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AUTHOR Carr, Annette
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ABSTRACT

This guide describes adaptive technology for reading printed text and producing written material, to assist the student who has a visual impairment. The special technologies discussed include auditory text access, text enlargement, tactile text access, portable notetaking devices, and computer access. The guide concludes with lists of the following aids: suggested readings; resources; periodicals; digitizers, optical card readers, and scanners; large print displays; speech recognition devices; and speech synthesizers. (JDD)

Center for Special Education Technology

Tech Use Guide

Using Computer Technology

Visual Impairments

Students who are blind or partially sighted are unable to read printed text, or have great difficulty seeing various sized text. Written material must be enlarged or transcribed into a tactile or auditory media. For students who have visual impairments, as well as their sighted peers, producing written material is essential for communicating with teachers, family, and friends. Their written ideas must be presented in a form that is understood by sighted individuals. Sophisticated computer technology provides powerful tools to help students who have visual impairments accomplish these tasks. Special devices can assist students with reading independently, communicating through printed text, and accessing computerized information.

Auditory Text Access

For centuries people with visual impairments have relied on friends and family members to read printed material to them. The discovery of "Talking Books" (long-play records which books were recorded on) gave the person with visual impairment some independence in reading. When cassette tapes became popular with the general public, it was found that printed material could be recorded faster and much more economically. Recordings For The Blind, Inc., and many community organizations/agencies and volunteer groups will record textbooks, articles, manuals, classroom handouts, and other material for students. The cassette tape recorder has been found to be a very versatile tool for people with visual impairments. In addition to being used for reading recorded books, it can be used to record personal messages/notes, classroom lectures, and frequently needed directions (operating instructions, travel directions, recipes, etc.).

Despite the portability of cassette recorders, they are somewhat bulky and cumbersome. Through using adapted tape recorders which record and play cassette tapes at a speed of 15/16 ips and utilize four recording tracks on the cassette tape, the capacity of a standard cassette is more than doubled. With a cassette tape's increased ability to contain a large volume of information, a system for locating specific information on a tape was needed. An audible tone can be added to a tape at the time of recording. This beep-like tone can only be heard when the tape is being rewound or fast-forwarded. The beep can be used to indicate the start of a chapter, message, recipe, or important information during a class lecture.

In addition to the cassette tape recorder, there are the commercially available phone answering machines. Many new models have a memo system which allows a message to be left on the machine without calling in on the phone. This allows both sighted and nonsighted people to leave messages for each other in an organized manner, which is accessible to all.

The auditory text access methods discussed thus far cannot provide the visually impaired reader with immediate access to printed text. Optical character recognition (OCR) systems can do just this. By placing printed material on an optical scanner (similar to a photocopy machine) the text is translated into a synthesized voice output. The reader has complete control over re-reading any paragraphs, sentences, words, or letters. Modern technology has made the Kurzweil Reader somewhat portable by reducing its weight to approximately 30 pounds and using a hand-held scanner. Optical character recognition systems offer individuals with visual impairments complete freedom to read what they want, when they want.

Text Enlargement

Students with visual impairments who have some functional vision may be able to read printed texts by using handheld magnifiers. Many of these magnifiers are small enough to be carried in a pocket or purse. Others which are larger and too bulky to carry around, are best left in one place where reading is most often done. Identifying an appropriate magnifier for a person with a visual impairment should be done by a low vision specialist and the person who has visual impairments.

Many individuals with visual impairments are unable to be assisted by handheld magnifiers. In these cases, it might be helpful to use large-print books. The American Printing House for the Blind, as well as other agencies, produce large-print text, hobby, and leisure-reading books. The size of the text in a large-print book depends on the reading level of the text. Books written for a reading level of grades 1-3 are produced in 18- point print, grades 4-7 in 14-point print, and grades 8-12 in 12- point print. This is only a general standard and is not followed by all companies. The increase in the print size often results in

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large, heavy, and bulky books. Transporting these books from class to class or from school to home is cumbersome. The size and weight of large print books may also cause some individuals neck, shoulder, and arm fatigue during reading.

A high-tech solution to obtaining enlarged text is the "Closed Circuit Television" (CCTV) system. A CCTV uses a camera to magnify the text and displays it on a 14" or 19" monitor similar to a television screen. Text can be enlarged up to 60 times on some models of CCTVs. There are a few types of monitor displays which can accommodate various types of visual impairments. Possible configurations include black on white or white on black, amber, and green displays. Color displays are not available, but are currently being developed by CCTV manufacturers. The camera/monitor make-up of most CCTVs requires that it remain in one place. Despite the CCTVs ability to give students with visual impairment the greatest access to printed material, the lack of its portability dictates when and where reading can be done. There are portable models available which contain the monitor and camera all in one unit weighing around 30 pounds. A new CCTV system on the market uses a handheld camera. The camera is small enough to carry with you and use with a standard 14" monitor located at school and home.

The CCTV is not limited to being used for only reading. Some CCTVs can integrate keyboards and printers to form complete computer terminals or word processing systems, thus allowing many users can produce handwritten materials or perform other fine motor tasks.

Tactile Text Access

Braille has been used by persons with visual impairments for many decades. This system of various combinations of six raised dots is the only media for producing written material for those individuals who are unable to read printed text. Two levels of braille, Grade I and Grade II, are used most often. Grade I braille is similar to inkprint, in that every word is written out letter-for-letter. This form of braille is rarely used as it is very bulky and slows down the reader. Grade II braille is much like shorthand. Symbols or signs are used to represent frequently used words and combinations of letters. Despite this compact format of braille, it is still very bulky and requires much storage space.

There are a number of braille codes which meet the needs of various types of written notation. These include nemoth code (used in math), braille music code, and computer braille codes. Each code uses the same combinations of dots, but assigns different meanings to each sign/symbol.

Producing braille for personal notes or communication with another person who knows braille can be done with a Perkins Brailler or a slate and stylist. Both methods are readily used and reliable. The Perkins Brailler is the most common method of producing braille; however, the brailler itself is quite heavy and not really suited for portability. A more portable and quiet method of producing braille, but one which requires a high level of skill, is the slate and stylist. It is useful for writing personal messages and notes.

Braille is very useful for individuals with visual impairments, but very few sighted individuals know how to read it. The students who have visual impairments must have a way of producing printed information. In the past this has been done with traditional typewriters. The student with visual impairments would translate his/her hands back and forth from the braille copy to the typewriter keyboard. Another inherent problem is the student with visual impairment inability to check his/her typewritten work for errors.

There are now devices available which interface the Perkins Brailler with a computer printer. These devices attach to the brailler and convert the braille characters to letters which can be printed out. An internal memory allows the user to edit the written material before printing it.

Obtaining books in braille can be a timely and costly process. The Opticon is an alternative tactile reading method for some students who have visual impairments. A handheld camera is scanned across each line of text and a grid of 144 vibrating pins re-creates the images on the printed page. The student uses his/her index finger to read a raised vibrating image of each letter. The Opticon requires many hours of practice before a user is able to use it efficiently. However, its portability and ability to give individuals with visual impairments immediate access to printed materials makes this device desirable for many.

Portable Notetaking Devices

Until recently, students with visual impairments had very few options for taking notes during class. Braille is slow, tape recording requires time outside class to re-listen to the tape and transcribe it into a hardcopy (braille or large print); and having other classmates take notes is not always reliable. This has changed with the development of portable notetaking devices. These devices utilize speech output and/or refreshable braille display in combination with standard keyboards or a 9-key Perkins Brailler keyboard. These devices are usually lightweight and run on a rechargeable battery or an AC adapter. Information can be stored, retrieved, and edited, as well as printed out.

Computer Access

The increasing use of computers in the classroom was originally thought to be a major problem for students with visual impairments. Instead, computer technology has given them the advantage they have been waiting for. One computer with the appropriate adaptive equipment can meet the many needs of one individual and the varying needs of people with visual impairments.

Information on a computer screen can be enlarged through the use of screen magnifiers, adaptive hardware installed inside the computer and/or software programs. Most hardware and software character enlargement products offer a wide range of text magnification. However, graphics can only be enlarged on the Macintosh computer.

The most popular computer access method for a person with a visual impairment is the use of speech-synthesized voice output. This can be achieved by installing a voice synthesizer unit into an external port on the computer. Before a speech synthesizer can produce voice output, a special software program must be run that will interface with both the speech synthesizer and the software program to which you want to gain auditory output. An example of this for the Apple IIE is a Slotbuster II speech synthesizer card, Apple Companion Speech software, and AppleWorks. A similar setup can be done for an IBM or compatible by using an Artic speech synthesizer card, Artic Vision Speech software, and WordPerfect. Many software packages on the market that are capable of using a speech synthesizer, like the Echo IIb, with no additional speech software.

A third method of accessing the computer is through a tactile display, or refreshable braille display. These devices use 20 sets of 6 pins each to represent 20 braille cells. At a touch of a key the next or previous 20 characters can be displayed. Computer users who prefer braille to auditory output find refreshable braille displays to be unreplaceable. At the present time there are no refreshable braille display devices capable of displaying graphics.

The computer can also be used for producing hard copy braille through the use of braille embossers. Additional software such as BEX or hardware such as the Ramsley braille translator must also be used. These products, as well as others, take print text and translate it to Grade I or Grade II braille before it is sent to an embosser. This process is not dependent on the user knowing Braille. Therefore, students with visual impairments can produce hard copy braille, and teachers can use the same products to create handouts in print as well as in braille at the touch of a key.

A unique feature found in the BEX braille translation software is its ability to convert the computer keyboard to a 9-key Perkin's brailler keyboard. This input method might be found suitable for the young student who knows how to use a brailler, but does not know how to type.

Throughout this guide we have presented only a small sample of adaptive technology to assist the student who has a visual impairment. By contacting the companies and agencies listed at the end of this guide, you will be able to obtain additional information about the devices discussed here, as well as other available devices. It is important to keep in mind that there is no **ONE** device that will meet all the needs of one individual. A person who is able to use a variety of devices and techniques will have greater access to the sighted world. Elementary and high school students with visual impairments who have the opportunity to use a variety of adaptive devices will be able to make informed decisions as to which devices best meet their needs as adults.

Readings

Computer Center for the Visually Impaired. (1985). *Computer equipment and aids for the blind and visually impaired.*, New York: Baruch College, The City University of New York.

Harrell, R., Lloyd, J., & Ryan, F. (1987). *California directory of services and products for the visually impaired.* California: Joint Action Committee of Organizations of and Serving the Visually Handicapped.

Mendelsohn, S. (1987). *Financing adaptive technology: A guide to sources and strategies for blind and visually impaired users.* New York: Smiling Interfaces.

National Braille Press. (1985).*The second beginner's guide to personal computers for the blind and visually impaired.* Boston, MA: Author.

National Library Service for the Blind and Physically Handicapped. (1986). *Reading, writing, and other communication aids for visually and physically handicapped persons.* Washington, DC: Library of Congress.

Resources

The American Printing House for the Blind, P.O. Box 6085, Louisville, KY 40206-0085, 502-895-2405.

National Library Service for the Blind and Physically Handicapped, The Library of Congress, Washington, D.C., 202-707-5100

National Technology Center, American Foundation for the Blind, 15 West 16th Street, New York, NY 10011, 212-620-2143.

Recordings for The Blind, Inc., 20 Roszel Road, Princeton, NJ 08540, 609-452-0606.

Periodicals

Braille Forum, The American Council of the Blind, 190 Lattimore Road, Rochester, NY 14620.

Closing The Gap, P.O. Box 68, Henderson, MN 56044.

Computer Disability News, The National Easter Seal Society, 2023 West Ogden Avenue, Chicago, IL 60612

Journal of Visual Impairment & Blindness, Publications and Information Services Department, American Foundation for the Blind, 15 West 16th Street, New York, NY 10011.

Raised Dot Computing Newsletter, Raised Dot Computing, 408 South Baldwin Street, Madison, WI 53703.

Sensory Aids Technology Update, Sensory Aids Foundation, 399 Sherman Avenue, Palo Alto, CA 94306.

Digitizers, Optical Card Readers, Scanners

AST-Vision Plus Card, AST Research, Inc., Apple Enhancement Product Group, 2121 Alton Avenue, Irvine, CA 92714, 714-553-0340.

Chorus PC-Eye and PC 1540, Chorus Data Systems, Inc., P.O. Box 370, 6 Continental Boulevard, Marrimack, NH 03054, 603- 424-2900.

Compuscan PSC Page Reader, Compuscan, Inc., 81 Two Bridges Road, Building 2, Fairfield, NJ 07006, 201-575-0500.

Digisector Series of Video Digitizers, The Micro Works, P.O. Box 1110, Del Mar, CA 92014, 619-942-2400.

Read-It! OCR VER - 2.0, Olduvai Corporation (USA), 7520 Red Road, Suite A, South Miami, FL 33143, 305-665-4665.

Thunderscan, Thunderware, Inc., 21 Orinda Way, Orinda, CA 94563, 415-254-6581.

Large Print Displays

Apollo Closed Circuit Television Magnifier Products, Telesensory Systems, Inc., P.O. Box 7455, Mountain View, CA 94039-7455, 415-960-0920.

Compulens, The Able Tech Connection, P.O. Box 2301, Kettering, OH 45429, 513-293-6803.

Large Print Display Processor, VTEK, Inc., 1625 Olympic Boulevard, Santa Monica, CA 90404, 213-829-6841, 800-345-2256, 800-521-5605 (in California.

Viewscan, Telesensory Systems, Inc., P.O. Box 7455, Mountain View, CA 94039-7455, 415-960-0920.

Speech Recognition Devices

Chatterbox Voice Reading Ability Drill, Voice Learning Systems, 2265 Westwood Avenue, Suite 9, Los Angeles, CA 90064, 213-475-1036.

Introvoice I, II, III, IV, The Voice Connection, 17835 Skypark Circle, Suite C, Irvine, CA 92714, 714-261-2366.

Micro-Ear, Artec Systems, Inc., 9104 Red Branch Road, Columbia, MD 20145.

Shadow/Vet Voice Entry Terminal, Scott Instruments Corporation, 111 Willow Springs Drive, Denton, TX 76205, 817-387- 9514.

Speech Synthesizers

Apple Cyber, Cyberon Corporation, 1175 Wendy Road, Ann Arbor, MI 48103, 313-665-8512.

Cricket Speech Synthesizer, Street Electronics Corporation, 1140 Mark Avenue, Carpinteria, CA 93013, 805-684-4593.

Echo+ Speech Synthesizer, Street Electronics Corporation, 1140 Mark Avenue, Carpinteria, CA 93013, 805-684-4593.

Mockingboard B, Sweet Micro Systems, 50 Freeway Drive, Cranston, RI 02920, 401-461-0530.

PC Voice, Arts Computer Products, Inc., 145 Tremont Street, Suite 407, Boston, MA 02111, 617-482-8248.

This Guide was developed by Annette Carr who is employed as a Technical Assistance Officer with the SPH/Deaf-Blind Technical Assistance Center at George Mason University, Fairfax, Virginia.

Additional **Tech Use Guides** on the following topics are available from the Center upon request:

- Guide for Teachers
- Guide for Parents
- Technology in the Workplace
- Computer Access
- Selecting Software
- Selecting Hardware
- Preschool Children
- Learning Disabilities
- Hearing Impairments
- Physical Disabilities
- Telecommunication Networks
- Augmentation Communication

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