student be in when accessing the computer?
- Will the student require an adjustable workstation to accommodate a wheelchair?
- Will anything need to be mounted?
- If a dedicated laptop is used, is there a power source? How will it be transported?
- Is there adequate lighting in the location(s) that the computer will be used in?
- If there is sound on the computer, will that impact the other students in the room? Are headphones necessary?
- Will the student need to print from the computer? Use a scanner?

Assistive Technology: past and present

What assistive technology (AT) has been employed in the past or is currently used with the student? List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist such as computer conflicts, lack of training, lack of interest, or other reasons. Do not discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time.

Differences in skill development, maturity, a different environment or other factors may make all the difference. If the student is currently using assistive technology note the AT used, location,

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level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Be certain to list low and high tech AT supports.

Sensory Considerations

Different environments have different levels of sensory stimulation. If the team has determined that sensory impacts are influential on the student's learning, identify the sensory levels in each environment in which the student will be using the computer.

Tasks

As a team, discuss and write on chart paper the reading tasks that the student needs to do.

One of the most important questions when assessing a student's need for assistive technology is: What are the tasks the student needs to do? In this instance what activities does the student need to participate in on the computer?

These are some questions to consider:

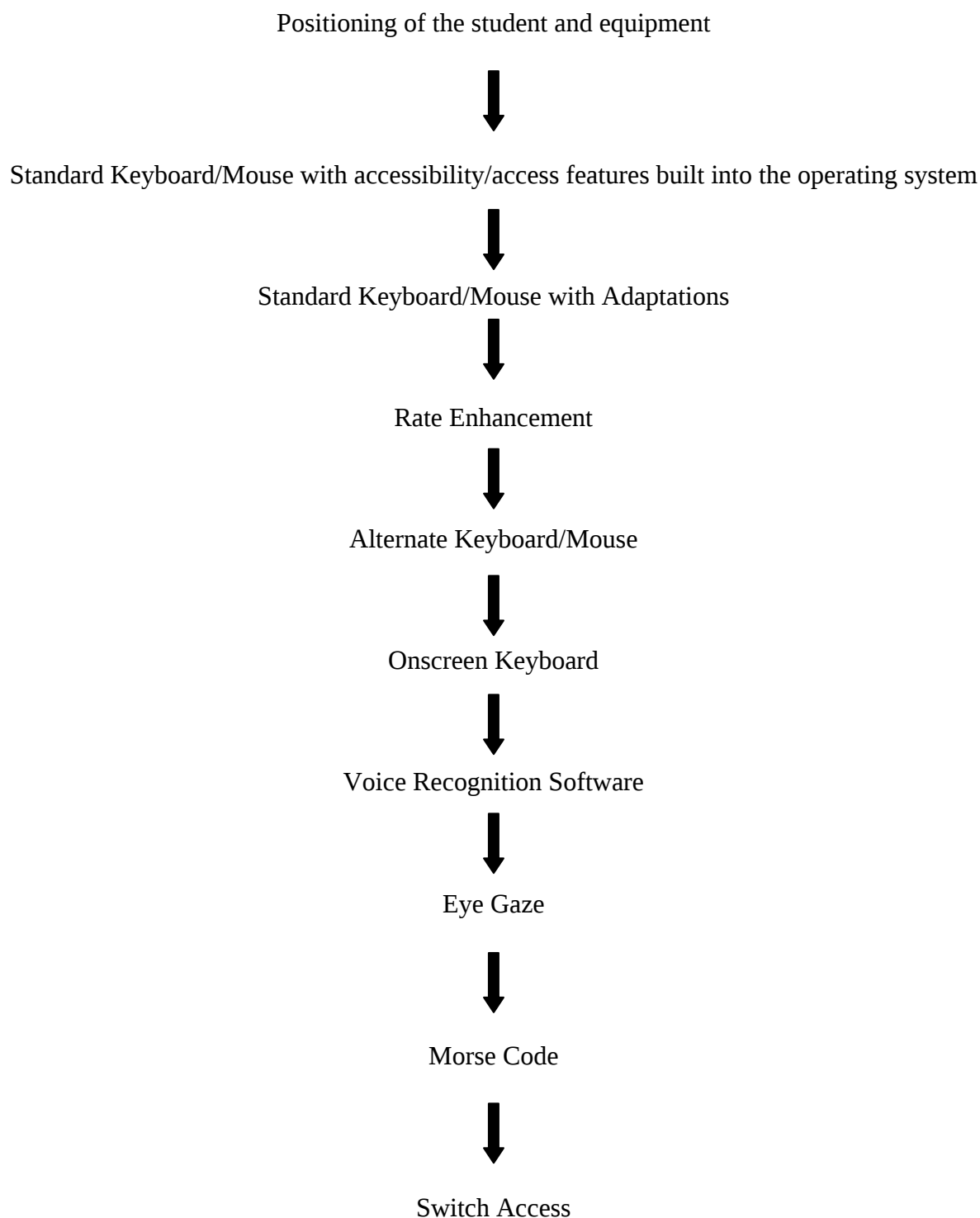
- Is the student able to access educational/special software to enhance participation in the curriculum?
- Is the student able to independently complete written work (reports, worksheets)?
- Is the student able to navigate the Internet? Use email?
- Is the student able to take notes?
- How does the student currently take tests?
- How does the student show their work in Math?

Solution Generation: Tools/Strategies

As a team, brainstorm and write on chart paper any assistive technologies and/or strategies you think will assist the student in successfully completing those tasks you identified.

The team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The tools and strategies discussed below follow the general continuum for computer access. The continuum is generally organized from low to high Assistive Technology. It is not intended to be used as a step-by-step protocol for using AT tools with a student, but rather an organizational continuum of types of Assistive Technology.

A Continuum of Considerations for Assistive Technology Computer Access



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Positioning of the Student and Equipment

Positioning of the student at the computer workstation is one of the first things that should be considered. Many students that have a physical disability may be able to access the computer via a keyboard and/or mouse if they are properly positioned at the computer workstation. Proper positioning and support enables the student to focus on learning. The student should sit comfortably in a well-balanced position. If they need to use their arms to support their body position or make constant position adjustments while using the computer keyboard, the seating system should be adapted.

One simple adaptation is the use of a non-slip surface on the chair to prevent slipping. While *Dycem* is the common solution for this, there are several low cost alternatives including non-skid rug material, shelf-lining material, rubber jar gripper, or non-skid vinyl safety tape. Rolled towels and pillows can also be used to make adjustments. An occupational or physical therapist should be consulted to help determine the most appropriate seating for the student.

Flexibility in the table height and positioning of keyboards and monitor is important. Students using wheelchairs usually sit higher than students in typical chairs so traditional desks and tables are usually too low to accommodate a wheelchair. Blocks or bricks can be placed under the table legs to raise the table. However, raising the table often results in raising the keyboard surface and monitor to an uncomfortable position. If this is the case, desk arms can replace standard arms on wheelchairs so that a lower table can be used. Using a wheelchair tray may also be considered.

Bi-level adjustable tables are convenient because correct working heights can be individualized quickly and easily, which is useful when several students requiring different table heights use the same computer. Other supports such as foot rests, articulating arm supports and wrist rests may improve access.

The computer monitor should be placed so the top of the screen is at or just below eye level. Keep in mind that many students with physical disabilities also have vision issues, so be sure to consider that the monitor may need to be placed to the right or left, or tilted up or down to accommodate the student's vision, as well as their position in the chair or wheelchair. A document holder may be used to place papers in the same visual plane as the monitor.

Some students find that the keyboard is easier to use when it is angled toward them, especially if they are using a pointing device (page 9). Angling the keyboard also positions it in the same visual plane as the monitor, reducing the need for the student to shift his gaze back and forth from the keyboard to the monitor. A slantboard can be used to angle a keyboard to varying degrees. An empty three-ring binder can also be used to angle the keyboard, using Velcro or non-slip materials to keep the keyboard in place.

A wrist rest or forearm support such as *Ergo Rest*® may provide needed support to increase control of movements and prevent accidental key activations. Gel supports located under the wrist or forearms provide a neutral resting position to increase stability for better fine motor control.

Operating System Built in Accessibility Features

All Macintosh and Windows operating systems have built in accessibility features that allow the user to customize features of the mouse and keyboard to better suit their individual needs. For Windows XP, Accessibility Options are found within the Control Panel. In Windows Vista they are found under “Ease of Access” within the Control Panel. On a Mac, the accessibility features are found in “Universal Access” within the System Panel.

Sticky Keys allows a user who can only push one button at a time to use the modifier keys (Shift, Control, Alt and Command) to press key combinations without having to hold down two or more keys at the same time. For example, when trying to type a capital letter, the user types [Shift] then the target letter, one after the other. The target letter will appear in uppercase and the next letter typed will automatically appear in lowercase. This is good for a student who is using one hand, or a pointing tool.

Filter Keys (Slow Keys on a Mac) ignores keystrokes that occur in rapid succession and keystrokes that are unintentionally held down for several seconds. This is good for someone who has a tremor or uncontrolled movements.

Mouse Keys allows use of the numeric keypad to move the mouse around the screen. This is good for someone who has a reliable method to access the keyboard, but has difficulty using a mouse.

Visual Display Options – Both Windows and Mac have customizable high-contrast schemes and modes to make it easier to see objects on the screen. There are options to increase the font and size of icons, cursor magnification, as well as text reading technology and screen magnification (although limited).

Standard Keyboard Adaptations

Repeat Rate – There is an option in Windows and Mac to adjust the character repeat rate to prevent multiple characters when a button is held down.

Keyguard - Keyguards are used to prevent accidental key presses. They are most often made of plastic and have finger-sized holes over each key. They are used to prevent accidental keystrokes or activation by stabilizing hand movement and preventing "drag" across dynamic screens. Keyguards are available for most standard keyboards and many augmentative communication devices.

Labels – Key labels are stickers that stick to the keys on the keyboard. They can be white letters on a black background, black letters on a white background, or color-coded. *ZoomCaps* are often used with children who have low vision or visual attention issues. Also available are large print, lowercase, color-coded labels from *Hoolean*.

Moisture Guard – A moisture guard covers the keyboard and protects it from dust, moisture, drool, etc.

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Pointing tools – A student with no functional use of their hands may use a head pointer or mouthstick to access the keyboard and/or mouse. A student with limited grasp might use a typing aid with a rubber tip that slips over the hand. A dowel or pencil with the eraser side down can also be used.

Keyboard Mask – For students who may only need to access a few keys on the keyboard, and are distracted by the many choices on a standard keyboard, it may be helpful to make a mask out of cardboard or foam to place over the keyboard, revealing only the necessary keys.

Standard Mouse Adaptations

Customizable Mouse Options - Students often have difficulty controlling a standard mouse, especially double clicking required for opening files and using the “drag” function. Built in features in both Windows and Mac include changing the double click speed, actions of the mouse buttons, pointer speed, cursor blink rate, and mouse pointer schemes.

Button Reassignment - The standard mouse for a Windows based computer is designed for right-handed use. You can reassign the buttons on a standard mouse in the Control Panel so that the right click makes a selection and the left click brings up the shortcut to menu items. You can also disable the right click button for students who unintentionally activate it or don’t need to use it. There is also the option to make both of the buttons make a selection.

Rate Enhancement

There are several software programs or features built into existing software that enable the user to reduce the number of keystrokes necessary to produce a word or action.

Abbreviation Expansion - Abbreviation expansion lets the user type in an abbreviation for a word or phrase, and the software spells out the full text on the screen (for example, “dc” + <Spacebar> = “Washington DC”. *Microsoft Word AutoCorrect* is a built in feature that allows you to create your own abbreviations and expansions, which work in Word only. *Typeit4me* is a popular abbreviation expansion program for the Mac.

Word Prediction/Completion - Word prediction/completion uses the first few letters typed by the student to “guess” at the desired word. After typing the first few letters, a list of words that begin with those letters is displayed. If the desired word is in the list, it can be chosen and automatically entered into the word processor. Many word prediction programs also read the list of “guesses” aloud. Some of the most popular stand alone word prediction programs are *Co:Writer* and *WordQ*. Word prediction is also available as an option in multi-feature programs like *Kurzweil 3000* and *Read & Write Gold*.

Macros - Macros are shortcuts that complete a set of commands in response to a set of keystrokes. A macro can simulate keystrokes and mouse input, activate applications, execute commands (e.g., maximize or close a window), and combinations of these. Examples of macros include: insert a name and address; launch or switch to a program; increase the volume; and copy

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data from one application and paste it in another. You can create Macros in Microsoft Word and Excel, as well as voice recognition software. There are many shareware programs for both Windows and Mac that will work in any application. If there are any functions or tasks that the student performs repeatedly, macros are effective in helping speed up those tasks.

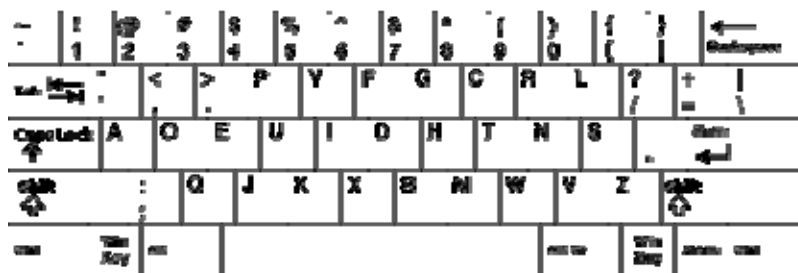
Auto Correction- The AutoCorrect feature in Microsoft Word provides the most common misspellings of words, including omissions, additions of incorrect letters, incorrect sequence of letters, misspellings due to inadvertent physical key hits, and also the user's genuine difficulty with spelling specific words. In all programs, lists of words can be modified. You can add words that you commonly misspell.

Alternative Keyboards

The standard QWERTY keyboard is modeled after the typewriter and is designed for a two-handed touch typist. This layout may not be ideal for students who will not touch type, students who will type with one hand, or students with cognitive difficulties. Although it is preferable to use the traditional keyboard since it is found in all settings, consider the many alternatives.

Alphabetical –The Alphabetical or ABC layout is often used with very young students, or those who are unfamiliar with or confused by the QWERTY layout. Students who use communication boards or devices may be familiar with the ABC layout for spelling out messages. Keyboards with an ABC Layout often have larger keys and/or brightly colored keys.

Dvorak - The Dvorak keyboard layout has the most-used consonants on the right side of the home row, and the vowels on the left side of the home row. The next most common letters are on the top row, and the least-used letters are on the bottom row. This can be a useful layout for someone who is using a pointing device such as a headpointer or a mouthstick.



The option for changing the keyboard layout is found in the Control Panel in Windows, and the System Preferences in Mac.

Ergonomic – Some ergonomic keyboards may be useful to students who need alternative positioning of the keyboard. Split keyboards, like the *FreeStyle*, enable the student to position the two keyboard halves separately in a way that is most comfortable for them.



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One-Handed - Many students who type with one hand do well with a standard keyboard and a modified hand placement. However, there are many different types of keyboards designed for one-handed users. A smaller-sized keyboard may be beneficial for a student using only one hand.

- There are Dvorak arrangements designed for either right or left one-handed typing. The hand rests near the center of the keyboard and the majority of the letters are centered on the home row or above.



- The Half-QWERTY Keyboard allows one-handed typing using either hand, or both, just like a standard keyboard. The student's functional hand is placed where it would normally go if they were a two-handed typist and that half of the keyboard is accessed as usual. To type the keys on the other side, the student holds down the spacebar while pressing the mirror-image key. This is most successful with students who were previously able to touch type with two hands.
- Another option is a chorded keyboard, which allows the user to enter characters or commands by pressing several keys simultaneously, like playing a chord on the piano. The *BAT keyboard* and the *FrogPad* are examples of chorded keyboards. Both are available in right or left handed versions.
- *AlphaSmart Portable Word Processor* – AlphaSmart products have built in right and left handed keyboard configurations, and can be used as a stand-alone word processor, or as an alternative keyboard to access the computer in the keyboard emulation mode.



Wireless - Wireless keyboards eliminate the need to be attached to the computer with a cord, which works well for students who use a power wheelchair with a tray or those who are distracted by cords. These utilize infrared (IR), radio frequency (RF), or Bluetooth technology. Keep in mind that Bluetooth and RF technology does not require line-of-sight between the keyboard and the receiver while IR does require line of sight between the keyboard and the receiver. Wireless keyboards can be found at many office supply or electronics stores.

Miniature/Compact – Compact keyboards have smaller keys, fewer key choices or a more "compact" layout. Some include a built-in track ball and/or wrist rest. These may be a good choice for students with a limited range of motion, or those using one hand or a pointing device to access the keyboard. There are several mini keyboards on the market, some wireless. The *Magic Wand Keyboard* has a built in mouse and requires only a light touch by the attached 'wand' to activate the keys, making it an option for students with muscular dystrophy.

Enlarged - Enlarged keyboards are larger versions of the standard keyboard, in whole or in part, usually with colored keys and a variety of layouts. Some are also programmable (see *IntelliKeys*). An enlarged keyboard is often used with students who have decreased fine motor skills, or who require color coding or an alternative layout for cueing. The Big Keys series comes in different layouts and color combinations.



Programmable - The *IntelliKeys*® keyboard is the most popular programmable keyboard. It is a flat, enlarged membrane keyboard that plugs into any Macintosh or Windows computer. It enables users with physical, visual, or cognitive disabilities to type, enter numbers, navigate on-screen displays, and execute menu commands. *IntelliKeys* comes with overlays for numbers, mouse movement, and alphabetical and QWERTY key layouts that can be slid into the *IntelliKeys* for instant use. Customized overlays can also be created and printed with Overlay Maker or existing overlays can be downloaded from the IntelliTools Activity Exchange (<http://aex.intellitools.com>). Many children's software programs now include ready-to-use custom *IntelliKeys* overlays. *IntelliKeys* can also be used as an alternative for mouse functions or as a switch.



Onscreen - An onscreen keyboard is an image of a standard or modified keyboard on the computer screen. A mouse, mouse alternative, or switch selects the keys. Some onscreen keyboards incorporate word prediction programs to increase speed and may include alternate keyboard layouts in addition to the traditional QWERTY layout. Windows and Mac operating systems have a built-in onscreen keyboard, but with limited extra features. The onscreen keyboard is an option for students who have accurate control of a mouse or mouse alternative (trackball, head controlled mouse, touchscreen), but struggle with the keyboard. The onscreen keyboard also removes the need to look back and forth from the keyboard to the computer screen. Popular onscreen keyboards include *OnScreen*, *WIVIK*, and *REACH*™.



WIVIK

Mouse Alternatives

For students who lack the ability to use a standard mouse, there are many alternatives to consider. Explore commercial types of mice at a computer store for a better individual fit. There are many different sizes, shapes, button configurations, etc.

Keyboard shortcuts - Use keyboard shortcuts as an alternative to the mouse in both Windows and Mac. Keyboard shortcuts use a combination of a modifier key plus another key to achieve a menu option (for example Control + V is the same as clicking on Edit > Paste with the mouse). For a list of keyboard shortcuts for Windows go to support.windows.com and support.apple.com for Mac.

Mouse Keys – Built-in feature of both Windows and Mac operating system, enables the student to use the arrow keys on the numeric keypad to move the pointer instead of using the mouse.

Left handed/Ergonomic – There are hundreds of different variations of computer mice, including left handed mice for Windows available on the Internet and in office supply stores. You may want to explore the options, which come in all different sizes and shapes including pen mice and vertical mice that place the hand in a vertical “handshake” position.



Wireless - There are many options for wireless mice and trackballs available at computer stores. These utilize infrared (IR), radio frequency (RF), or Bluetooth technology. Keep in mind that Bluetooth and RF technology does not require line of sight between the mouse and the receiver, while IR does require line of sight between the mouse and the receiver.

One Button – Many children are confused and/or frustrated by the right click button on the standard mouse. While it is possible to disable the right click from the operating system, many teachers and students prefer a one-button mouse. The *Chester Mouse* is a small single-button mouse with no scroll wheel.

Touchpad/Trackpad – Some students with limited range of motion and/or strength may be able to access a touchpad (commonly found on laptop computers). Sliding your finger across the pad moves the mouse. Clicking can be done with buttons or by "tapping" lightly on the surface. External trackpads are available for both PC and Mac computers.

Trackball – If a student has difficulty gripping or moving a standard mouse, a trackball may be easier to use. A trackball is basically an upside-down mouse. Rather than moving the mouse on the table, the trackball remains in one place and the ball on the top is moved with the palm, thumb, fingers, or other body part. The *BigTrack* is the largest trackball on the market. It requires less fine motor control than a standard trackball and has a left and a right mouse click button located behind the trackball to avoid unwanted mouse clicks. The *BigTrack* works well with young children, and with students who do not have



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good fine motor control. Some trackballs have been adapted with switch jacks so that switches can be connected to emulate mouse buttons (*SAM Trackball*, *TRAXSYS Roller Plus*, *WAVE Wireless*).

Joystick – Many students may be familiar with a joystick as a way to access a video game. Joysticks may have four or five directional controls, and can be proportional or continuous use. Joysticks can be positioned for use with the hand, chin, foot, or head. Some joysticks have been adapted with switch jacks so that switches can be connected to emulate mouse buttons (*SAM Joystick*). The *Jouse2™* and *Quadjoy™* are joysticks controlled by the mouth.

Touchscreen - Touchscreens allow you to use your finger (or a pointer) instead of a mouse. The touchscreen is a more concrete concept than a mouse or trackball, so it may be useful for young children, or those with cognitive disabilities. A touchscreen can be an add-on (*TouchWindow*, *Magic Touch*), or an integrated monitor system (*Magic Touch*, *3M™ MicroTouch™ Displays*). Some laptops now come with touchscreens as well. Be aware that not all built-in touchscreens are touch-sensitive. Some require use of a stylus to access.

Foot-controlled Mouse – For students who do not have good hand function, but can utilize their feet, foot-controlled mice are available including the *No Hands Mouse* and *Footime™*.

Head-controlled Mouse – A head-controlled mouse translates the movement of the student's head into cursor movements on the screen. Some require only a small reflective dot be worn on the individual's forehead or eyeglasses (*Tracker Pro*, *HeadMouse® Extreme*). As with the other mouse alternatives a head controlled mouse can be combined with an on-screen keyboard to completely replace the functions of a conventional keyboard. Mouse clicks can be done with a switch or dwell selection software.

Dwell Selection – For students who can control the mouse pointer, but have difficulty clicking the mouse, dwell selection performs the operation by holding the cursor over an icon or menu option for a specified amount of time. The software can send left-clicks, right clicks or double-clicks. Dwell software is often used in conjunction with an on-screen keyboard. *MagicCursor 2000* and *SmartClick* are dwell software programs available for Windows and Mac.

Interactive Whiteboards

An interactive whiteboard is a touch-sensitive display that connects to a computer and digital projector to show the computer image. While not a practical solution for personal use, many classrooms have interactive whiteboards, which can be great for students who cannot access a keyboard or mouse. The large touch sensitive screen can be mounted or positioned so that students in wheelchairs can access it. Students can write or draw on the screen with their finger or a special "pen". Specialized software can translate handwriting into typed text. An onscreen keyboard could be used, allowing a student to "type" using large arm movements rather than fine finger movements.

Speech Recognition

Speech recognition software converts words spoken into a microphone into text or commands. Although speech recognition may seem like the simple answer for students who have difficulty with keyboarding, many things need to be considered including:

Speech – The student should have relatively clear, consistent speech. Students with accents or mild to moderate dysarthria have been successful with speech recognition. Appropriate training of the software is essential for accuracy.

Cognitive abilities – The student should be able to understand how speech recognition works and have experience with general use of the computer. They must also have fairly intact strategic memory system.

Dictation skills – The student needs to be able to compose and dictate clear, well-structured sentences without hesitations or fillers (umm, ahhh). The student must know how to and be able to create complete sentences.

Literacy/Editing - The student must be able to review the text that has been dictated, identify errors and correct them. It is very important to correct recognition errors because this helps the speech recognition program improve its voice model. If corrections are not made, recognition accuracy is compromised.

Motivation – Speech recognition can be frustrating during the beginning stages, so the student must be very motivated and able to see the benefit of the initial work to achieve success.

Support – Speech recognition technology, especially in a school setting, requires much support. As many team members as possible should be trained to use the technology so that support can be provided in various situations.

Training the software to recognize the student's voice used to be a time consuming and frustrating process, requiring lengthy sessions of reading text aloud. However, the process of training a speech recognition program is much simpler now, and is no longer a barrier for most students. Students with severe visual or reading difficulties can be supported as they progress through the initial training.

Windows Vista has a built in speech recognition feature for dictation of text and control commands. Mac OSX has *Speakable Items* which lets you navigate menus and enter keyboard shortcuts; speak checkbox names, radio button names, list items, and buttons; and open, close, control, and switch among open applications, but not dictate text. *MacSpeech Dictate* is a software program that enables the Mac user to enter text and speak commands.

The most popular speech recognition software is *Dragon NaturallySpeaking*, which enables the user to enter text into any Windows-based software program, navigate the Internet, as well as enter commands (“close window”, “print document”) by voice. *Dragon NaturallySpeaking* uses continuous speech and can have an accuracy rate of up to 99% with appropriate training.

Dragon NaturallySpeaking is a great option for students that have a physical disability and need to have “hands-free” access to the computer. *MathTalk* is an additional program that can be combined with *Dragon NaturallySpeaking* to dictate equations into *Scientific Notebook*. *Read&Write Gold* and *ClaroRead* also integrate with *Dragon NaturallySpeaking* to provide speech feedback to confirm that the dictated text is accurate.

SpeakQ is a voice recognition program that is designed for students with learning disabilities. It is used in conjunction with *WordQ*. *SpeakQ* is an option for students who can use the keyboard, but have difficulties with the processes of writing and reading. These students can benefit from a combination of word prediction, speech output and speech input to generate text. The reading demands are reduced, especially in the training where the computer uses speech output to prompt the student what to say. There are two modes. In the Speak and Select mode, spoken words are displayed as a list of choices enhanced by word predictions. The student then selects from the list of words or phrases (using the keyboard or mouse), or type letters to further refine the suggestions. In the Speak Continuously mode, spoken words are entered directly into the document. There are no verbal commands for control or correction.

Eye Gaze

Eye gaze systems are used to move the cursor on the screen to activate an onscreen keyboard or other specialized software. Dwelling or eye blink is used to make a selection. The eye-tracking piece is attached to the monitor and it reads the eye movement. To be able to functionally operate eye control systems, users must be able to look up, down, left and right and direct their gaze to all areas of a computer screen. They must be able to focus on a spot for a specified amount of time. Eye problems such as nystagmus, strabismus, visual acuity and medication that affect eye tracking can influence the accuracy the systems. Some systems track one eye and others track both. Problems can occur if users have severe involuntary head or eye movements. Students who do not have voluntary control over any body part except their eyes, and are unable to use voice recognition technology typically use these systems. Typical users may include students with a neurological disease, high-level spinal cord injuries, or cerebral palsy. Examples of eye gaze systems include *Quick Glance*, *ERICA*, and *My Tobii*.

Morse Code

Morse Code - Morse code uses two switches (see Switch Access page 17) and adaptive software to enter keyboard characters into a word processor. Morse code is not a common input method because it requires learning Morse code and it's slow, but for single switch users it can work well. Morse code input doesn't require the ability to watch the screen as visual scanning software does. If a single switch is used for entering the code, a dash is differentiated from a dot by holding the switch closed for a longer period of time. In two-switch Morse code, one switch is used for entering dots while the other is used for dashes. Mouse movement can be achieved using *MouseKeys* (accessibility feature that allows the keyboard number pad to replace the mouse), although it is tedious. The *Darci USB* is a plug and play device that replaces the keyboard and mouse for Morse code input in any Windows application. *EZ-Keys* is a software program that provides Morse code access.

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Switch Access

Switch access may seem like an easy alternative input method for accessing the computer. However, the student's cognitive abilities must be considered. Having the physical ability to activate a switch does not mean the student will be able to use scanning as an input method.

Switch scanning should only be considered after all other access methods have been ruled out. It is slow and tedious, but can be a successful access method for those who need to use it. Before recommending switch access for input, try it yourself. You will get a feel of the cognitive demands and patience required for this type of access.

Switch assessment

When assessing a student for switch access, a switch site will need to be determined. This involves finding a consistent, controlled movement that can be easily repeated many times without causing fatigue or pain. This usually involves a lot of trial and error. It is often helpful to observe the student while resting or during other activities. Students are usually very aware of their own bodies, so always ask the student what they think is their best movement for switch access. They are usually right. Typically, upper extremities are considered first, then the head, and then lower extremities. However, some would argue that the head is a more natural access method for students since there is a more direct connection with the eyes.

During the assessment, the switch itself should not be the activity. It should be a means to participate in something interesting and motivating on the computer. Do not say, "Hit the switch", but rather say, "make the balloons pop", or "turn the page". It may make sense to start with activating a simple switch toy or music if that is motivating for the student.

Modes of Scanning – Different modes of scanning can be used, based on the student's physical and cognitive abilities.

Automatic – The student activates the switch to begin the scan. Scanning proceeds automatically at a predetermined rate until the student activates the switch again to make a selection. This requires a high degree of motor control by the student to wait for the desired selection and then activate the switch at the required time. It also requires the ability to continually attend and visually track the movement on the screen. This is NOT an ideal method of input for many students.

Single Switch Step – In single-switch step scanning, the student must keep activating the switch until the desired selection is highlighted. To make the selection, they must wait for a certain period of time without activating the switch.

Two Switch Step - In two-switch step scanning, one switch moves the highlight from one selection item to the next and the second switch selects the desired item. The student controls all timing and movement. Two-switch scanning can be extremely efficient, allowing the student to make selections faster than with single-switch scanning. While the action of two physical

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movements can require more motor planning and concentration, with practice it can become a rhythmic, kinesthetic movement which requires less active thought.

Inverse – The student must maintain the switch activation until the desired selection is highlighted. Releasing the switch makes the selection. This requires the ability to hold a motor pattern and quickly release. The student must maintain direct attention to the screen, and anticipate the need to release the switch.

Characteristics of Switches

When assessing for switch use, these are some questions to keep in mind:

- How big is the switch target surface?
- Which areas actually activate the switch? The center? The edges?
- What does the switch feel like? Is it soft or hard? Does the student prefer or dislike a particular texture?
- How much pressure is required to activate the switch?
- Can the student easily release the switch?
- What type of feedback (if any) does the switch provide when activated? Is the student distracted or startled by a “click” sound?
- Is the switch durable? Can it withstand moisture/dirt?
- Is the switch easy to mount? Can it be positioned to accommodate the student in different body positions?
- Does the switch come in a wireless version?

Types of Switches - There are two main types of switches, mechanical and electrical. Below are examples of switches that are commonly used for computer access. This list is in no way exhaustive and new switches are always under development. Check vendor websites and catalogs frequently for new products.

Mechanical – Mechanical switches require that the student actually physically touch the switch for activation. The amount of pressure needed to activate these switches can vary. Examples include:

- **Push** (sometimes called button or touch) **switches** are the most common type. The student activates the switch by pushing against its surface. These switches have a single surface area for activation. They are usually pressed with a hand, but can also be pressed by other body parts. The *JellyBean* and *BuddyButton* are common push switches.
- **Light Touch Switches** require less pressure to activate than push switches. Examples include the *ASL Micro Light Switch* and the *Plate Switch* from AbleNet.
- **Lever switches** can be activated by pushing in any direction. They are easily mounted and are typically activated by the head or gross hand movement. The *Ultimate Switch*

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from Enabling Devices, The *Wobble Switch* from PRC and AbleNet's *Flex Switch* are examples of lever switches.

- **Motoric-Specific Movements** activate switches such as pinch, grip, bat, pull, etc. Enabling Devices and AbleNet make several switches that require specific movements.
- **Pneumatic (sip and puff)** switches depend on a change in air pressure for activation. Sipping activates one switch, puffing activates the other.
- **Dual Switches** are two switches in one housing, each having its own action. A dual switch can be used for Morse code or for 2-Switch Step Scanning. The *Rocker* switch from AbleNet is an example of a dual switch.
- **Wireless Switches** - If cords and wires are a hindrance, consider a wireless switch that connects a receiver to the toy/device and then transmits information through radio waves. The *JellyBeamer* by AbleNet is a popular wireless switch.

Electrical – Electrical switches do not require physical contact for activation. Different types of mechanical switches include:

- **Proximity** switches simply require a motion near the surface. They are sensitivity-adjustable (*ASL Adjustable Proximity*, *AbleNet Untouchable Buddy*).
- **Fiber Optic** switches have a visible light, and breaking the beam of light activates the switch. Fiber optic switches can be set up at any reliable site such as a finger or chin (*ASL Fiber Optic*, *Fiber-Optic Eye-Blink Switch* from AMDi).
- **Infrared** - The *Self-Calibrating Auditory Tone Infrared (SCATIR) Switch* works by detecting a beam of reflected pulsed infrared light. The SCATIR Switch can be controlled with an eye-blink, eyebrow movement, finger movement, head movement, and facial muscle movement. Using the *Multi Infrared/Sound/Touch (IST) Switch* by Words+, students can access software with virtually any kind of body motion—the blink of an eye or a vocalization/breath.
- **Sensor** switches send up electrical impulses from the muscle (small movements) that activates the switch. This type of switch requires careful placement. (*Enabling Devices Sensor Switch Kit*, *Don Johnston Sensor*). The *Impulse™* from AbleNet senses tiny muscle movements and sends a signal to a receiver via wireless Bluetooth technology to activate the switch.
- **Wheelchair Integration** - It is possible to use the same switches used to drive a power wheelchair to access the computer. Adaptive Switch Labs specializes in fiber optic switches that can control both the wheelchair and the computer. A special interface box and a visual display are added to the wheelchair electronics to enable computer access. Note: Not all wheelchair electronics and/or switches have this capability.

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Switch Interface – Remember, a switch does not plug directly into the computer, it requires a computer interface. The computer is connected to the switch interface, which is then connected to the switch. The switch interface then determines what the computer receives when the switch is pressed. When you press a switch, the interface box makes the computer think that a key on the keyboard or a mouse button is being pressed. So if you would normally press the spacebar to turn the pages in an electronic book, you can now use a switch instead. Switch interface boxes can be wireless, too (*IntelliSwitch, Swifty, Quizworks USB Switch Interface*).

Product	Vendor	Website
USB Switch Interface	Crick	http://www.cricksoft.com/
Switch Interface Pro	Don Johnston, Inc	http://www.donjohnston.com/
IntelliSwitch	IntelliTools	http://www.intellitools.com/
SwitchHopper	RJ Cooper	http://www.rjcooper.com/
USB Switch Interface Plus	Quizworks	http://www.quizworks.com/
Wireless Switch Interface	Quizworks	http://www.quizworks.com/
Swifty	Origin Instruments	http://www.orin.com/

Mounting - Switches sometimes must be mounted in place to make them easier to use. This provides stability for the student by ensuring that the switch stays in one consistent place. Switches that are pressed with the hand can be held in place on a table or desk with Velcro. For students who access switches in other ways, a mounting system may be useful. Mounts can be rigid or flexible (gooseneck). Popular commercial mounts include the *Slim Armstrong* and the *Magic Arm*. Camera mounts may be considered as a lower cost alternative.

Switch Accessible Software - Some software programs have been developed specifically for use with a switch to develop cause & effect, choice making, early literacy skills, allow independent test taking (*Test Me Score Me*) or to give students access to curriculum specific topics (*Switching on Science/American History*). Other programs have built-in options to allow switch use (*Classroom Suite, Clicker*).

Many standard software programs can be accessed through a switch with the use of additional switch software (*Discover Envoy, SwitchXS for Mac, EZ Keys*).

Switch Accessible Software is available from the following vendors (among others):

AbleNet (SoftTouch)	http://www.ablenetinc.com/
Creative Communicating	http://www.creative-comm.com/
Crick Software	http://www.cricksoft.com/
Don Johnston, Inc	http://www.donjohnston.com/
Inclusive TLC	http://www.inclusivetlc.com/
IntelliTools	http://www.intellitools.com/
Judy Lynn Software	http://www.judylynn.com/
Laureate Learning Systems	http://www.laureatelearning.com/
RJ Cooper	http://www.rjcooper.com/
Marblesoft-Simtech	http://www.marblesoft.com/

Solution Selection: Tools & Strategies

Use a Feature Match process to discuss and select those ideas, tools, and strategies that were generated during the solution brainstorming. Select those that best match the student, the environment and the reading tasks that need to be accomplished. Limit your selections to a reasonable number and prioritize them according to those that can be accomplished immediately, in a reasonable time period and those that will be considered at a later time or require additional or significant staff training.

Implementation Plan

After tools have been selected and prioritized, identify any trials or services that are needed including procurement of trial equipment and materials, team member(s) responsibilities, start date, length of trial, training needed and any other student/staff specific issues. Be certain to identify objectives and criteria of performance to determine the effectiveness of the trials.

Trials – Take advantage of AT loan libraries for trial equipment when possible. Many manufactures of software provide trial CDs or downloads from their websites. Plan to use the technology for at least a month to determine effectiveness. Of course, adjustments and modifications should be done as necessary during that time.

Training - Identify at least two staff members and a family member to be trained (along with the student) by an AT professional. Training should take place in the environment where the computer will be used. Several training sessions may be necessary, depending on the complexity of the chosen technology.

Data – Collecting data will help determine the effectiveness of the assistive technology. Identify what objectives you will measure. For example, you could collect samples of written work before and after implementation to look at quality & quantity of work, or identify level of independence in computer access before and after implementation.

Documentation - Keep good records on the assistive technology (vendor, tech support, date of purchase, warranty, instructions) and its use by the student to be passed on during transition to another teacher, grade, or school.

Product Resources

The following is a list of products mentioned in this chapter. Keep in mind that there may be multiple vendors for each product. Inclusion on this list is not an endorsement.

Product	Vendor	Website
BAT Keyboard	Infogrip	www.infogrip.com
BigKeys	BigKeys Company	www.bigkeys.com
BigTrack	Infogrip	www.infogrip.com
Chester Mouse	Chester Creek	www.chestercreektech.com
ClaroRead	Claro Software	www.clarosoftware.com
Classroom Suite	IntelliTools	www.intellitools.com
Co:Writer	Don Johnston, Inc.	www.donjohnston.com
Darci USB	WesTest Engineering	www.westest.com
MacSpeech Dictate	MacSpeech	www.macspeech.com
Discover Envoy	Madentec	www.madentec.com
Dragon NaturallySpeaking	Nuance	www.nuance.com
Dycem	Dycem	www.dycem.com
ErgoRest	Comfort Keyboard Systems	www.comfortkeyboard.com
ERICA Eyegaze	Eye Response Technologies	www.eyeresponse.com
EZ Keys	Words +	www.words-plus.com
FreeStyle	Kinesis Corporation	www.kinesis-ergo.com
FrogPad	FrogPad, Inc.	www.frogpad.com
Half QWERTY	Matias Corporation	www.half-qwerty.com
Headmouse Extreme	Origin Instruments	www.orin.com
IntelliKeys	IntelliTools	www.intellitools.com
Jouse	AbleNet	www.ablenetinc.com
Kurzweil 3000	Kurzweil Educational Systems	www.kurzweiledu.com
Magic Arm	RJ Cooper	www.rjcooper.com
Magic Cursor 2000	Madentec	www.madentec.com
Magic Touch	RJ Cooper	www.rjcooper.com
Magic Wand	In Touch Systems	www.magicwandkeyboard.com
MathTalk	Metroplex Voice Computer	www.mathtalk.com
MicroTouch	3M	www.3m.com
My Tobii	Tobii ATI	www.assistivetech.com
AlphaSmart (Dana & Neo)	Renaissance Learning	www.renlearn.com
OnScreen	RJ Cooper	www.rjcooper.com
Quadjoy	SEMCO	www.quadjoy.com
QuickGlance	EyeTech Digital Systems	www.eyetechds.com
REACH Interface Author	Applied Human Factors	www.ahf-net.com
Read & Write Gold	TextHELP Systems	www.texthelp.com
SAM Joystick	RJ Cooper	www.rjcooper.com
SAM Trackball	RJ Cooper	www.rjcooper.com
Scanbuddy	RJ Cooper	www.rjcooper.com

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Product	Vendor	Website
Slim Armstrong	AbleNet	www.ablenetinc.com
SmartClick	Innovation Management Group	www.imgpresents.com
SpeakQ	Quillsoft	www.wordq.com
Switching On Science	SoftTouch	www.ablenetinc.com
SwitchXS	AssistiveWare	www.assistiveware.com
Test Me Score Me	SoftTouch	www.ablenetinc.com
TouchWindow	ProEd	www.touchwindow.com
Tracker Pro	Madentec	www.madentec.com
Traxsys Roller Plus	Don Johnston, Inc.	www.donjohnston.com
Typeit4me	Ettore Software	www.typeit4me.com
WAVE Wireless Trackball	AbleNet	www.ablenetinc.com
WIVIK	Prentke Romich Company	www.prent-rom.com
WordQ	Quillsoft	www.wordq.com
ZoomCaps	Meeting the Challenge, Inc.	www.mtc-inc.com