

## Technologies for special needs students

In 1997, the Individuals with Disabilities Education Act Amendments 197 (PL 105-17) insured that students with disabilities have access to general education. This act adheres to the notion that parents, students, and teachers will work together to design an individualized education program (IEP) for special needs students. As a result, the *inclusion* of special needs students into regular classes has been mandated. Therefore, it is essential that science teachers have an understanding of the variety of technologies that are available for special education students. This is especially important considering that classroom science teachers are legally required to participate in the development of a student's IEP. An IEP is a document that specifies guidelines for modifications to a student's classroom instruction. These modifications are based on the special needs of a student and should be designed to increase the probability of classroom success for the special needs student.

You might wonder why today's science teachers need to keep current with the latest technologies available for special education students. When you consider that more than 50 million Americans are identified as having a disability, classroom technology applications for special education students is crucial (Sharp 2002). Especially for those that would generally not be able to participate in scientific activities without the use of the latest technologies. Moreover, with the federal government's mandate of the Individuals with Disabilities Education Act Amendments of 1997 (PL 105-17), it is imperative that science teachers comply with the state and federal special education guidelines.

### Computer-assisted instruction

Research supports the use of *computer-assisted instruction* (CAI) for special needs students as a supplement to traditional instruction (Christmann et al. 1997). One of the obvious benefits is that a computer allows special needs students to work at an individual pace. Several

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excellent science-based CAI software packages are available for special needs students. An excellent example is Edmark's Virtual Lab Series, which gives special education students the opportunity to explore light and electricity ([www.riverdeep.net/edmark](http://www.riverdeep.net/edmark)). Through computer simulation software, students can participate in lab activities that might otherwise be difficult, if not impossible. In addition, students who are unable to perform tasks that require the use of fine motor skills can use software that operates with single-switch technology. Single-switch technology allows students to trigger mouse "clicks" without applying pressure to mouse buttons. Another software designer, DK Multimedia, has several science programs, such as Earth Quest, Nature 2.0, and Dinosaur Hunter, that incorporate multimedia software applications into instruction for special needs students ([www.educate-me.net/educatecategory.cfm?Category=126](http://www.educate-me.net/educatecategory.cfm?Category=126)).

### Assistive technologies

Another form of technology that is available for students with disabilities is *assistive technology* (AT). Basically, anything that makes a task easier to perform (including handheld text readers, sonar vision glasses for the blind, and keyboard aids) is considered assistive technology. Assistive technology also includes services for evaluation, design, customization, adaptation, maintenance, repair, therapy, training, or technical assistance (Sharp 2002).

On a daily basis, all people use technology to function more fully in their lives. However, for people who have disabilities, it is sometimes impossible to function in a world designed for people without disabilities. Ironically, Stephen Hawking, a world famous scientist, has benefited from some of the same assistive technologies that are available for students today (see Figure 1 for examples). Because disabilities differ among students, each student must be fitted with assistive technologies that are commensurate with their individual needs. Therefore, we have included a list of Internet resources for your future reference.

### Conclusion

It is also important to note that in order to stay in compliance with the Individuals with Disabilities Education Act Amendments of 1997 (PL 105-17), it is imperative for science teachers to work directly with special education teachers to incorporate assistive technologies into students' science instruction based on individual needs. Currently, there are many technology applications for special education instruction. These applications allow special education students to feel comfortable and experience more success in the classroom, which are two key elements of any successful learning environment.

### Internet resources

Assistive Technology Solutions—[www.abilityhub.com](http://www.abilityhub.com)  
Keyboard for students with special needs—[www.maltron.com/#singlehanded](http://www.maltron.com/#singlehanded)  
Special keyboards—[www.fentek-ind.com/bigkey.htm](http://www.fentek-ind.com/bigkey.htm)  
Special needs software—[college.hmco.com/education/resources/res\\_prof/students/spec\\_ed/tech\\_resources/index.html](http://college.hmco.com/education/resources/res_prof/students/spec_ed/tech_resources/index.html)  
Voice controlled devices—[www.donjohnston.com](http://www.donjohnston.com)  
Voice recognition system—[www.intellitools.com](http://www.intellitools.com)  
Adaptive Technology Resource Center—[www.utoronto.ca/atrc/reference/tech/techgloss.html](http://www.utoronto.ca/atrc/reference/tech/techgloss.html)  
Resources for students with disabilities—[www.disabilityresources.org](http://www.disabilityresources.org)

### References

Christmann, E.P., J.L. Badgett, and R. Lucking. 1997. The effectiveness of microcomputer-based computer-assisted instruction on differing subject areas: A statistical deduction. *Journal of Educational Computing Research* 16(3): 281–296.  
International Society for Technology in Education (ISTE). 1998. *National educational technology standards for students*. Eugene, Ore.: ISTE Press.  
National Research Council (NRC). 1996. *National science education standards*. Washington, D.C.: National Academy Press.  
Sharp, V. 2002. *Computer education for teachers*. New York, N.Y.: McGraw Hill Publishing.

## Standards

Special education applications can be aligned with any content standard for students in grades 5–8 (NRC 1996). The integration of technology into science instruction for special education students is in compliance with the *National Education Technology Standards for Students* (ISTE 1998) as follows:

### 1. Basic operations and concepts

- Students demonstrate a sound understanding of the nature and operation of technology systems.
- Students are proficient in the use of technology.

### 2. Social, ethical, and human issues

- Students understand the ethical, cultural, and societal issues related to technology.
- Students practice responsible use of technology systems, information, and software.
- Students develop positive attitudes toward technology that supports lifelong learning, collaboration, personal pursuits, and productivity.

### 3. Technology productivity tools

- Students use technology tools to enhance learning, increase productivity, and promote creativity.
- Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.

### 4. Technology communications tools

- Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
- Students use media and formats to communicate information and ideas effectively to multiple audiences.

### 5. Technology research tools

- Students use technology to locate, evaluate, and collect information from a variety of sources.
- Students use technology tools to process data and report results.
- Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.

### 6. Technology problem-solving and decision-making

- Students use technology resources for solving problems and making informed decisions.
- Students employ technology in the development of strategies for solving problems in the real world.

**FIGURE 1** Assistive technology glossary

### Onscreen keyboard



A great number of people are unable, for various reasons, to use a standard keyboard. These reasons can range from limited movement or motor control to low strength in the hands and fingers. For many, an alternative keyboard can solve these problems, but for others the best solution is to use a virtual or onscreen keyboard. An onscreen keyboard generally appears on the same display used for programs and will remain permanently visible. The keyboard can then be accessed using the pointer device. In the simplest sense this means a standard mouse, but through the use of alternative pointer devices or switches a large number of disabilities can be addressed.

### Voice recognition systems



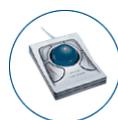
Voice recognition allows a user to use his/her voice as an input device. Voice recognition may be used to dictate text into the computer or to give commands to the computer (such as opening application programs, pulling down menus, or saving work).

### Alternative keyboards



Alternative keyboard layouts and other enhancements allow people who experience difficulty with conventional keyboard designs to use computers. The products available range from keyguards that prevent accidental key activation, to alternative keyboards with differing layouts, sizes, etc. for people who have specific needs, to alternative input systems which require other means/methods of getting information into a computer.

### Alternative mouse devices



Alternative pointing devices are used to replace the mouse. The keyboard keypad can function as a mouse using *mousekeys*. Mousekeys allow the user to manipulate the cursor on screen using keys on the keyboard. Many of the alternative keyboards have mousekeys built in, so the keys on the keyboard can toggle between text input or mouse input. Trackballs are upside down mice, with the ball on top and several buttons. Many trackballs offer the left and right mouse buttons plus one or two more which can be programmed to be a double click or drag lock. Many local computer vendors stock trackballs and the programmable ones are also available from assistive technology vendors. These allow the user to manipulate up to five switches to control the mouse—the more switches the user can control, the faster the mouse can be manipulated. Mouse input can also be given by high-tech pointing devices, which transmit the location of a transmitter or reflective dot on the user's head to the computer system. Separate switches, or just dwelling on a location, are used for mouse clicks and drags. These are frequently used with on-screen keyboards for text input by people with limited movement due to quadriplegia or muscular dystrophy.

**FIGURE 1** Assistive technology glossary

### Speech synthesizers



An external speech synthesizer is a hardware device used for speech output. Typically, they are used with screen readers or optical character recognition/scanning software programs for people who are blind or visually disabled. External speech synthesizers were used exclusively before the advent of sound cards in computers. Now, with multi-channel sound cards people who use screen readers or other speech output software can have both the “voice” of the computer and the system sounds audible at the same time. Some people who require the system sounds, or who prefer to leave their sound cards to perform other functions may want to use an external speech synthesizer instead of the internal sound card. For example, if they want to listen to a CD, watch a DVD, or do some audio/video conferencing, they might want to leave the sound card channels free to do so. This may also be a critical piece of equipment for people who are also composing music or using audio editing programs.

### Screen magnifiers



Screen magnification software is used by people with visual disabilities to access information on a computer screen. The software enlarges the information on the screen by pre-determined incremental factor. Magnification programs run simultaneously and seamlessly with the computer’s operating system and applications. Most screen magnification software has the flexibility to magnify the full screen, parts of the screen or provide a magnifying glass view of the area around the cursor or pointer. These programs often allow for inverted colors, enhanced pointer viewing, and tracking options.

### Switches



Switches are a common solution for users with mobility disabilities, such as muscular dystrophy, multiple sclerosis, cerebral palsy, spinal cord injuries, and head injuries, who need to use computers or other electronic devices, but have difficulty with the physical interface. To allow easier manipulation than a standard keyboard or joystick, a specially-designed switch may be composed of a single button, merely a few buttons, a sensory plate, or another of the whole host of adaptive switches available; it may also be touch-free, relying instead on motion sensors, brain activation, or a sip-and-puff mechanism. Aside from simplifying user interfaces, switches can also be used as developmental aids, teaching children (or adults) how to interact with their external environment.

### Screen reading and talking browsers



A screen reader is the commonly used name for voice output technology. Hardware and software produce synthesized voice output for text displayed on the computer screen, as well as for keystrokes entered on the keyboard. Voice-based browsers use the same technology as screen reading software, but are designed specifically for Internet use.