Working Together: People with Disabilities and Computer Technology

Providing access to technology

A wide variety of technology has been created to diminish or eliminate barriers faced by people with disabilities, especially barriers related to computers and technology. Hardware and software tools–known as assistive technology– can aid in tasks such as reading and writing documents, communicating with others, and searching for information online. As the types of assistive technology expand, and as mainstream technologies become more accessible, students and employees with disabilities are more and more capable of handling a wider range of activities independently. Still, people with disabilities continue to face a variety of barriers to computer use. These barriers can be grouped into three categories: input, output, and documentation. Specific assistive technology, and approaches to using them, are described below.

Mobility Impairments

Mobility disabilities can affect both fine and gross motor control. For example, Standard height computer tables may be too low for some wheelchair users or a standard keyboard or mouse may be inoperable for someone who does not have use of their arms and/or hands.

Input

Equipment that provides flexibility in the positioning of monitors, keyboards, documentation, and tabletops is useful for many individuals with disabilities. Plugging all computer components into power outlet strips with accessible on and off switches makes it possible for some individuals to turn equipment on and off independently.

Some technology assists individuals with little or no use of their hands in using a standard keyboard. Individuals who have use of a finger, or who can use a mouth- or head-stick or another pointing device, control the computer by pressing keys with the pointing device. Software utilities can create "sticky keys" that electronically latch the SHIFT, CONTROL, and other keys to allow sequential keystrokes to input commands that normally require two or more keys to be pressed simultaneously. Keyboard guards (solid templates with holes over each key to assist with precise selection) can be used by those with limited fine motor control.

Sometimes repositioning the keyboard and monitor can enhance accessibility. For example, mounting keyboards perpendicular to tables or wheelchair trays at head-height can assist individuals with limited mobility to press keys with their hands or pointing devices. Other simple hardware modifications can assist individuals with mobility impairments.

Some hardware modifications completely replace the keyboard or mouse for individuals who cannot operate these standard devices.

- Expanded keyboards (larger keys spaced far apart) can replace standard keyboards for those with limited fine motor control.

- Mini-keyboards provide access to those who have fine motor control but lack a range of motion great enough to use a standard keyboard.

- Left- and right-handed keyboards are available for individuals who need to operate the computer with one hand. They provide more efficient key arrangements than standard keyboards designed for two-handed users.

- Track balls and specialized input devices can replace a mouse.

For those who find the above options burdensome, virtual keyboards are available. Virtual keyboards can be accessed via eye gaze tracking or via switches. Eye gaze tracking devices allow the user to type by looking at different locations on the screen. Switches, meanwhile, make use of at least one muscle over which the individual has voluntary control (e.g., head, finger, knee, mouth). In scanning input, lights or cursors scan the virtual keyboard. To make selections, individuals press the switch. Hundreds of switches tailor input devices to individual needs. In Morse code input, users input Morse code by activating switches (e.g., a sip-and-puff switch registers dot with a sip and dash with a puff). Special adaptive hardware and software translate Morse code into a form that computers understand so that standard software can be used.

Speech input provides another option for individuals with disabilities. Speech recognition systems allow users to control computers by speaking words and letters. A particular system can be trained to recognize specific voices.

Software can further aid those with mobility-related disabilities. Abbreviation expansion (macro) and word prediction software can reduce input demands for commonly used text and keyboard commands. They expand an abbreviation (such as a person's name and title) into a longer string of text and anticipate entire words after several keystrokes, respectively.

Output
Screen output does not present a challenge, but individuals with physical disabilities who have difficulty obtaining output from printers may need assistance from others.

Documentation
On-screen help, online videos, and a wealth of digital tutorial options provide more efficient access to learning to use technology, particularly for individuals who are unable to turn pages in books.

Blindness
Individuals who are blind cannot access visual materials.

Input
Most individuals who are blind use standard keyboards, however, braille input devices are available. Braille key labels can assist with keyboard use.

Output
Speech output systems can be used to read screen text to computer users who are blind. Special software programs (called screen readers) "read" computer screens and speech synthesizers "speak" the text. Using headphones can also help reduce the distractions for the user and for others nearby. Refreshable braille displays allow line-by-line translation of screen text on a display area where vertical pins move into braille configurations as screen text is scanned. Braille displays can be read quickly by those with advanced skills, are good for detailed editing (e.g., programming and final editing of papers), and do not disrupt others in work areas because they are quiet. Braille printers provide "hard copy" output for users who are blind.

Documentation
Scanners with optical character recognition can read printed material and store it electronically, so that it can be read using speech synthesis or printed using braille translation software and braille printers. Online library access and digital documents, as long as they are accessible, provide independent access to journals, syllabi, and homework assignments for students who are blind. Online documentation can support computer users who are blind if it is delivered in an accessible format.

Low Vision
For some people with visual disabilities, the standard size of letters on the screen or printed in documents are usually too small for them to read. Some people cannot distinguish specific colors from others.
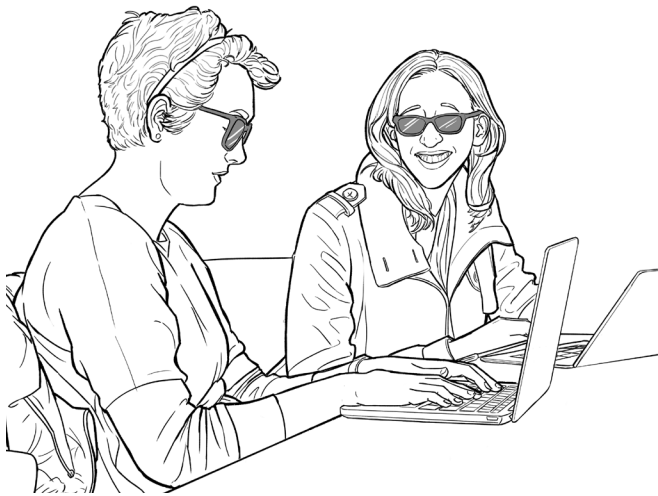
Input

Most individuals who have visual disabilities can use standard keyboards, but large print keytop labels are sometimes useful.

Output

Special equipment for individuals who are visually impaired can modify display or printer output. Computer-generated content can be enlarged on the monitor or printer, thereby allowing individuals with low vision to use standard word processing, spreadsheets, email, and other software applications. For individuals with some visual disabilities, the ability to adjust the color of the monitor or change the foreground and background colors is also of value. For example, special software can reverse the screen from black on white to white on black for people who are light sensitive. Anti-glare screens can make screens easier to read. Voice output systems are also used by people with low vision.

Documentation

Scanners with optical character recognition can read small print material and store it electronically, where it can be read using speech synthesis. Online library access and digital documents, as long as they are created accessibly, help provide access to journals, syllabi, and homework assignments for students who need materials enlarged.

Hearing or Speech Impairments

Some individuals face barriers to content presented orally.

Input

Students with hearing impairments use standard keyboards and mice.

Output

Audio output should be captioned or transcribed.

Documentation

Video tutorials should be captioned.

Specific Learning Disabilities

Educational software where the computer provides multi-sensory experiences, interaction, positive reinforcement, individualized instruction, and repetition can be useful in skill building. Some students with learning disabilities who have difficulty processing written information can also benefit from completing writing assignments, tutorial lessons, and drill-and-practice work with the aid of computers.

Input

Quiet work areas may benefit some individuals with learning disabilities who are hyper-sensitive to background noise. Many benefit from using spelling and grammar checkers and word prediction programs (software that spells out whole words from fragments). Similarly, macro software that expands abbreviations can ease the entry of commonly used text.

Output

Some individuals with learning disabilities find assistive devices designed for those with visual impairments useful. In particular, large-print displays, alternative colors on the computer screen, and voice output can compensate for some reading problems. People who have difficulty interpreting visual material can improve comprehension and the ability to identify and correct errors when words are spoken or printed in large fonts.

Documentation
Some individuals with learning disabilities find it difficult to read text. Electronic documentation can be enlarged on the screen or read aloud with text-to-speech systems to make it accessible. Video tutorials and other methods of training can often be preferred.

Accessible Technology
Making assistive technology available to individuals with disabilities does not solve all accessibility issues. Applications software, web resources, documents, online courses, and other digital tools and materials must also be designed in accessible formats. For more information about accessible technology design, consult *uw.edu/ accessibility*.

Video
Multiple video presentations about assistive technology and accessible technology design can be found at DO-IT's video page at *uw.edu/doit/ videos*.

About DO-IT
DO-IT (Disabilities, Opportunities, Internetworking, and Technology) serves to increase the successful participation of individuals with disabilities in challenging academic programs and careers, such as those in science, engineering, mathematics, and technology. Primary funding for DO-IT is provided by the National Science Foundation, the State of Washington, and the U.S. Department of Education.

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