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ABSTRACT

Articles published during 1997 include: "The Multi-Disability Workstation for Small Libraries" (Dick Banks and Steve Noble); "Talking Books: Toward a Digital Model" (John Cookson and others); "World Wide Access: Focus on Libraries" (Sheryl Burgstahler); "The Virtual Library: Collaborative Data Exchange and Electronic Text Delivery" (Steve Noble); "The Law and Library Access for Patrons with Disabilities" (Sarah Hawthorne); "Remote Realtime Captioning for Classroom Participation by Deaf and Hard of Hearing Students" (Jeffrey B. Bishop and Carole M. Collier); "Talking Pages: Vermont's Struggle To Provide Universal Access to Information" (Fred Jones); "EASI Expands K-12 Program" (Carmela Cunningham); "Software Review Zoomtext Xtra: Integrating Screen Magnification and Synthesized Speech" (Dick Banks); "Review: Working Together: Faculty and Students with Disabilities. A Presentation Packet Created by Do-It (Disabilities,k Opportunities, Internetworking, Technology)" Ann Neville; "Online Information and Networking" (Steve Noble); "K-12 News: The Making of the 'Whatever' Page" (Anne L. Pemberton); "Science, Technology and Math Issues for K-12 Students with Disabilities" (Carmela Cunningham); "Peer Support: What Role Can the Internet Play?" (Sheryl Burgstahler); "Project Gold: A Club for Girls with Disabilities" (Kimerly J. Wilcox); "Perspectives on Inclusion by Design: Science Curriculum Reform and Special Education" (Eric J. Pyle and Gretchen Butera); "K-12 Web Resources for Science, Engineering and Math" (Dick Banks); "Virtual Reality Tactile System for Access to Graphics" (John C.D. Nissen). Individual issues also contain news items, reviews, and calls for papers. (DB)

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Cambridge, Mass.: Brookline Books, 1996.

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THE MULTIPLE-DISABILITY WORKSTATION FOR SMALL LIBRARIES

Dick Banks, Adaptive Technologist
Steve Noble, Recording for the Blind and Dyslexic

This presentation is designed to assist those who need to know how to make their library computing environment as accessible as possible, while at the same time trying to work with a small budget. The presenters will focus on workable solutions to today's library access problems.

THE COMPUTER

There are two ways in which libraries may approach the issue of access. The first option involves purchasing a new computer for the adaptive workstation. The second option may be dictated by funds, which would mean using an existing workstation for disability access.

Using an existing workstation will dictate access options, which means you will need to know a few things. Knowing the answers to the following questions will help in determining a plan of action. The questions offered here are certainly not all- inclusive. The more that is known, the better:

1. What is the operating system? DOS, Windows, MAC, etc.

2. How much RANDOM ACCESS MEMORY (RAM) does the computer have and how much is available for new software?

3. How much DISK DRIVE SPACE is available?

4. How many PORTS are available for additional hardware?

5. What kind of MONITOR AND VIDEO CARD does the computer use?

6. Does the computer have a 286, 386, 486, or 586 PROCESSOR? In buying a new computer it is best to adopt the policy of the more the better. Unfortunately the reality in many situations is that such a policy is not possible because of budget constraints. With budget constraints in mind, the following list could be considered as minimums. Remember that we are discussing a general adaptive workstation:

1. 16 megabytes of RAM, random access memory. 2. 1 gigabyte HARD DISK DRIVE SPACE with 3.5 FLOPPY disk drive. 3. At least one PARALLEL and one SERIAL PORT MORE than you need. 4. VGA/SUPER VGA color monitor minimum of 15 inches. 5. CDROM and SOUND CARD.

ADAPTIVE CONSIDERATIONS

It is very wise to consider future library plans when investing in a computer. You may be using a DOS based cataloging system now. Will you consider changing to a Windows, graphical user interface (GUI) based system in the future? If this is the case, it needs to be understood that adaptive hardware/software, in many cases, is not compatible between these operating systems. The same is true with MAC.

DISABILITY CATEGORIES

For the purpose of discussing adaptive computing it is helpful to address the issue in disability category terms. This is done to help understand what hardware/software can be helpful. In other words, certain adaptations are designed to help people with different needs. There are a number of adaptations that are helpful to a variety of these categories as well.

Blind and Visually Impaired

Many blind and low vision users learn to type early in school. Many computer keyboards have raised dots on the letters "F" and "J" and on the number "5" on the numeric keypad. Showing a user these

guides may make their task of learning the keyboard much easier. The main concern may be special keys like the CONTROL, ALT, and DELETE keys on the IBM or compatible, or COMMAND OPTION keys on the Macintosh.

Braille key labels can be created by using a DynaTape device and would be useful in establishing relative key positions. A person who uses Braille would be unlikely to be able to read the letters with all fingers sitting directly on top of the keys, as Braille is normally read by moving the fingers across raised dots. However, Braille DynaTape is very useful for identifying many keys on the keyboard that may vary from keyboard to keyboard, such as the control key, delete key, etc. Clear DynaTape allows a sighted user to still be able to read the key labels. Many computers that are made accessible serve a dual purpose. In other words, the computer may be used by a person with a disability and, at times, serve as a regular workstation for the general lab user. For this reason, it may be wise to consider solutions that take generic computer use into consideration. One of the greatest tools for blind and low vision users is the speech synthesizer. A speech synthesizer coupled with a screen reading program allows the user to hear input from the computer in a variety of ways. Programming the screen reader to read all or portions of the screen make it possible to access an online catalog and save configuration files so that users don't need to spend a great deal of time learning how to use the library's online information.

There are speech synthesizers and screen reading programs that work for DOS and for Windows. An important thing to remember is that since DOS and Windows are really different operating systems, screen readers will not work in both formats. A different screen reading program will need to be considered for each operating system. Some MAC operating systems contain screen reading capabilities which may or may not work for online catalogs.

One of the most exciting advances in adaptive technology is OCR or Optical Character Recognition. The term scanner may be more familiar to you. This technology has been available for a number of years. Scanners look very much like small photocopy machines. Books or loose pages of text are placed on the scanner and the text is scanned and converted to computer readable form which can then be saved to a file.

A Braille printer can be used to print a hard copy of search results or text files. Many blind people prefer to have a hard copy of materials just as sighted users do. The price of Braille printers has dropped significantly in recent years and if the budget allows, a Braille printer should be a part of the workstation.

Physical-Mobility Impairment

For people with a mobility impairment, computer technology offers an opportunity to gain independence in daily living, education and working activities. A computer can be modified for an individual with a disability affecting motor control. There are varying degrees of impairment which can make it difficult to consider accommodations. There are however, some adaptive technology hardware and software accommodations that are helpful and quite reasonable.

A software package like ACCESS DOS and WINPACK are free and contain a number of software programs. Sticky Keys, Mousekeys and Repeat Keys are some of the programs included with these packages. ACCESS DOS and WINPACK are freeware and available on many computer billboards and Internet ftp and World Wide Web sites.

Sticky Keys allows the user to depress one key and LOCK that key until the next key is depressed. This can be very useful in giving keyboard commands that require pressing two keys at the same time. Capitalizing the first letter of a word at the beginning of a sentence can be impossible for someone who has the use of only one hand.

Mousekeys is a program that allows for manipulation of the mouse pointer by using numbers on the numeric keypad.

Patrons who have difficulty controlling hand movement may find releasing a key before the keystroke is repeated many times to be nearly impossible. Repeat Keys can be programmed to delay repeating

keystrokes up to three seconds.

There are hardware solutions for this population as well. One such product is a trackball. A trackball is a mouse device which permits the user to move the mouse cursor by using a rolling motion on a stationary base. The clicking action is done by pressing mouse buttons with the heel or side of the hand on the base of the trackball. Mouse buttons can be programmed to perform double click requirements and dragging.

Learning Disabled

Perhaps the most challenging of categories is that of the learning disabled. It is important to remember that many hardware and software adaptive technologies that are helpful to blind and low vision users can be used to assist people with learning disabilities. Screen enlargement is a good example. Many people with dyslexia find larger characters and cursors to be quite helpful. Additional products, such as word prediction, macro programs and grammar checkers can make a real difference in enhancing the abilities of patrons with learning disabilities.

Hearing and Speech Impairments

As a general rule, both of these categories need little in the way of specialized adaptive technologies. There are a number of computer programs that notify the deaf and hearing impaired when the computer beeps by giving a visual signal on the computer screen such as a flashing musical note.

Communication is the real issue with both of these populations. Being able to understand the user and having the ability to make yourself understood can be a real challenge. The computer can be a useful tool in communicating. If the user has computer skills, typing in a word processor or editor is extremely helpful in communicating.

WHAT ABOUT COST?

How much money will a library need to consider a general access workstation? Although prices vary depending on product, the following is offered as a general estimate:

* New Computer with CD-ROM drive, 2800 bps Modem, 3.5" floppy drive, 15" color monitor, 1 GB hard disk space, and 16MB Random Access Memory...$995 to $1395

*Screen Enlargement...$295 - $700

*Speech Synthesizer...$395 - $595

*ACCESS DOS or WINPACK...no cost

Price ranges reflect differences in particular models, and a discussion of these differences is beyond the scope of this paper. If there is a college or university close to you, call the library and ask what they are doing or using in the way of adaptive equipment. There may be a user of adaptive technology in your community.

THE INTERNET, LIBRARIES AND RESOURCES

Nothing has opened windows to the world quite like the Internet. This is particularly true for people with disabilities. Research is now a only an Internet connection away. Literally thousands of libraries around the world are accessible online. The Internet is often referred to as the information superhighway. There are many resources to help librarians access this information. EASI (Equal Access to Software and Information) is one of those resources.

EASI offers a discussion list called AXSLIB-L, which is devoted to access to libraries. It is free and all that is required is an e-mail address. Many members on AXSLIB-L have been working with access issues and libraries and are willing to share their experiences with others.

EASI has a software library with freeware, shareware and demo programs available via the Internet. Having this software available gives people the opportunity to try a particular access technology to see if it would work in a particular situation. The EASI World Wide Web page has hundreds of documents and links specifically dealing with computer and information technology issues for people with disabilities. It is a virtual "one stop shopping center" and it is all free. Connect to EASI at the following URL:

http://www.rit.edu/~easi

CONCLUSION

Making libraries accessible to people with disabilities opens a new world of opportunities to a population who, in many cases, have never enjoyed the wonders of a library. Access to libraries for this population can mean an equal opportunity to advance in education. Education often leads to better jobs and greater independence. Adapting a computer to meet the needs of people with disabilities has changed in the past ten years in three important areas. Products have become more numerous and less expensive. Resources to assist libraries in their efforts have increased dramatically and the technical aspects of installation and use are far less threatening.

This paper, which was delivered at the California State University Northridge Conference "Where Assistive Technology Meets the Information Age" (March 18 - 22, 1997) is reprinted, with permission of CSUN's Founder and Director, Harry J. Murphy, Ed.D.

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TALKING BOOKS: TOWARD A DIGITAL MODEL

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ABSTRACT

We propose to develop performance criteria for next-generation digital talking books (DTB) by using the National Information Standards Organization (NISO) standardization process. This process entails soliciting advice from all interested parties including users, consumer organizations, and manufacturers, then seeking consensus on the characteristics of the contemplated product. NISO is accredited by the American National Standards Institute (ANSI) to develop and maintain technical standards for information services, libraries, publishers, and others involved in the business of creation, storage, preservation, sharing, accession, and dissemination of data.

INTRODUCTION

At present, library access for blind and physically handicapped persons is served by analog cassette tape. This technology has enjoyed the acceptance and economy found in the consumer entertainment market for over twenty-five years. As digital technology gains in market share, the analog cassette is likely to become less attractive from both a cost and consumer - preference standpoint. The two forces, cost and preference, will ultimately converge to motivate a move to digital methods. In anticipation of this, a digital talking book (DTB) standard is needed to define requirements, examine the feasibility of proposed features, and most importantly, explore user- control preferences.

Developing a standard necessarily begins far in advance of system-wide hardware implementation so that when the forces for change become compelling, a practical system, with acceptable controls, will be fully defined and tested. Developing the standard under the auspices of the National Information Standards Organization (NISO) is appropriate because NISO is the only organization accredited by the American National Standards Institute (ANSI) to develop and maintain technical standards for information services, libraries, publishers, and others involved in the business of creation, storage, preservation, sharing, accession, and dissemination of data.

WHY A STANDARD?

A standard is required to define minimum performance and optional features for next-generation library-access equipment used by blind and physically handicapped individuals. It will address problems of control, audio quality, media compatibility, copy- right protection, ease of international interlibrary loan, and affordability. Interested parties include patrons, particularly as represented by advocacy organizations, media producers (volun- teer and commercial), rights owners, equipment producers, librarians, and international borrowers and lenders.

SCOPE AND APPLICATION

The proposed standard is intended to define minimum performance requirements for next-generation patron-access equipment. It will also describe optional features. While the standard will be written in a digital context, it will not define the software or hardware internals of a particular implementation. Emphasis will be on performance characteristics and control. Potential implementers would include manufacturers of digital and analog hardware, developers of multimedia authoring and presentation software, and media producers. Available resources, individuals, and organizations with expertise in the subject matter include various advocacy and service organizations such as the American Council of the Blind, Association for Education and Rehabilitation of the Blind and Visually Impaired, American Foundation for the Blind, American Printing House for the Blind, Blinded Veterans Association,

National Federation of the Blind, Recording for the Blind and Dyslexic, and National Library Service for the Blind and Physically Handicapped (NLS/BPH). Engineering expertise is available at NLS/BPH as are funds.

Developing the proposal into an American National Standard will require an engineering talent, financial support for developing software that tests control concepts, and the funding of program administration including communications and travel.

IMPLEMENTATION

The effect on users of moving from existing technology to the proposed new standard will likely range from virtually transpar- ent to profound. "Virtually transparent" means that, although tactile interfacing will not necessarily be the same as with a cassette player, it could be functionally identical. Similarly, sound quality could be identical to today's performance but would very likely be improved through the use of digital methods. "Profound" means that readers would have access to multiple levels of optional complexity and product-specific presentation-software features. This dual approach satisfies the demands of patrons who prefer simplicity while accommodating those who prefer more elaborate features.

Because the technology, and associated costs, found in the consumer audio market are changing, limiting the time for development of the proposed standard is important. The existing system is based on analog cassette tape, while the standard will define a system that will be digitally based but not restricted to any particular distribution medium or implementation. Projecting at least ten more years of acceptable and economical use for cassette tape suggests that the standard should be finished within five years to allow for a gradual transition period. A gradual transition will control technical risk, enhance user acceptance, and encourage financial support.

When recommending a new standard, NISO requires the proposer to estimate what portion of the user community will be motivated to adopt the standard. For talking books, the entire community will be so motivated by expanded functionality and lower cost. The "entire community" includes blind and physically handicapped patrons as well as the infrastructure of people who support and implement the library system. This community includes librarians; producers of talking books and magazines, both commercial and volunteer; equipment manufacturers; and software developers. The new standard will, again, range from transparent to profound in impact on this community. For example, audio studios may continue to narrate into conventional analog equipment while their product would become usable only by processing through digital encoding software that is not found in today's production stream.

RELATED STANDARDS

Related standards include the various levels of MPEG (ISO/IEC 11172, 13818 and 14196), MPEG-7 (under development), HyTime (the Information technology - Hypermedia/Time-based Structuring Language ISO/IEC 10744), the Standard Generalized Markup Language (SGML, ISO-8879), and MHEG, which is under development by an ISO/IEC JTC1/SC29 working group.

Work in Progress

DTB development has been undertaken by the Swedish Library of Talking Books and Braille and by Recording for the Blind and Dyslexic (RFB&D). The Swedish have produced a "Digital Audio-based Information System" (DAISY) that partitions digitized spoken audio into phrases that can be randomly accessed from an audio version of the book's table of contents. RFB&D has experimented with a design based on PWWebspeak playing audio files.

PWWebspeak is a text-based web browser that communicates with the user via a speech synthesizer. We intend to build on the experience and expertise acquired in these and other projects by inviting their developers to participate in the standardization process.

Work to be Undertaken

In support of the standardization process, we intend to begin simulating DTBs in software using common off-the-shelf software systems, typically called multimedia authoring/presentation (A/P) software. The objective of this experimentation is to assess the technical and cost implications of implementing various DTB features and performance characteristics identified in the standardization process. A central concern with each feature is the structure and control preferred by users. Thus an essential requirement of simulation will be real-time user control. This will allow us to explore, on a feature-by-feature basis, the range of control options preferred by users. Examples of A/P systems that run on a personal computer are Macromedia's Director and Asymetrix's Toolbook.

Basic Simulation

Using authoring/presentation software, we will test PC-based presentation of recorded digital audio and will explore use of the corresponding text for indexing. These features are supported well enough by A/P packages to demonstrate the general concepts by developing short DTB excerpts with in-house expertise. Going beyond excerpts, complete books average twelve hours of spoken audio and require about 3,000 megabytes of storage (3Gb). Interactively presenting a data set this large with a PC presents difficulties that can be eased by eliminating inaudible components through application of a "smart" data-reduction algorithm. One such encoding algorithm that enjoys wide popularity is known as MPEG. Using this encoder, it should be possible to reduce the data set, without perceptible distortion, to about 300 megabytes. At present, coding of this type is not directly supported by A/P software. Moreover, linking coded audio closely with the corresponding text is not supported either. Implementation will require considerable programming expertise that we will obtain from external sources. Control of the product, however, will be alterable so that the simulation will be an efficient vehicle for exploring user-control preferences.

The complexity of a PC keyboard makes it unsuitable for studying user-control preferences. We are investigating the use of hand-held remote controls for this purpose. A typical programmable device is marketed as a multimedia-presentation controller or remote mouse. By itself, however, such a remote is not useful without spoken audio feedback and prompting. Thus, the simulator system must support voice synthesis. Again, A/P software does not support this capability, so integration of an external program is necessary.

Bookmarks that are retained from session to session are also important for a basic DTB simulation. Making them user-specific so that multiple users are supported may be desirable. The bookmarking concept, along with most other DTB features, would probably be implemented by making use of the scripting languages built into the authoring/presentation software. These languages are interpretive, like BASIC, and allow control structures similar to those of the C programming language. For simple functions, they are manageable by casual users, but for complex functions, such as multiple bookmarks for multiple users, they require a seasoned programmer. The end user is not expected to know or care how the scripting language works.

Augmented Simulation

Beyond basic simulation, there are many DTB features that could be explored. We will strive to implement those identified in the standards development process that can be evaluated in the PC environment. At the outset, we will consider time-scale modification (TSM) and multiple-book support. As in the case of basic simulation, our objective is to assess cost and technical feasibility while studying user-control preferences. In the long term, simulation of voice control might be explored.

TSM is variable-rate playback of spoken audio without pitch distortion. In TSM, pitch and presentation rate are controlled by adding and deleting speech segments. Intelligibility and listener comfort depend on which segments are repeated or deleted and the temporal length of the segments. We will experiment with methods that distinguish between vowels and consonants. Changes to consonants are avoided while repetitive intervals (pitch periods) found within vowel utterances or silences may be deleted or repeated.

We will strive to allow placement of bookmarks wherever index points are supported. For basic DTB simulation, this will be at the chapter and page level. For augmented simulation with finer indexing resolution, corresponding bookmarks will be allowed. How many bookmarks, for how many books, how

they are identified, how they are accessed, and related questions are the kind of user-control considerations that the simulator will help us to investigate.

CONCLUSION

We have undertaken standardization of the next-generation digital talking book through the NISO standardization process. During the process, we explore technical feasibility, cost and user-control preferences of various DTB features, and performance characteristics through PC-based simulation. We solicit the comments and participation of all interested parties.

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WORLD WIDE ACCESS: FOCUS ON LIBRARIES

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The dramatic growth of both electronic information sources and adaptive technology make it possible for libraries to serve visitors with disabilities as never before! Libraries can play a key role in increasing the independence, participation, and productivity of people with disabilities. Besides providing access to adaptive technology, they can help assure that their electronic resources are accessible when using that technology. This paper summarizes guidelines that can be employed to make electronic resources in libraries easier to use by patrons with a diverse set of characteristics. World Wide Web access issues are highlighted.

The varied features of the World Wide Web are attractive to a wide variety of users. Yet many Internet surfers are unable to view graphics and photos because of visual impairments, or cannot hear audio because of hearing impairments. If "universal design" principles are employed, all visitors to Web pages can access the content. Universal design means to concentrate on content rather than flashy graphics and audio and consider the full spectrum of potential users. Documents, menu items, graphics, video clips, and other materials are made as accessible as possible.

As a Web developer, you need to consider the diversity of people who may visit your Web pages. Some visitors:

* cannot see graphics because of visual impairments.

* cannot hear audio because of hearing impairments.

* use slow connections and modems and choose not to view graphics.

* have difficulty when screens are unorganized, inconsistent and cluttered and when descriptions and instructions are unclear. These difficulties may occur because they have learning disabilities, English is their second language, or they may be younger than your average visitor.

Perhaps the most important consideration in designing Web pages is to make sure that a Web site visitor is not required to use a specific browser to access the information provided at that site. Today, numerous Web sites require the use of a particular version of Netscape. Although this is a popular browser, it is not the only option. For Web site developers, accessibility to the maximum number of potential customers should be a top priority. Many of the accessibility issues and tips described below make a favorable impression for all Web users, regardless of disabilities.

General Web Design Tips

* Maintain a simple, standard page layout throughout a document. Once a method of layout is determined for your page(s), stick with it. A consistent interface for your pages will make it easier for anyone contacting your site to find and access information. Buttons and navigational links should always appear in the same places (top, bottom or both) on a page, and headers should follow a consistent format.

Just about everyone benefits when Web developers follow this guideline, but particularly people with learning and visual impairments and for whom English is a second language. Consistency and simplicity are keys to accessibility.

* Use universally recognized HTML tags. Don't use formatting tags (such as **BLINK**) that are only supported by one Web browser. The HTML version 2.0 standard is the best bet for compatibility with a wide variety of Web browsers.

When Web designers follow this design principle, everyone using a text-based browser, particularly those who are blind, benefits.

* Test your pages with a variety of Web browsers. Test your Web pages on at least three different Web browsers. One of the browsers tested should be a text-based program such as Lynx. This testing will ensure that pages are accessible to people who may be using a different browser than you. If possible, also examine your pages using browsers on different platforms (e.g., Macintosh, PC and X)

Though it is possible, with some programming on the server side, to determine what browser someone is using and make certain types of information available, most developers do not have the resources available to do this.

All potential Web site visitors will benefit when this guideline is followed.

* Provide alternate text for browsers that can't display images. Many people cannot see pictures or drawings. This can be due to a disability or as a result of using a text-based browser. The tag when used with a graphic will allow a written description of the image to be conveyed to the user. The tag is an excellent way to make a graphical button accessible to those using text-based browsers. Also, for those developers using graphical bullets, an ALT tag can contain other text that provides a good alternative such as an asterisk or text.

Following this guideline benefits all Web site visitors who cannot see images, either because of blindness or because their Internet access method restricts them to using a text-based browser.

* Avoid using tables. Tables are not supported by all browsers and can be confusing for people using voice output to read text on the screen. Screen reading software cannot differentiate between columns so that text is read constantly from left to right.

Applying this guideline benefits anyone using a browser that doesn't support tables and anyone using voice output to read text.

* Avoid using a single mode of delivering information other than text. If information is to be conveyed using audio or video files, provide text alternatives. For example, if an audio file contains dialogue or lyrics, a transcript of the file will enable someone with a hearing impairment to access it. Also, video may contain information that can be provided in descriptive text form.

Web site visitors who may be blind and/or deaf benefit when this guideline is followed.

* Provide text alternatives to image maps. Image maps are graphics that contain multiple areas that, when selected with a mouse or other pointer, jump to another web page or section. The only method of making image maps accessible is to provide a text alternative.

Anyone using a browser without graphics capability, those who cannot see images, and users who have turned off loading of graphics all benefit when this guideline is followed.

* Don't use complicated backgrounds. Many backgrounds do not provide enough contrast for easy viewing. Users with visual impairments often invert their screen colors due to light sensitivity. Backgrounds and other formatting that changes the color of text can make a page inaccessible to someone with a visual impairment or for someone with a reading impairment. If a custom background must be used, select something that provides good contrast with your text.

Site visitors with visual impairments and people accessing via slower connections benefit when this guideline is followed.

When care is taken to assure that Web sites adhere to universal design principles, a larger audience of Internet users will be able to make use of the wealth of information resources on the Net. Libraries are in a unique position to demonstrate universal access features and to provide universal access to information resources, including those offered on the World Wide Web.

DO-IT Resources

A videotape and handout titled "World Wide Access" is available through the DO-IT program for $20. A good launching point to find resources for making accessible Web pages is the DO-IT HTML Guideline page at

http://weber.u.washington.edu/~doit/Other/design.html

DO-IT (Disabilities, Opportunities, Internetworking and Technology) is primarily funded by the National Science Foundation. Additional funds for helping libraries make electronic resources accessible to people with disabilities are provided by the Telecommunications Funding Partnership.

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THE VIRTUAL LIBRARY: COLLABORATIVE DATA EXCHANGE AND ELECTRONIC TEXT DELIVERY

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Libraries have been in existence for thousands of years. The earliest known libraries can be traced to early Sumerian cultures where legal documents, business transactions, and even tax records were kept within collections of clay tablets. The Egyptian ruler Ramses II is credited with founding a library of 20,000 papyrus scrolls around the year 1250 B.C. Certainly the greatest library of ancient times was the Greek library at Alexandria, Egypt. Established during the 3rd century B.C., it is thought to have contained somewhere between 500,000 and 700,000 volumes at its largest extent. The library at Alexandria had all the traits we still commonly associate with libraries. It had a designated librarian, a catalog of its holdings, a "copy center" where scribes prepared copies of scrolls, and a reference section complete with dictionaries of various languages. And like most libraries today it even had space problems, as an annex in the Temple of Serapis had to be used to house a spillover of some 40,000 scrolls.

Over these many years, the primary function of libraries has seen only slight change, while the manner in which this function is carried out has evolved along with human advances in technology. The switch from clay tablets to papyrus, and later to vellum, parchment, and paper, together with the codification of written languages such as Greek and Latin, were early technological innovations that helped facilitate an information revolution during late antiquity and into the middle ages. Yet another information revolution was brought about at the height of the Renaissance thanks to the invention of moveable type in 1456. Despite these advances in technology, the mission of libraries has remained fundamentally the same: to provide access to information through collecting, preserving, and disseminating knowledge found within various media.

The intent of this presentation will be to look at two specific tasks which must be performed by libraries in the pursuit of their primary mission of information access--namely bibliographic access and document delivery--and how various technologies used to perform these tasks may either help or hinder the inclusion of persons with disabilities. The pivotal points of this study will focus on two primary highlights. The first primary highlight of this session will be a soon to be completed project funded by the National Science Foundation (NSF) which will provide a merged electronic database indexing nearly all alternative format accessible texts available in the English language within the North American continent. The second primary highlight of our study will be computer mediated document delivery by the use of various types of accessible electronic texts, including digital audio.

THE VIRTUAL LIBRARY

Though the proper usage of the term "virtual library" is still being debated, this expression usually refers to libraries that exist primarily in an electronic environment, and ultimately to the future convergence of all computer accessible information via the Internet. During the 1970s we began to see the first explicit references to the "electronic library," though the underlying concept of libraries utilizing digitally stored information had earlier roots. Most historians of modern library systems are quick to point to statements made in 1961 by the mathematician John Kemeny, who predicted that the library of the year 2000 would consist primarily of terminal connections to distant computer sites holding text materials in central locations across the world. Although the expansion of world-wide computer networks via the Internet has led many to predict the coming age of a true "virtual library" in which any individual anywhere in the world could have full access to all library holdings simply by logging on with their own personal computer, quite a number of obstacles--not the least of which is concerns over intellectual property rights--currently stand in the way.

THE ELECTRONIC CARD CATALOG

Access to bibliographic information via electronic methods, however, has even earlier origins. In 1939, the inventor Vannevar Bush wrote his now famous article entitled "Mechanization and the Record" in

which he outlined the creation of the "Memex," a "mechanical indexing device to assist the memory." Although the practical limitations of creating library databases on vacuum-tube computers delayed its arrival by a number of decades, the development of semiconductor components made the "online public access catalog" or OPAC a reality in the 1960s and 70s. Even though it was not immediately recognized at the time, the OPAC was a god-send for disabilities access, especially for blind and visually impaired users. Line-input OPACs together with adaptive technology devices such as screen readers and refreshable braille displays made library catalogs fully accessible to many persons with disabilities for the very first time.

Throughout the 1980s, the expansion of computer networks-- especially the Internet--dramatically increased the access potential for users of bibliographic databases. Through facilities such as Telnet, and now the World Wide Web, anyone with an Internet connection can now use the OPACs of libraries throughout the globe, assuming of course that the catalog is connected to the Internet. Libraries designed specifically for persons with disabilities are no exception. The National Library Service (NLS), which provides braille and audio recordings for individuals who are blind or visually impaired, has provided Internet access to its OPAC via the Library of Congress Information System (LOCIS) since the early 1990s. Recording for the Blind and Dyslexic (RFB&D), previously known simply as Recording for the Blind, has been running an Internet accessible catalog of its audio library holdings since 1992. The RFB&D catalog also has the extra feature of an online ordering module which allows registered borrowers and educational institutions (now limited to members of a special test group) to order recorded texts as part of the online session. The cassette tapes are then mailed to users. In effect, this database is a hybrid system which combines both the functions of bibliographic access and document delivery functions into one service.

THE COOPERATIVE DATA EXCHANGE PROJECT

The practice of merged library databases, where one electronic catalog lists the holdings of several libraries, has been common for several years, especially among academic libraries. Systems such as the Washington Library Network (WLN), the Research Library Information Network (RLIN), and the Online Computer Library Center (OCLC), are familiar examples. The sharing of automated data ultimately helps library users to identify where particular information materials may be found without having to contact each library individually. This practice also reduces the need for each library to duplicate the same holdings found at other libraries, since most libraries participate in Inter- Library Loan (ILL) programs. In times of shrinking government funding and increasing costs of monographs and journals, ILL programs have become an essential part of libraries' document delivery operations.

Since the number of organizations producing accessible alternative format materials is very small, and demand for these services is growing at a much higher rate than the supply can accommodate, it has become essential for these organizations to merge their bibliographic resources. To facilitate this transfer of automated data, the NSF provided funding for the development and implementation of a cooperative database exchange program which would eventually give each organization bibliographic information on all accessible text materials in the English language available on the North American continent. This electronic networking project will ultimately provide direct access to users through Internet accessible catalogs such as the one on LOCIS, and will provide essential coordinating information to member institutions thereby eliminating wasteful duplication of resources.

The National Library of Canada, the American Printing House for the Blind, the National Library Service for the Blind and Physically Handicapped, and Recording for the Blind and Dyslexic- -the four major North American organizations producing accessible materials or maintaining databases of these materials--began initial cooperation to share bibliographic data in 1992. This led to a grant from the NSF in July of 1993 to fund the implementation of the project up to its projected date of completion in January of 1998. By this date, all member organizations will have full bibliographic access to nearly all items available in braille, large print, audio, and digital formats. At the same time, efforts are underway to catalog accessible materials produced by many smaller organizations, and it is hoped to eventually include materials available in English produced outside of the continent. The end result of this project will be the largest "virtual library catalog" for accessible text materials on the planet.

ACCESSIBLE ELECTRONIC DOCUMENT DELIVERY

Moving beyond bibliographic access, the coming virtual library age has profound implications for direct access to library holdings. Though a few current online systems--such as RFB&D's Internet catalog--are equipped for direct ordering of materials via computer, the ultimate document delivery system would allow direct digital access to the text itself, making virtually all written materials instantly accessible via screen enlargers, screen readers, or braille printers and displays. There are currently a number of organizations which are producing electronic versions of printed texts via print file conversion or scanning the text using Optical Character Recognition (OCR) technology. Though many government agencies and corporations are now producing texts only in electronic form as cost saving measures, the vast majority of all information continues to exist primarily on printed paper. Some print-access organizations, such as RFB&D, have been engaged in converting printed books into electronic texts which can be distributed to users on computer diskettes. RFB&D's current Digital Audio project will additionally produce some texts in CD ROM format which will allow access to electronic texts linked to digitally recorded human voice, allowing for richer information access and better suitability for persons with perceptual disabilities that have difficulty utilizing printed texts as well as additional comprehension difficulties when using synthetic speech.

There are currently a number of initiatives underway to get all textual and most non-textual forms of information into electronic formats to facilitate a true virtual library. Project Gutenberg, the Online Book Initiative, the Internet Public Library, the Digital Library Initiative, and the World Wide Web Virtual Library Project are some of the largest projects now under way which may someday lead to the ultimate global virtual library.

CONCLUSION: HOPES AND CONCERNS

The current trend toward Internet access and services is bringing the dream of a virtual library closer to a reality. It is important to keep in mind, however, that some troubling questions remain ahead:

* Who will pay for information access--will we develop into a polarized society of the information-poor and the information- rich?

* Will concerns over intellectual property rights lead to a system where "free public libraries" no longer exist and all information must be on a pay-for-access principle?

* How will we guarantee that the virtual library will be accessible to persons with disabilities? Will popular graphical systems and multimedia delivery methods create new obstacles to the universal access of information?

These are all vital concerns to the development of a 21st century virtual library. It is very important that all members of the disability community remain vigilant in keeping informed of new developments and giving needed critical feedback to those who are now developing the virtual library.

Project EASI (Equal Access to Software and Information) has set up a special listserv to discuss these and other library access concerns. The Access to Libraries Listserv, AXSLIB-L, can be joined by sending an email message to: listserv@sjuvm.stjohns.edu with the subject line blank and the following command as the first and only line of the text: sub axslib-l yourfirstname yourlastname Please be sure to substitute your name. If you have any problems, just send a note to this author and he will add you to the list.

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THE LAW AND LIBRARY ACCESS FOR PATRONS WITH DISABILITIES

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Introduction:

The information age arrived in the last half of the twentieth century. Computers became more than computational devices; they became writing, reading and storage tools. For the formerly print disabled population, this suddenly opened exciting new worlds of information. Where the printing press, four centuries before, had raised barriers to information, the computer with alternate input and alternate output devices brought new freedom and independence. For libraries, this means that there is a new population to be served: patrons with disabilities. These new users do not know what to expect when they visit a library, and librarians similarly do not know what is possible to provide nor what they are required to provide.

The Architectural Barriers Act mandated physical access to buildings. Now disabled patrons are also insisting on access to the information in those buildings. Educational institutions understood that the 1973 Rehabilitation Act required provision of access to educational materials. Traditionally, this meant providing either reader services or audio taped materials. Now this must be expanded to mean access to information technology. The Americans with Disabilities Act, besides reinforcing the schools' obligation to make information technology accessible with alternate computer technology, makes this same obligation apply to public libraries.

Information is power, and a healthy democracy must guarantee access to this information and power equally for all of its citizens. Many librarians see these new patrons as an exciting challenge rather than a threat or burden. What they are looking for is some concrete help and directions.

Special Challenge to School Libraries

The three predominant areas of concern for most campus libraries are: providing information in specific alternative formats; making these accommodations in a timely manner; and, reconciling issues of responsibility related to reasonable accommodations and readily achievable practices as specified in federal regulations. As more information is delivered digitally, providing timely access to information in a patron's preferred format becomes more achievable. Regulations set forth under Section 504 and the ADA have been interpreted as requiring that public entities - including college and university libraries - assure communications with individuals with disabilities are as effective as communications with all others. To achieve this objective, both the type of information being communicated and the preference of the patron with the disability must be taken into consideration when determining the most appropriate

access accommodation. A library may elect to provide a blind patron with a reader or tape recording of research information but if the nature of the information is detailed and the patron prefers a directly accessible format (such as braille or electronic text), the library may be obliged to honor such a request to assure effective communication of that information to that individual. Thus, placing preference ahead of convenience when determining specific formats for alternative communication of information has become a priority that libraries must recognize.

A second emerging priority for postsecondary libraries is providing timely access to information in alternative formats. According to the U.S. Department of Education, Office for Civil Rights, this means providing individuals with disabilities access to information at the same time all others have access to the information. For traditional libraries, this creates an enormous challenge; particularly when it involves converting print materials into braille or electronic text. Most libraries have neither the technology nor the trained staff to accomplish this in a timely manner.

In response to this situation, colleges and universities need to support the development of systems and strategies to render print information into alternative formats in a timely manner. One such system currently under study is the Braille Transcription Center project at California State University, Fullerton. This project has been established to study the feasibility of regionalizing braille transcription services for many colleges and universities from a central facility. Through the effective utilization of modern computer-based technologies and telecommunications capabilities, projects such as this could go a long way toward reducing the amount of time needed to render print materials into alternative formats. Finally, the issue of readily achievable must be considered. This provision has been granted to public entities such as libraries under both Section 504 and the ADA. However, a review of its interpretation clearly reveals broader implications for this provision. On the surface it appears that many areas of providing accessibility are not readily achievable and therefore need not be addressed by public entities. This must be regarded as a provision and not as a protection. When evaluating whether a reasonable accommodation is readily achievable, be sure to carefully consider how your organization's upstream planning may affect downstream accessibility. For example, declaring access to electronic information to be not readily achievable when your organization has control of the document structure, operating systems, and workstation configurations may be unacceptable.

The positive news regarding these three areas of concern is that more information is being archived electronically in digital formats everyday. Properly managed digital information can provide effective access to information in a variety of alternative formats in a timely manner for all library patrons. However, to achieve this level of accessibility for the future, alternative access to electronic information must be established as a priority when designing tomorrow's digital information systems.

What the Law Mandates

the Americans with Disabilities Act reiterates legal obligations that recipients of federal funds, such as most public libraries, were already obligated to do under Section 504 of the Rehabilitation Act. However, the ADA has had an especially dramatic impact on public libraries.

Conceptually, the enactment of the ADA makes it easier for courts and others, since they are interpreting a different statute, to justify taking a new look at information access issues and to redefine legal standards in a way that takes into account newly available technological solutions for providing persons with disabilities information access. Indeed, many ADA provisions make specific references to the multitude of assistive technology devices now on the market. In contrast the most advanced piece of technology mentioned in Section 504 is the tape recorder!

As an example of the approach taken to libraries under Section 504, Appendix A of the Department of Education's implementing regulations states:

"...As long as no disabled person is excluded from a program because of the lack of an appropriate aid, the recipient need not have all such aids on hand at all times. Thus, readers need not be available in the recipient's library at all times so long as the schedule of times when a reader is available is established, is adhered to, and is sufficient. Of course, recipients are not required to maintain a complete braille library."

Notice that the emphasis under Section 504 is on making sure that the person with the disability is not excluded from access. By contrast, Title II of the ADA requires that:

"A public entity [such as a public library] shall take appropriate steps to ensure that communications with applicants, participants, and members of the public with disabilities are as effective as communications with others... In determining what type of auxiliary aid and service is necessary, a public entity shall give primary consideration to the requests of the individual with disabilities" [28 Code of Federal Regulations (C.F.R.) 35.160].

The U.S. Department of Education, Office for Civil Rights, which has primary responsibility for enforcing the ADA as it applies to public libraries [28 C.F.R. 35.190(b)(2)], has repeatedly held that the term "communication" means the transfer of information, and it includes the right of a person with a disability to equally access the verbal presentation of a lecturer, the printed text of a book, and the vast resources of the Internet. The shift from simply ensuring that the person with the disability is not excluded, to emphasizing access that is "as effective as" that provided to nondisabled persons, is significant. It is particularly dramatic when coupled with the public institution's obligation to give "primary consideration" to the specific type of accommodation requested by the person with the disability.

There are definitely some limits on this obligation. A public library is not required to incur an "undue" financial or administrative burden. When determining what constitutes an undue financial burden, available funds of not only the local site but also the resources of any overarching parent organization, e.g., the city, county, state) will be taken into account.

Since optical character recognition scanners and adaptive computer software programs don't charge an hourly wage to "stand around" the way human readers do, it is not an undue burden to expect most public libraries will have on hand, during all the hours that the library is open to nondisabled users, a method by which a blind user can access the same information provided to nondisabled users. Some administrative responsibilities, not imposed on nondisabled persons, may be assigned to persons with disabilities. For example, a library may be concerned about leaving expensive adaptive technology unguarded in an open area so there may be prerequisites to using the equipment, such as obtaining a key from the librarian.

Note that when a blind user, who is a novice to the adaptive technology, needs training, the blind user may be asked to schedule such training during working hours at a nearby offsite high tech center. On the other hand, there should be a process whereby the trained user, while operating the library's adaptive technology, can get answers to questions that might reasonably arise during the use of the equipment.

With respect to whether a library can rely primarily, or even exclusively, on personal readers, it is highly unlikely that any library organizing its resources through a computer-based information system, can justify not having a scanner with voice output as well as both screen and hardcopy print capacity.

Then there is the issue of Internet access. The home pages of many Web sites are not designed to be read by text-based scanners. Therefore, readers may be used to assist the blind individual in navigating through information that is not easily decipherable when relying exclusively on adaptive technology.

The movement toward adaptive technology and away from personal assistants such as readers has, in some instances, worked against the preferences of persons with disabilities. Provided the technological method for access is adequate and the public entity offers the necessary training and backup support, in most cases an institution may opt to rely on technology rather than personal readers, even when the person with the disability prefers readers.

One of the unclear issues is the degree to which a library can require the user with the disability to learn new software programs, when the user is already proficient in a different program. My own thoughts on this are that, if the library is employing a program that is generally regarded as providing effective access by persons with that type of disability (e.g., blindness), the person with the disability may be required to learn the program selected by the institution. On the other hand, if the library has installed a

program that is generally regarded as providing inferior access for persons with disabilities, the person with the disability can make a strong argument that "primary consideration" should be given to his/her particular software request in order to ensure that s/he is provided communication that is "as effective as" that provided to nondisabled persons.

The U.S. Department of Education, Office for Civil Rights, is currently conducting a statewide ADA compliance review to evaluate the extent to which California Community Colleges provide blind and low vision students access to printed materials and computer-based information systems. This review includes the methods by which the colleges provide access to the campus library. Each of the over one hundred colleges has already completed written self-evaluations, and OCR is planning onsite visits to several campuses in the next few months.Just as the courts mandate that there must be access to physical buildings based on the Architectural Barriers Act, the Americans With Disabilities Act is steadily moving in the direction of mandating barrier-free access to information housed in those buildings: schools, universities and libraries.

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REMOTE REALTIME CAPTIONING FOR CLASSROOM PARTICIPATION BY DEAF AND HARD OF HEARING STUDENTS

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INTRODUCTION

A remote realtime captioning system has been in use at the University of Iowa since August of 1996 to allow Deaf and hard of hearing students to participate fully and independently in classes. Captioning is provided on a laptop computer system that the students take to class. The audio signal from the classroom microphone is transmitted via modem over a telephone line to the captioning service where a captioner transcribes the text of the lecture. This text is transmitted back to the student in the classroom via modem and is displayed on the computer. This article presents a discussion of the advantages and disadvantages of remote realtime captioning and other communication options.

CLASSROOM COMMUNICATION OPTIONS

Sign language interpreters are frequently employed to allow Deaf and hard of heari g students to participate in classes. There are some problems associated with interpreter services: in many places, particularly rural areas, there is a limited supply of qualified interpreters to provide regular classroom service. Classes with unique or technical terminology may be difficult to interpret accurately. American Sign Language (ASL) interpreters do not provide a literal word-for-word translation, which means some material could be judged to be irrelevant, and therefore omitted, by the interpreter. Illness, bad weather or circumstances may make it necessary to recruit a substitute on short notice. Variance in fees charged by individual interpreters makes cost projection difficult. Furthermore, not all deaf and hard of hearing students are fluent in sign language and some students prefer reading written English.

Providing interpreters instead of remote realtime captioning has some advantages. Since the interpreter is "on site," all conversation can be interpreted including speech not picked up by the microphone. An interpreter can immediately "voice" for the deaf student who wishes to ask questions or participate in a discussion. Students do not need to transport, assemble, or know how to use computer equipment. Additionally, there is no missed information due to technical problems.

Notetakers can be used to provide notes for deaf or hard of hearing students during classes. The notes are usually read after class, which may reduce the effectiveness of teaching. The student usually does not have access to the lecture material at the same time it is presented with visual aids, nor does the student have the opportunity to follow the notes and ask questions during the lecture. The primary advantage of notetakers is that this service can often be provided at little or no cost. Some instructors are willing to

provide the student a copy of their lecture notes and visual materials.

Assistive listening devices, including hearing aids and FM amplification systems, can be used by students in classrooms. Many classrooms and auditoriums are already equipped with FM transmitter systems so that students can readily use an FM receiver and a hearing aid to hear the lecture.

Some deaf and hard of hearing students are proficient in speechreading. This can be advantageous in situations where the student is in close proximity to the instructor and the instructor faces the student. In many classes, however, the instructor may be using a white board or overhead projector in a darkened room. Although speechreading can augment other methods, alone it is not sufficient for most students.

CAPTIONING SERVICES

Captioning is typically generated using a stenotype machine. The stenotype machine incorporates the use of a shorthand notation so that entire words can be entered with one or two keystrokes using a chorded keyboard in which more than one key may be activated simultaneously. The stenotype machine can also store macros and abbreviations to increase the transcription rate and allow accurate entry of technical words and phrases. This technology can provide an almost verbatim rendering of the instructor's lecture.

Realtime captioning refers to captioning that is provided as class is in session. Several lines of text are displayed on a screen almost simultaneously with the lecture, allowing the student to read along with demonstrations and visual aids. Captioning can be provided either on-site or remotely.

On-site captioning is provided by a court reporter attending the class with the student and providing real-time writing of lecture material and class discussion in an accurate format. Everything said in the room has the potential of being captioned. On-site captioning has several of the same disadvantages as on-site sign language interpreters, including scheduling and locating replacements.

Remote captioning is provided by a captioner located at an off-site office receiving the audio transmission from the classroom. The captioning is then transmitted back to the classroom. This allows captioning services to be based in areas where there are sufficient numbers of qualified captioners. A service that has a staff of captioners can meet a wider range of scheduling demands and can provide backup staff in cases of illness or absence. This greatly reduces the scheduling burden on the campus staff. Class schedules can be given to the captioning service, which will schedule captioners appropriately. Economic advantages of having a staff of captioners serving several customers without travel expenses could result in lower rates than interpreting or on-site captioners. The primary disadvantage is that remote captioning is limited by the capability of the microphone system in the room. Normally, only the instructor wears a microphone. Student participation may be hindered, because questions and discussion would not be captioned unless repeated by the instructor.

IMPLEMENTATION OF REMOTE REALTIME CAPTIONING

In the Fall 1996 semester, The University of Iowa through Student Disability Services provided remote realtime captioning in four classes for two students. This service was expanded to six courses for three students in the Spring 1997 semester. This service was initially provided on an informal basis as a "pilot project." Currently, The University is accepting bids to establish a three-year contract, with the option to renew every year.

The present implementation of remote realtime captioning requires the student to bring a PC compatible laptop computer (486 or better) to class. The computer is provided either by the University from an equipment rental pool, or by the student (sometimes provided by State Rehabilitation Services). A modem with simultaneous voice/data transmission capability is supplied by the captioning service along with appropriate software. The University pays a refundable deposit for the modems which allow remote realtime captioning using only a single phone line. In most cases, this phone line must be installed and/or activated before classes begin. The service uses a single phone line for simultaneous transmission of voice and data. This is an important feature, since many classrooms and other facilities have only a single line available. Some services use one line for voice to the service and another line for data from

the service.

A wireless microphone system, currently provided by the University, is used to transmit audio from the classroom. The instructor wears a lapel microphone with a small transmitter, and the student plugs the receiver into the modem for transmission to the captioning service. We have had some success with a low-cost wireless microphone system (approx. $150) but need a more powerful system for some rooms (approx. $500).

The service provider to date has been RapidText of Newport Beach, California (Voice 714/644-6500, TDD 714/644-7131). At the beginning of each semester, a glossary of terms from the textbook for each course is sent to the service so the stenotype systems can be programmed to use macros and abbreviations. Also, a copy of the class syllabus allows the service to plan for days that classes do not meet and for exam sessions where captioning is not required. The service schedules captioners and stenotype stations for each class.

PROCEDURE FOR USING CAPTIONING IN THE CLASSROOM

Since the service has several stenotype stations, each with a separate phone line, the service provides a list of phone numbers to call from each class to initiate service. The phone numbers (along with long distance access codes) are programmed into the captioning software at the beginning of the semester. Before each class, the student sets up the system by connecting the modem, phone line, microphone, computer, and power supplies. The student then gives the wireless lapel microphone to the instructor. When the software is launched, it displays a menu with the name of each class. The student makes a selection from the menu, and the appropriate number for the stenotype station at the service is dialed. A pre-programmed message is then sent to the service that indicates the phone number in the classroom from which the student is initiating the call. The service then returns the student's call and makes a connection. This procedure is used so that the long distance charges are paid by the service provider.

Once the connection is established, the captioner transcribes any speech transmitted by the microphone. A word-for-word transcription is displayed on the student's computer approximately two seconds after it is spoken. The captioning of the lecture appears on the screen and is saved automatically as a text file for later use. Students have the capability of typing their own notes during the lecture in a separate window and these are also saved automatically. During class, the student can communicate with the captioner by typing in a message box. This is often used to ask questions such as "Can you hear?"

TROUBLESHOOTING AND TECHNICAL SUPPORT

An important consideration for implementation of remote realtime captioning is troubleshooting and technical support. The wireless microphone, computer, and modem all must be connected properly by the student, usually in less than 10 minutes before class starts. The students must be trained to connect and use the computer system, and technical assistance may be needed if problems occur. The wireless microphone system uses batteries which must be replaced periodically. The software and files on the computer can become corrupted and should be backed up. Consultation with technical support from the service provider may be required for audio problems or connection failure.

The University of Iowa has a Coordinator of Services for Deaf and Hard of Hearing Students working with Student Disability Services and an Assistive Technology Specialist working with Information Technology Services to provide support for remote realtime captioning. University staff technical support for remote realtime captioning averages about 5 hours per week, with more support required during testing and set up at the beginning of each semester, and less later in the semester.

Since the students have a computer, modem, and phone line in the classroom, they are able to send e-mail to local and remote support staff if they are experiencing a problem with the captioning. The students also use e-mail to inform the captioning service in advance when captioning service will not be required in class due to change in schedule, illness, or exam.

RESULTS

The captioning service has been used in courses that use technical terminology including microbiology, calculus, organic chemistry, and cognitive psychology. Based on the success of the "pilot project," The University of Iowa has decided to continue to offer remote realtime captioning, in addition to other communication options, on a permanent basis.

COMMENTS FROM STUDENTS

Student 1:

Q. What do you like best about captioning compared with interpreters in class?

A. Since I am not very skilled with sign language, I find that an information medium such as captioning is more closely related to my natural learning methods. Although captioning is not perfect, neither are interpreters. What I like best is that I do not have to concentrate too hard as I would with an interpreter. Also, the availability of a hard copy of notes from the captioning has proved helpful.

Q. What do you see as the most serious limitations or shortcomings of the captioning service now?

A. There are several. First of all, I feel the captioners lack a scientific vocabulary. Often words are misspelled or misused, therefore causing confusion for me. An obvious solution to this is to train the captioners so they may be familiar with a scientific vocabulary. I believe an interpreter may be slightly more accurate with science terms since they are in the classroom and can see what the professor is writing and will interpret the correct word for me. Other problems are the technical problems such as connection failure and disconnections during class. Although these are not exactly the most serious problems, they can be quite frustrating. The transporting and assembling of all the equipment can also cause a few problems although not serious.

Student 2:

Q. What do you like best about captioning compared with interpreters in class?

A. For the first time, I am able to take notes and read the professor's lecture verbatim simultaneously without missing any vital information. I also like the fact that I can always go back to the notes (or even print them out) at any given time - it is always available and it's really helpful because I can read over the information as many times as I'd like - it's like being able to bring a tape recorder to class like a lot of hearing people do - something that I, as a deaf person, never had the opportunity to do before. Another aspect of the captioning service that I really like is the fact that I am able to read the lecture word-for-word as opposed to listening via an interpreter because in sign language, there is ONE sign for so many different words and sometimes it really matters which word the professor chose to use in presenting the information (particularly information requiring a lot of technical words) - It's also nice not having to rely on a fellow classmate for notes.

Q. What do you see as the most serious limitations or shortcomings of the captioning service now?

A. While there are a lot of positive things about the captioning system, there are some disadvantages that are inevitable such as not knowing exactly what is going on if a remote connection is not established (which does not happen often at all) or if there is a problem with the microphone, I can't test it myself because I can't hear it to check if the audio is coming through. There also have been problems with static but that hasn't happened in a long time. Another thing is sometimes when the microphone doesn't work, the internal microphone in the modem can sometimes pick up what the professor is saying if he/she is close enough. But if he/she is far away from where the modem's internal microphone is, the captioner won't be able to pick it up and then the person using the captioning service misses out on what is being said. There isn't a system that is error-proof but the pros to using this system greatly outweigh the cons.

Student 3:

Q. What do you like best about captioning compared with interpreters in class?

A. Without a doubt, the major advantage is simply having lectures on screen in front of me, in the event that I need to look away or jot down some notes. With an interpreter, I must watch the interpreter at all times, otherwise I will miss information. Interpreters can never translate a lecture word-for-word - it is much too cumbersome and time-consuming. Thus, there is a potential that an interpreter may decide a piece of lecture material is relatively unimportant, when in fact it is, and neglects to translate it to the student (hopefully this does not happen too often!). Since interpreters must condense lecture material, it is not the same as hearing a lecture in a professor's words. In contrast, captioning is able to capture (hopefully) every word the professor says, thus transmitting the full original content of the lecture to the student. Another handy feature of captioning is that it saves the lectures automatically, so that I may refer to it like any other form of lecture verbatim. I've found that for a hearing-impaired person, this can be a life-saver, as much of class time is spent trying to understand what is being said, rather than completely absorbing the material.

Q. What do you see as the most serious limitations or shortcomings of the captioning service now?

A. As you can imagine, it can be a pain having to lug the equipment to class daily and set up before class, which also requires that the student arrive far ahead of time to allow ample time for setting up. If a person has a class before the class requiring captioning, this can be a real problem. It can also pose a problem for those who are not morning people and have a hard time getting up way in advance! The equipment itself can create problems, as something may go wrong and valuable class time is spent trying to figure out what the heck is wrong. By the time the problem is solved, the student will have missed a good deal of lecture material. So captioning is not always dependable, and students may be without any way of understanding the lecture if the captioning equipment or phone-line malfunctions. If this happens, I would need to resort to speechreading, a very exhausting thing to do, which would be impossible in cases in which the professor has a strong accent.

FUTURE DEVELOPMENT OF CAPTIONING SERVICE

Based on experience with the one year "pilot study", the following areas for future exploration or implementation have been identified in order to improve or expand captioning service:

* Expand remote captioning to non-classroom settings such as staff, faculty and student organization meetings and events

* Develop projection or display capability for the entire class (including students with English as a second language and students with learning disabilities) to benefit from realtime captioning

* Replace the external modem with an internal modem to reduce set-up time etc.

* Locate and utilize an appropriate microphone system in discussion classes

* Relocate location of phone jacks and power outlets to eliminate cables strung across walkways in the classroom

* Explore the possibility of using a voice synthesizer with the computer system to "voice" for students in class

* Use "Internet Phone" or similar technology to reduce long distance phone bills

* Explore the possibility of wireless communication (cellular phone modem)

ACKNOWLEDGMENTSThe authors wish to thank those at The University of Iowa responsible for initiating the remote realtime captioning pilot project:

Donna Chandler, Director, Student Disability Services Bill Cleveland, Director of Telecommunications, Information Technology Services Jackie Lewis, Student Disability Services David Sealey, Information Technology Services Larry Thoen, AV Equipment Specialist, Division of Continuing Education.

We also wish to thank the students who used the remote realtime captioning system. In the spirit of true pioneers, they kept a positive attitude and moved forward in spite of a variety of initial difficulties with the system.

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TALKING PAGES: VERMONT'S STRUGGLE TO PROVIDE UNIVERSAL ACCESS TO INFORMATION

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Too many times I've heard print challenged individuals explain how they've joined conversations about an article in the day's local newspaper without the advantage of being able to have read it for themselves. Because of technology, this is a frustration of the past.

The purpose of this article is to share Vermont's experiences with the development of a valuable service to print challenged individuals with the hope that others will benefit from our findings.

Our journey began in October 1996 when a diverse group of interested Vermonters began to investigate the options for making local newspapers accessible to print challenged persons. As a result of our extensive search, which led us down many different roads, the final destination was even better than we had hoped for. Not only would we have access to local newspapers, but Vermont would become the first state to provide universal access to the Internet via text to speech with the end user needing only a touch tone telephone.

It took us a year to make this decision, but we feel comfortable with the fact that we explored all of the options. In the end it boiled down to the following three options:

1. Contract with an existing newspaper text-to-speech phone service.

2. Create our own Interactive Voice Response (IVR) System using telephony development software to create telephone access to newspapers via text-to-speech.

3. Chose a product named Web-On-Call which would allow telephone users to access the Internet and listen to the content of newspapers.

The pros and cons for each alternative required us to take a hard look at each option.

The first option was "Newsline," a service provided by the National Federation for the Blind. We found that it did offer a variety of national news sources and the ability to add local newspapers; however, we felt that the annual service fees were cost prohibitive. This was a critical issue for us because in Vermont we would need to establish at least seven service sites to provide local call access for our users. We did explore the possibility of 800 numbers and were strongly advised to stay away from such unpredictable costs. We also learned that this service would be limited to blind and visually impaired users and we clearly wanted to establish a system open to all print challenged persons. For these and other reasons we decided to keep looking.

At this point we considered bringing in a consultant to help us set up our own (IVR) system; however, once again, the fee ($20,000) was too high. We also considered designing a simple demo system using Macintosh applications, but we found we would be limited to a one line system which would be potentially frustrating to users.

We then returned to the drawing board to think about how the Internet could be used to our advantage. Our local newspaper did not have a web page, but they were interested in discussing its use for this population. We began testing immediately to see how the files from the newspaper would work when converted to HTML and were thrilled to find out that it was an easy conversion. At this point, our plan was to create a text only web page so computer users could access and read the information with screen readers and products like WebSpeak. Our excitement soon turned to disappointment when we realized that very few print challenged individuals actually had or used computers.

The above realization gave us more energy to continue pursuit of the appropriate telephone text-to-speech option for us. With that in mind, we decided to create a two-tiered system that would share one database of newspaper files to support two applications. One application would be used to create web pages and the other for a telephone Interactive Voice Response (IVR) system. We investigated this option and found several companies sold development software that would allow us to create our own telephone text-to-speech. We even found development software to create such an application that didn't require any programming experience. We were encouraged by this and, as a result, pursued this option by entering negotiations with a local Internet Service Provider (ISP) to create the database of newspaper files, design and host a text-only web page of newspaper files, and create the telephone access application. Our excitement ended once again when the price quote was given. At this point, out of frustration, we kept looking and finally discovered Newspapers for the Blind, a Michigan-based company that offered a similar service as Newsline but at a substantially lower cost. It also offered the ability to access national and add local newspapers by telephone users. There were, however, two downsides. One was the service fee, which seemed high when compared to the ongoing costs of a system we would create ourselves. The second downside was that the system was not linked to the Internet, which meant that in order to support our two-tiered system the newspaper would need to send data to support both the web and telephone options. This would make double work for the newspaper, which would go against our promise to keep daily time investment to a minimum.

At this point we were weighing the options between creating our own system or going with Newspapers for the Blind, who had already worked out the kinks. We were certainly leaning toward the latter when the important question of ongoing service costs was asked. It boiled down to a year-to-year comparison, which played out by showing that there was a huge savings in service costs in a system we created ourselves. We decided to create our own system and after several meetings we were ready to contract services and purchase necessary hardware/software. During our final negotiations we discovered a company called NetPhonic, which led us in yet another direction.

We began by prospecting the NetPhonic program, known as Web On Call, and we were pleased to find out that it facilitated access to web pages via the phone using Text-to-Speech. The added bonus was that in addition to accessing our local newspaper's web page, virtually all of the Web would be potentially accessible via telephone. There is even an option for users to have information sent via fax, E mail, postal mail, Internet or Intranet. Furthermore, the information is dynamic and, consequently, renewed as web pages are updated, which is in contrast with Newsline and Newspapers for the Blind, since they offer only static information that is often twenty four hours old.

In addition, the system can be enhanced by adding Email on Call which will allow users to read E mail messages over the phone and reply to senders by recording voice mail and sending it as an attachment in WAVE file format. There is also an option to sort messages in main In-box by author, date or subject.

We decided to go with NetPhonic. The design is the perfect match for us because it is a telephony system that is tied to the World Wide Web and, therefore, allows for universal access to the wealth of information that is available on the Internet with the end user needing only a regular touch tone phone. We also found the start up and annual costs to be reasonable and much lower than any other alternative. The reason for the cost savings is primarily due to the fact that it is an automated system designed to support both web page and telephone access to information.

After all the time that we invested, we are finally happy with our choice. We will continue to strive for improvements, including:

1. Voice quality that gets closer and closer to the quality of human speech.

2. Better ways to establish local call access for statewide efforts. We are hoping to find a way to have one main hub for our server that can be accessed statewide with local call access using options like call forwarding or frame relay, etc. We don't have the answer but we will keep looking.

3. We will watch how the E-Rate legislation will affect our effort to provide local call access.

4. We will pursue cellular phone companies to see if they would be willing to help us provide a

statewide system to access at a reasonable cost.

We will always be looking to the future to find answers to these and other questions as they arise.

Despite our long journey we are pleased to have arrived at this destination and we hope the above information will help others as they travel down these same roads. We believe this approach will significantly help print challenged persons in Vermont have access to information they long for. We will work with users to customize the information they desire and at this point we think it will include local newspapers, weather, employment options and stock quotes. The sky is the limit!

Our first server will be installed in Montpelier, Vermont at the Vermont Department of Education by October 1, 1997. We then hope to establish sites statewide with local call access for all Vermonters.

For more information contact Fred Jones, M.Ed., 802-828-3067, E-mail, fjones@doe.state.vt.us

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EASI EXPANDS K-12 PROGRAM

Submitted by:
Carmela Cunningham
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Children who do not get a solid foundation in science and mathematics during Kindergarten through 12th grade will not be properly prepared to study science, math, engineering or technology (SMET) successfully in college. Too often students with disabilities fall into this group of being unprepared to study science, math, engineering and technology in post-secondary school.

EASI, an affiliate of the American Association for Higher Education has begun work on a two-year National Science Foundation project to create and disseminate materials to help K-12 students with disabilities become prepared to do post-secondary and professional work in technical fields.

In particular, EASI is preparing materials to address the five basic issues facing students with disabilities. First, there is an attitude among teachers, administrators, and sometimes even parents, that students with disabilities can't "do" math or science.

Second, K-12 math and science course work is often waived for students with disabilities, which means that they don't develop the foundational skills in these fields. This also makes it impossible for some students with disabilities to meet national standards in science and math.

Third, students with disabilities are not getting adequate training on adaptive computing technology that would allow them to work in the technical fields.

Fourth, students with disabilities and their parents must learn to be advocates to lobby for the appropriate technology and other accommodations necessary for students with disabilities to succeed in school and in the workplace.

Fifth, students with disabilities often require extra help in making the transition from one level of education to the next and from the educational setting to the workplace.

The materials EASI is developing for this project are designed primarily for the use of K-12 Individualized Education Plan (IEP) coordinators, science, math and computing faculty, administrators in K-16, special education coordinators, and those in schools of education who work directly with current and potential K-12 teachers.

EASI has already created materials directed at these K-12 issues, including a new component that has been added to the EASI-SEM online course on science and math access. The three-week course runs quarterly. EASI also distributes monthly informational releases with strategies and tactics and is in the process of creating other publications that will be made available online and in hard copy. If you'd like to have your name included on the monthly informational release list, send a request to Dick Banks at rbanks2@discover-net.net

For more information on this project, check out EASI's K-12 corner at http://www.rit.edu/~easi or contact Norman Coombs at nrcgsh@rit.edu or Carmela Cunningham at carmelac@aol.com

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SOFTWARE REVIEW
ZOOMTEXT XTRA: INTEGRATING SCREEN MAGNIFICATION AND SYNTHESIZED SPEECH

Dick Banks
EASI Electronic Resource Manager

For many visually impaired and learning disabilities individuals, screen magnification has unlocked the door to computer access. The same holds true for synthesized speech. Until recently, in order to use both technologies simultaneously, it was necessary to use three different hardware or software utilities. The user would need to have screen magnification, a speech synthesizer and a screen reader. Information technology, and adaptive technology in particular, is changing in two important ways: costs are dropping as products become increasingly sophisticated. ZoomText Xtra exemplifies both trends.

What is ZoomText Xtra?

ZoomText Xtra is a software program that was developed by AI Squared and is comprised of three components: screen magnification, screen reading and scanning with OCR (Optical Character Recognition). It was specifically designed for access to Microsoft Windows applications and documents. ZoomText Xtra is comprised of three product levels. Each level progresses to meet the needs of a broader user population. Two levels are reviewed here; the third, which is the OCR component, will be made available in 1998.

Level 1

Level 1 is a complete and sophisticated screen magnification program. This level works in both Windows 3.1 and Windows 95. The need for sophistication in a screen magnification program is essential if it is to meet the needs of a wide variety of degrees of visual impairment. Users can adjust the degree of magnification and other screen features. The following section includes some of the major adjustments along with a brief explanation of their functions.

Magnification Levels

Magnification levels can be adjusted from 2 to 16 times the size of the normal presentation of the computer monitor.

Edge Smoothing

As the size of screen presentation increases, there is a tendency for text and graphics to, "break up." Edge smoothing greatly reduces this break up.

Zoom Windows

Zoom Windows allows the user to define specific parts of the screen to be magnified. This is helpful when one area of the screen needs to be monitored more than the entire screen. For example, it can be very difficult to see the mouse pointer when trying to scroll down in a document when using the scroll bar.

Cursor Size and Mouse Pointer

Low vision users often have a very difficult time keeping track of the cursor or mouse pointer. Level 1 allows the user to manipulate the size and color of these features.

Configuration Settings

When a computer is used by a number of individuals, general settings of a screen magnification program

may not work well. This is because there are different degrees of visual impairment. Level 1 of ZoomText Xtra allows an individual to configure the program to suit his/her needs and save those settings to a personal configuration file. Since there is no limit to the number of these files, each individual can set up ZoomText Xtra and save the set up files; once they've customized Zoomtext Xtra, program users can invoke their personal configuration file and all settings will be returned to their preference. This feature has great appeal to institutions such as schools and libraries.

Level 1 of ZoomText Xtra has many additional features that are beyond the scope of this review. Perhaps the most impressive feature of Level 1 is the ability to configure settings in a wide variety of ways and have different configuration files for any number of users.

Level 2

Level 2 offers the same screen magnification power as level 1. The basic difference in level 2 is the addition of speech. The speech in level 2 uses the computer's own sound card that comes with nearly every new IBM or compatible. The speech engine is a software program called Tru-Voice that is included with ZoomText Xtra. This is an important feature because, in the past, a separate hardware speech synthesizer was needed to produce speech. This speech synthesizer was "driven" by a screen reading program.

Speech Features

Speech is fully synchronized with screen magnification. Synchronization means that the magnification "follows" the reading of text. As the text is being read in the document reader, each word is highlighted as it is pronounced.

ZoomText Xtra vocalizes all essential Windows components. Some of these components include menus, controls, titles and dialog messages. Verbosity settings allow the user to control the amount of speech feedback spoken. This is useful because there are often repetitive messages that become annoying in Windows programs. Once they have been read, there is no need to hear them repeated.

The speech can be echoed by character or by word. There are times when the user is better served by hearing their keyboard input character-by-character (for example, when doing computer programming or typing email addresses). Hearing typed input word-by-word is most effective in word processing applications.

The built in speech software supports all Windows 95 sound cards. ZoomText Xtra also supports most of the major speech synthesizers. This is important because if an individual or institution already uses a hardware speech synthesizer, they can continue to do so.

Doc Reader

The Doc Reader, which is available to the user in Levels 1 and 2, allows the user to read in any Windows application. Often users would like to review what they are doing but would rather not lose their place in the application. The Doc Reader permits the user to review their work in a number of ways and then return to their place in the application.

System requirements

ZoomText Xtra requires a PC compatible system that includes the following:

486 or higher processor. Windows 3.1 or Windows 95 16, 256 color capability or High Color display driver minimum 8 MB of memory. 16 MB preferred.

Level 2 requires that you have a Windows sound card or SSIL speech synthesizer.

Personal Note

This article does not cover all of ZoomText Xtra's features. Raather, it is intended to highlight the systems integration of speech and magnification; anyone who has tried to synchronize speech with screen magnification using separate hardware and/or software products certainly understands the challenge.

This program was designed so that all components work together. Is it perfect? No. It is very close however. The installation is painless. It took the author about 10 minutes without the use of the manual. Installation was very straightforward with step by step onlineinstructions. When the program was launched, the on screen control center was simple to understand and navigate.

I have found this program to be nearly flawless in its performance. It does exactly what it says it will do. Nothing is perfect but on a scale of 1 to 10, with 10 being the highest, ZoomText Xtra is a 9.8.

Often when new products are introduced, it is wise to wait until bugs are discovered and fixed. This is a rare exception.

AI Squared can be found on the web at:

http://www.aisquared.com

Readers can find more details about this product along with pricing information. They also have a fully functioning demo.

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WORKING TOGETHER: FACULTY AND STUDENTS WITH DISABILITIES A PRESENTATION PACKET CREATED BY DO-IT (DISABILITIES, OPPORTUNITIES, INTERNETWORKING, TECHNOLOGY)

Submitted by: Ann Neville
University of Texas, Austin

REVIEW:

0The DO-IT (Disabilities, Opportunities, Internetworking, Technology) Program is based at the University of Washington, but reaches students in high schools and other colleges as well. With programs and mentoring, students are encouraged to set academic goals and see examples of people doing work that would not have been possible for them before computers and other technical advances. By showing possibilities, it broadens horizons.

On another front, the program addresses the needs of people who will be working with students with disabilities. One outcome of this work is a set of presentation packets intended for use in a variety of academic settings. These packets, developed by Sheryl Burgstahler, PhD, Director of the DO-IT program, are intended to enable people who have varied levels of experience to conduct awareness presentations. Presentation packets include "Universal Access: Electronic Resources in Libraries," and "Working Together: Faculty and Students with Disabilities." The latter is the subject of this review.

WORKING TOGETHER: FACULTY AND STUDENTS WITH DISABILITIES

This packet is elegantly presented in a loose-leaf binder, and includes scripts and supporting materials for either a short (20-minute) or a longer, more detailed presentation. These materials include a glossary of terms, templates for transparencies, handouts to duplicate, and one or more videotapes.

The Working Together short presentation is one that can be done by people with little or no experience of working with students with disabilities. Necessary local information would include contact information for the offices and personnel who provide services to students with disabilities. A drawback to a presenter without background would be the inability to deal with a question-and-answer session. However, the generation of questions makes evident the need for a follow-up session, and that's the real advantage of this format. Faculty or students could make this presentation to a departmental meeting or other small group as an introduction to the issue, and the group can then design a request for a more extensive follow-up that will focus on the needs they have been able to identify. The presentation would certainly arouse faculty interest and involvement, and once preliminary work has been done, the person or persons who plan and provide access can do the follow-up.

The comprehensive script must be presented by someone with experience in providing academic accommodations for students with disabilities. It deals with concrete issues, and will generate substantial questions, and not just about the technology. The most difficult issue related to accommodating students with disabilities is the balance between "academic freedom" and accommodation. It's a hot-button topic with many, and there should be a resource person available to work with faculty who are concerned with this issue.

The presentations provide information on the legal implications for departments and individuals, provide clear information on a wide variety of disabilities and the technologies and strategies used by students and teachers to accommodate those disabilities, and offer a selective list of resource agencies and electronic forums that focus on disabilities and academic issues.

"Working Together: Faculty and Students with Disabilities" is a good, slick package that takes a lot of the background work out of preparing presentations. The program can be used to advantage in any area within an academic institution that needs to begin, or to enhance, its program for individuals with disabilities.

For more information on DO-IT and its programs, contact: v Sheryl Burgstahler
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DEPARTMENT:
ONLINE INFORMATION AND NETWORKING

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DISCUSSION LISTS

BLIND-DEV

Blind Development is an unmoderated discussion list dedicated to the issues involved in the development of computer products and adaptive equipment for blind and visually impaired computer users. The purpose of Blind-DEV is to serve as a catalyst in speeding the development of emerging assistive technologies, and to ensure that access to new computer technologies is built-in rather than needing to be added after the fact.

To subscribe to this list, send email to listserv@maelstrom.stjohns.edu with a blank subject line and with the following command in the email body: subscribe blind-dev

BLIND-ETC

Blind-ETC is a new list designed for the discussion and support of topics relating to the blind and visually impaired community. The List encourages discussion of computer operating systems, adaptive technology, new products, sales announcements, and other pertinent information.

To subscribe to the list, send email to listserv@maelstrom.stjohns.edu with a blank subject line and the following line in the body of the text: subscribe blind-etc

CSW-DIABETES

CSW-Diabetes is intended for college students and high school seniors 17 or older with diabetes. If you would like to subscribe to this list, send email to majordomo@list.sjcme.edu with a blank subject line and the following line in the body of the text: subscribe csw-diabetes

ELECTRONIC NEWSLETTERS

ADD/ADHD

The ADD/ADHD Newsletter for Parents is a monthly newsletter which discusses various approaches to helping children with these disorders. Topics to be discussed include the use of medications, cognitive and behavioral approached to therapy, support groups, biofeedback training, nutritional approaches, and many other pertinent areas.

To subscribe to this newsletter, send a blank email to homebi@hartley.on.ca (no command statements are needed).

BRAILLE MONITOR

To receive the Braille Monitor as a monthly electronic newsletter, you should send email to listserv@braille.org with a blank subject line and the following command as the body of the note: subscribe brl-monitor

WORLD WIDE WEB

FEDERAL ACCESS BOARD

The Access Board is an independent federal agency which has three primary responsibilities. First, the Board enforces the Architectural Barriers Act of 1968 which requires federally financed buildings to be accessible to persons with disabilities.

Second, the Access Board develops accessibility guidelines for entities covered by the ADA. The agency also provides technical assistance and training on these guidelines. Finally, the Board is responsible for developing accessibility guidelines for telecommunications equipment under the Telecommunications Act of 1996. The web site for the Federal Access Board contains useful information on current regulations relating to disability access. The site can be located at HTTP://www.access-board.gov

NATIONAL COUNCIL ON DISABILITY

The National Council on Disability (NCD) is an independent federal agency making recommendations to the President and Congress on issues affecting 49 million Americans with disabilities. NCD is composed of 15 members appointed by the President and confirmed by the U.S. Senate. NCD's overall purpose is to promote policies, programs, practices, and procedures that guarantee equal opportunity for all individuals with disabilities, regardless of the nature or severity of the disability; and to empower individuals with disabilities to achieve economic self-sufficiency, independent living, and inclusion and integration into all aspects of society. The NCD web site contains government reports and other useful information and is located at http://www.ncd.gov

BLINDNESS RESOURCE CENTER

The Blindness Resource Center is a new section of the web site operated by the New York Institute for Special Education (NYISE), a private non-profit educational institution serving the needs of educators within the disability community. The Resource Center contains a wealth of very useful information in the blindness field. You can reach the Blindness Resource Center at http://www.nyise.org/blind.htm#index

MCARE

MCARE, the National Clearinghouse on Managed Care and Long- Term Services and Supports for Adults with Developmental Disabilities and Their Families, has established a web site providing the most current information on managed care, long-term services and supports, and self-determination. The web site can be reached at http://www.mcare.unh.edu

NARIC

The National Rehabilitation Information Center (NARIC) is a library and information center on disability and rehabilitation. Funded since 1979 by the National Institute on Disability and Rehabilitation Research (NIDRR), NARIC collects and disseminates the results of federally funded research projects. NARIC's document collection, which also includes commercially published books, journal articles, and audiovisuals, grows at a rate of 250 new documents per month. Many of these documents and other useful information can be found on their web site at http://www.naric.com/naric

RFB&D

Recording for the Blind and Dyslexic is a national non-profit organization which has recorded text-books for blind and visually impaired students since . Over the years, RFB&D has expanded its consumer base to include the full range of 1948 print related disabilities such as individuals with mobility impairments and cognitive perceptual disorders such as dyslexia. RFB&D currently has a lending library of some 75,000 recorded books, and also distributes some books for purchase in electronic formats. To learn more about RFB&D, or to search their new web-based catalog of books, you may visit their web site at http://www.rfbd.org Return to Contents Page

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K-12 NEWS: THE MAKING OF THE "WHATEVER" PAGE

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The idea of the Whatever page was born on a December day in 1996 when I visited the class of a special education teacher, Sharon Kirkpatrick, at Hylton High School in Prince William County, Virginia. Sharon, her students, and I were sitting around in Sharon's classroom brainstorming about creating a web page "By LD Kids For All Special Ed Kids" when the name burst forth.

Nick, who works part-time as Technical Support for a national nternet Provider, is the Webmaster for the page. Nick collected the completed pages and pasted them first onto his own web space on Erol's. Mike and Will, students who graduated in June, 1997, developed the concept and visuals for the opening graphic. The idea came originally from Will, but Mike did the all of the graphics required to build the animation. A zipper opens to let out the title of the page, WHATEVER, slides out, puffs out, turns multicolored, puffs out again, then disappears. The zipper re-appears. Then it reopens, and the titles goes through its little performance again. The annimation continues as long as you are viewing the page. Mike now has his copywrite on the animated graphic.

Students who worked on The Whatever Page during 1995-96 and are continuing with the project in 1996-97 include Mark, John, Jerry, Sean and Jeremiah. They can be reached via email by writing to their teacher at skirkpat@pen.k12.va.us, and requesting the class address, or by visiting The Whatever Page and using the email link to write to them. They also request that those who visit, sign the guest book. The students truly look forward to mail received from The Whatever Page.

Other than the animated zipper, The Whatever Page is a quiet and pretty page. A black and dark grey wooly texture back the yellow and light turquoise letters. The font is soft and easy to read. The page has a definition for Whatever, provides a link to LD Online and a link to science resources, a link to a list of the members of the Whatever Team, and link to paragraphs written by the students. The paragraphs reflect students' feelings about their learning disabilities, special education classes, school and life in general.

On the original Whatever page, the students had included links to places of interest to each of them. Unfortunately, strict guidelines that required links must be "squeaky clean" meant that some fantasy and science fiction links had to go. Students who had to edit their connections cheerfully did so as soon as they learned of a problem. They were explicitly concerned for younger LD kids who would be visiting their pages. They learned valuable lessons about the need for research to maintain standards and meet guidelines.

Students who had to edit their connections cheerfully did so as soon as they learned of a problem. They were explicitly concerned for younger LD kids who would be visiting their pages. They learned valuable lessons about the need for research to maintain standards and meet guidelines.

Deadlines were also a part of the learning experience of the original Whatever page. The idea was strong in December, but it got lost in the holidays followed by exams. Just before spring fever totaled it for the year, Mrs. Kirkpatrick put "The Whatever Page" on the program for the school's first Tech Night in April. All that day the students worked hard to pull the whole thing together and get it loaded up on Nick's web site for its debut just a few hours later. The audience for the debut of "The Whatever Page" was again presented, this time to the Visiting Committee reviewing the school for accreditation. In June, e-mail was added to the page, and in September, 1997, the Guestbook, entitled "What's Up" was begun, and a new Frames version was completed.

[Photo shows Sharon Kirkpatrick, a Special Education Teacher at Hylton High School, Prince William County, Virginia who teaches and coaches the creators of "The Whatever Page".]

Sharon Kirkpatrick has announced that there is a lot more to come on the Whatever page, including student writings -- most of which require no more work than to be put in place when Nick and his team get a free moment during the whirlwind beginning of a new school year. She wants the kids to design a creative counter for the page, and has given the students a new deadline in October for the newest addition to be completed.

Sharon says she sees this as a never-ending project, and is wondering if Nick, who is now a Senior, will train to be the next Webmaster for the page.

The Whatever Page lives on two servers. The older version is on Erol's at http://www.erols.com/nickapal/whatever/ . During the summer of 1997, "The Whatever Page" was moved onto the county server at http://www.pwcs.edu/techkids/whatever.htm . The newest "Frames" version is at http://www.pwcs.edu/techkids/frames3.htm .

The Whatever Page was begun as a page project for Academy One on Virginia's PEN which is found at http://www.pen.k12.va.us/Anthology/Pav/Academy1 . Academy One on Virginia's PEN is the first and oldest of the learning pavilions in the Electronic Academic Village, and can be found at brower at http://www.pen.k12.va.us/Anthology/Anthology.html. Virginia's PEN is the statewide education network sponsored by the Virginia Department of Education. The Whatever Page is the first and main attraction in the section for Special Students on Academy One on Virginia's PEN.

Readers are encouraged to visit, and drop a line or two to the students who created this page By LD Kids for All Special Ed Kids.

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Information Technologies and Disabilities

December 1997

Dear Readers

Welcome to a special edition of EASI's "Information Technologies and Disabilities" Journal. This quarter's edition will focus on science, math and technology issues for K-12 students with disabilities. EASI's general focus for the past several years has been on both post-secondary education and the workforce. Within the scope of creating materials to help prepare individuals with disabilities to compete in higher education and the workplace, EASI's work has touched on K-12 issues in the past. However, this is the first edition of the journal that will exclusively focus on K-12 challenges and strategies.

This edition of the journal is partially supported by EASI's National Science Foundation grant to compile and disseminate information about K-12 science, math, engineering and technology access. For more information about EASI's NSF materials, see: http://www.rit.edu/~easi.

The material in this edition of the journal has been contributed by individuals who have been working in the K-12 science and math arena. We think their insights will prove valuable to you.

We hope you enjoy this issue of the ITD Journal, and we encourage your comments and reactions.

Sincerely,

Carmela Cunningham
ITD Journal Special K-12 Issue Editor

EASI-SEM (Starts January 5, 1998) is an online workshop providing insights on how to make science and math more accessible to students with disabilities.

Copyright Statement

Articles

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SCIENCE, TECHNOLOGY AND MATH ISSUES FOR K-12 STUDENTS WITH DISABILITIES
itdv04n4 ARTICLE1

By Carmela Cunningham EASI carmelac@aol.com

This article is an overview of the complicated issues that face K-12 students with disabilities as they study in the fields of science, math and technology. In particular, it focuses on the importance of building solid foundations in the math and science basics.

PEER SUPPORT: WHAT ROLE CAN THE INTERNET PLAY?
(ITDV04N4 ARTICLE2)

by Sheryl Burgstahler, Ph.D. University of Washington
sherylb@cac.washington.edu

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This article examines the value of peer relationships for students with disabilities. In particular, it looks at computer-mediated communication between students with disabilities and how such communication can ease social isolation that often is a by-product of having a disability.

PROJECT GOLD: A CLUB FOR GIRLS WITH DISABILITIES
(ITDV04N4 ARTICLE3)

By Kimerly J. Wilcox, Ph.D. University of Minnesota
wilco001@maroon.tc.umn.edu

This article describes one of several National Science Foundation projects that focus on helping young students with disabilities prepare for study and work in the technical fields. Project Gold is an innovative program at the University of Minnesota that focuses on preparing and encouraging girls with disabilities so that they can study and work in the science, math, engineering and technology fields.

PERSPECTIVES ON INCLUSION BY DESIGN: SCIENCE CURRICULUM REFORM AND SPECIAL EDUCATION
(ITDV04N4 ARTICLE4)

By Eric J. Pyle & Gretchen Butera
Department of Curriculum & Instruction
West Virginia University
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This article is an excellent overview of the problems facing teachers who are tasked with teaching science to all students in their charge. It focuses on ICOR, a project that teamed science and special education educators to examine the benefit of designing science curriculum that addressed the needs of students with disabilities, rather than trying to add on to existing science programs.

K-12 WEB RESOURCES FOR SCIENCE, ENGINEERING AND MATH
(ITDV04N4 ARTICLE5)

by Dick Banks EASI Electronic Resource Manager
rbanks2@discover-net.net
http://www.rit.edu/~easi/workshops.html

This article is an overview of some science, engineering and math resources available on the World Wide Web. The author includes comments on what Web sites are readily accessible and which ones need a little more work. The article ends with an important plea for advocacy.

VIRTUAL REALITY TACTILE SYSTEM FOR ACCESS TO GRAPHICS
(ITDV04N4 ARTICLE6)

by John C.D. Nissen Director, Cloudworld Ltd.
jn@tommy.demon.co.uk

This article focuses on a tactile system for making graphics accessible to blind and visually impaired individuals.

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SCIENCE, TECHNOLOGY AND MATH ISSUES FOR K-12 STUDENTS WITH DISABILITIES

By Carmela Cunningham EASI
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Children who do not get a solid foundation in science and mathematics during Kindergarten through 12th grade will not be properly prepared to study science, math, engineering or technology (SMET) successfully in college. Too often students with disabilities fall into this group. There are several basic issues facing students with disabilities.

First, there is an attitude among teachers, administrators, and sometimes even parents, that students with disabilities can't "do" math or science.

Second, students with disabilities are often waived out of math and science course work in K-12, which means that they don't develop the basic foundational skills in these fields. This also makes it impossible for many students with disabilities to meet national standards in science and math.

Third, students with disabilities are not getting adequate training on adaptive computing technology that would allow them to work in the technical fields.

Fourth, students with disabilities often require extra help in making the transition from one level of education to the other and from the educational setting to the workplace.

Fifth, students with disabilities and their parents must learn to be advocates to lobby for the appropriate technology and other accommodations necessary for students with disabilities to succeed in education and the workplace.

NEGATIVE ATTITUDES AND AWARENESS

The negative attitudes that K-12 students with disabilities face parallel those that adults with disabilities face. A 1989 study by the National Science Foundation (Changing America, 1989) reported that the single most significant barrier faced by individuals with disabilities is negative attitudes on the part of faculty and employers. This is particularly harmful, because not only does it deny or limit some students' entrance into the fields of science, engineering and math, but it almost ensures that those individuals will never be able to enter science, engineering or mathematics careers when they enter the work force.

Parents, teachers and service providers can do a great deal to help students face and debunk these negative attitudes. Often, all it takes to get teachers, administrators and parents to believe that students with disabilities can do math and science is to show them the tools and accommodations available.

LOWERED EXPECTATIONS AND WAIVED REQUIREMENTS

The perception that students with disabilities are not capable of doing work in science and math is often reinforced by teachers and parents. Too often students with disabilities are not held responsible for the work that is being done by their peers, and teachers from preschool on will often have lower expectations for students with disabilities. All too often teachers in the early grades are pleased that a student with a disability can do any of the class work. "She is just amazing," is the attitude. And "We don't want to make her work harder than her friends" is the justification for lowering expectations and waiving requirements for students with disabilities. Unfortunately, parents often buy into this argument as well.

Later, after students have been cheated out of a full K-12 education because of these lowered expectations, no one understands why college classes or expectations in the work place are too demanding for them. This mind set that creates lowered expectations and waived requirements is often a

greater disability than is the physical disability.

Some schools have been experimenting with extending the time that elementary and secondary schools provide for students with disabilities to learn basic skills. This can include doing one year's worth of work in two year's time. However, some parents and teachers have raised the issues of the importance of having students move ahead with their social groups and of the perception that retention is only for students who "are dumb." Perhaps it's time to rethink the issue and convince parents, teachers and school administrators that more time to master the basics is a likely option for many students with disabilities.

ADAPTIVE TECHNOLOGY - A NECESSARY FOUNDATION

K-12 students with disabilities should be introduced to and trained on adaptive technology as early and as much as possible. A basic foundation in using computers and special applications to make the computers accessible is critical for children with disabilities if they are to move into higher education and into the workplace.

Students will need to meet basic math and science requirements in college, whether they specialize in those fields or not. It's difficult to introduce students to specialized technology at the same time that they're trying to get through a math or science class, which they may find difficult. Students who are taking the math or science as part of their core requirements, rather than as a major, have a particularly tough time learning special math or science software programs, and students who don't have a good math foundation are fighting a three-way battle.

Helping students become familiar with adaptive technology early, slowly and comfortably, helps prepare them for the more advanced technology they'll need in college.

TRANSITIONS AND MAINSTREAMING

When a student moves from one educational setting to another, it is a time of anxiety. If that student has a disability, the anxiety is multiplied. The new environment may have to be physically adapted. New classmates will have questions, and new teachers will need information on how to best help a student with a disability progress and become an interdependent part of the new classroom or school.

One of the main issues facing parents of children with disabilities is whether or not to allow their children to be mainstreamed - put into regular school classrooms. Many people see it as an equality issue. Others see it practically - some children aren't able to learn what they need to learn in regular classes.

Whether or when children with disabilities are mainstreamed into the general school population is an issue that must be addressed for each child. Some students do just fine entering the general population at a young age. Others benefit by going to special classes for a few years and then moving into mainstream classes. The important thing is to make sure that mainstreaming is right for the individual child, rather than being done as a policy decision.

ADVOCACY

Many parents agree that the most trying thing about having a child with a disability is the fight to get services and an appropriate education for their child.

One woman, who happened to be a special education teacher before she gave birth to a son with cerebral palsy, talked about her exhaustion at fighting the system, which she was quick to point out, was actually trying to do the best thing for her son.

Linda's son is now 16 years old and entering high school. Because Linda's husband is a computer programmer, the couple has long been aware of the benefits of computers for individuals with disabilities. Before Paul even started school, his father had set him up with a computer and worked with him to learn to use the computer to communicate and accomplish other tasks. Paul's parents also bought

all the computer equipment he needed for school and made sure he had the appropriate adaptive devices and software packages to complete his school work. So, what's the problem?

As Paul moves into high school, the equipment that he has used will no longer serve his needs. He must have a laptop computer to take from room to room, and he needs other adaptive accommodations that will make it possible for him to use the computer in multiple classrooms. The school district isn't much help in coming up with a good mobile system, and Paul's father is left with the responsibility of making accommodations.

Fortunately for Paul, his mother is a special education teacher and his father knows computers. Most children with disabilities don't have the same resources available.

And that's where advocacy really becomes important. Parents and the students themselves must work to find what is legally mandated, to find the resources available, and to successfully lobby for the services they need. There are hundreds of organizations, funds and laws that support services for students with disabilities. The problem is that getting appropriate services doesn't always happen automatically. Teachers and service providers can help students become good self-advocates both through encouragement and by helping them learn what their rights are.

EASI, an affiliate of the American Association for Higher Education is working on a two-year National Science Foundation project to create and disseminate materials to help K-12 students with disabilities become prepared to do post-secondary and professional work in these technical fields. For more information on EASI's K-12 project, check out EASI's K-12 corner at:

http://www.rit.edu/~easi/k12.html

EASI also sends out informational releases with strategies and tactics and is in the process of creating other publications that will be made available online and through hard copy. If you'd like to have your name included on the monthly informational release list, send a request to Dick Banks at rbanks2@discover-net.net

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PEER SUPPORT: WHAT ROLE CAN THE INTERNET PLAY?

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ABSTRACT

The need to provide access to mentors and adult role models for students with disabilities is well-documented. However, peer relationships also offer developmental opportunities that should not be overlooked or undervalued. Peers can act as role models, offer friendship, advice and information, promote a sense of belonging, and empower each other. The experiences of an active electronic community of high school students with disabilities demonstrate that computer-mediated communication (CMC) provides an environment where rich peer relationships can be experienced.

The results of a study of participant experiences suggest that CMC between peers can help ease the social isolation and advance the academic and career goals of students with disabilities.

INTRODUCTION

Many young people with disabilities have few friends and limited support from peers (Gottlieb & Leyser, 1981). They often report feelings of rejection and isolation. The impact of social isolation is far-reaching, affecting not only friendships, but also academic and career success (Hawken, Duran, & Kelly, 1991). Ultimately, people with disabilities experience higher unemployment rates and lower earnings (McNeil, 1997).

As the end of high school approaches, so does the termination of a structured environment and pre-college support systems (Burns, Armistead, & Keys, 1990). When compared to people without disabilities, people with disabilities are less prepared to meet the challenges of adulthood, more likely to continue to live with their parents after high school, and engage in fewer social activities (Moccia, Schumaker, Hazel, Vernon, & Deshler, 1989).

Students with disabilities are rarely encouraged to prepare for challenging fields such as science, engineering and mathematics, and they are less likely to take the courses necessary to prepare for post-secondary studies in these areas (Burgstahler, 1994; Malcom & Matyas, 1991; National Science Foundation, 1997).

Although higher education can enhance their employability and vocational success, fewer young adults with disabilities participate in post-secondary education and, of those who begin such programs, disabled students are more likely than non-disabled students to drop out of school prior to completion (DeLoach, 1992; Moccia et al; Wagner). Adolescents with disabilities who wish to attend college are often faced with responsibilities they are unprepared to meet because they are conditioned to depend on others, and they lack self-advocacy and independent-living skills (Transition summary, 1988). Those enrolled in college often hesitate to request the specific accommodations they need (Amsel & Fichten, 1990).

The levels and types of resources available to students with disabilities change as students move from pre-college programs to post-secondary campuses and to employment situations, and programs to help bridge the gaps between these critical stages are rare. Students with disabilities can benefit from interactions with peers and adults with disabilities who are pursuing and participating in academic and career activities that they might otherwise have thought impossible for themselves. However, they are often isolated by great distances, transportation and scheduling challenges, communication limitations,

and other obstacles that make it difficult for them to meet and interact in person (Aksamit, Leuenberger, & Morris, 1987; Brown & Foster, 1990).

PEER SUPPORT

Benefits from positive relationships with others exist for everyone, including people with disabilities. Many types of relationships are important to development - parents, siblings, grandparents, friends, and adult mentors all play key roles in people's lives. One approach to successfully integrating isolated students into academic environments is to help create informal peer support groups and friendships. Social support can ease the transition period following high school when a student's structured environment ends and many support systems are no longer in place (Burns, Armistead, & Keys, 1990; Ostrow, Paul, Dark, & Berhman, 1986, in Jacobi, 1991; Stainback, Stainback, & Wilkinson, 1992).

Peers can serve some of the same important functions generally associated with adult mentors. Peers can act as role models; offer friendship, advice and information; promote a sense of belonging; and empower one another (Byers-Lang & McCall, 1993; Kram & Isabella, 1985; Stainback, Stainback, & Wilkinson, 1992). However, peer relationships tend to involve greater reciprocity and mutuality, encouraging each participant to be the giver as well as the receiver of support (Burns, Armistead & Keys, 1990; Kram & Isabella). Students can discover their potential to participate in academic opportunities and careers by interacting with others with similar interests and concerns.

Forming peer support groups can be problematic for students with disabilities. Specific challenges result because mainstreaming limits their interactions with other students with disabilities. They often experience rejection by their non-disabled peers, and barriers to social activities result from their disabilities (e.g., lack of the ability to speak, unavailable transportation, need for an interpreter or personal assistant, inaccessible buildings).

COMPUTER MEDIATED COMMUNICATION

Computer-mediated communication (CMC), where people use computers and networking technologies to communicate with one another, can connect people separated by time and space who might not otherwise meet. The removal of social cues and social distinctions like disability, race, and facial expression through text-only communication can make even shy people feel more confident about communicating with others. Young people can learn in ways that people learn best - through sharing information, questioning information, verbalizing opinions, weighing arguments, and active learning (Harasim, 1990). Although proximity is critical to developing peer and mentor support in most settings (Stainback, Stainback, & Wilkinson, 1992), the Internet provides a medium that has the potential to build and sustain human relationships over great distances.

Adaptive technology makes it possible for anyone to participate in computer-mediated communication regardless of disability. For example, people who are blind can access computers using voice output and those with mobility impairments can use head sticks, voice input, alternative keyboards and other devices to overcome barriers imposed by a standard keyboard. In addition, people with hearing and speech impairments communication more fully electronically than in face-to face interactions (Burgstahler, 1993). The combination of adaptive technology and Internet communication can help overcome the geographic, temporal, and disability-related barriers to establishing peer support groups. There is some evidence that CMC can reduce social isolation and allow independent access to information resources (Burgstahler, Baker, & Cronheim, 1997; D'Sousa, 1991; Pemberton & Zenhausern, 1995; Stephenson, 1997).

THESE KIDS DO-IT!

The DO-IT project demonstrates the role that CMC can play in helping disabled students minimize social isolation and achieve academic and career goals. DO-IT (Disabilities, Opportunities, Internetworking, and Technology), winner of the President's Award for "embodying excellence in mentoring underrepresented students and encouraging their significant achievement in science, mathematics, and engineering," is directed by the University of Washington and primarily funded by the

National Science Foundation. DO-IT works to increase the participation of students with disabilities in academic programs and careers in science, engineering, and mathematics (SEM). DO-IT Scholars, college-bound disabled high school students interested in SEM from throughout the country, meet face-to-face during short live-in summer study programs at the University of Washington in Seattle. DO-IT Scholars then communicate year-round with each other and adult mentors and access information resources via the Internet. A wide range of disabilities is represented in the group, including mobility impairments, hearing impairments, visual impairments, health impairments, and specific learning disabilities.

EXPLORATORY STUDY OF PEER-TO-PEER CMC

An exploratory study, building on earlier work (Burgstahler, Baker, & Cronheim, 1997), was undertaken to examine the role that CMC can play in easing the social isolation and advancing the academic and career goals of students with disabilities. Research data came from several sources. Seven thousand, seventy three electronic mail messages exchanged between 38 DO-IT Scholars during a two-year period were collected and coded according to the contents of the messages. Participation was voluntary. Private messages which participants elected not to copy to the research archive were not included in the study. In addition, Scholars documented their interests in survey questionnaires and focus groups and parents of Scholars recorded their impressions in survey questionnaires and letters.

RESULTS AND DISCUSSION

Most DO-IT Scholars report that they use Internet resources daily. They like computers for a number of reasons. Computers are engaging and fun. When combined with adaptive technology, computers help them overcome physical, communication, and cognitive challenges imposed by their disabilities. Computers facilitate access to people and resources. As one Scholar wrote, "It's easy, and fast and you can download things. I use it every day I can...I love to use the computer and everything on-line. If I had it taken away I think I would go crazy."

One parent noted that her son was using the computer "anywhere from four to seven days a week," and another remarked that the single biggest benefit of the DO-IT program to her son was "constant computer use where there was minimal interest before."

Scholars most often use their Internet accounts to communicate via electronic mail. The table below summarizes the content of the electronic messages exchanged between Scholars. Each message was coded by content and according to whether a participant is seeking information or providing information in a message. (Note that percentages add to more than 100% because some messages include content in more than one category. For example, this message, in response to two questions posed by another Scholar, was coded as providing both academic information in SEM and personal information: "First question. I am taking health and, yes, I hate it with a passion. Oh well, have to have it to graduate. Second question. Yes we have a winter dance, and yes I am going. :)."

Peer-to-Peer Scholar Messages
7,073 messages from June, 1993, through May, 1995

	Seeking Information	Providing Information
Personal	26%	60%
Disanilities	2	9
DO-IT Activities	8	24
Technical/Internet	16	42
Academic, SEM	2	8
Academic, non-SEM	6	19
College Transition/Adaptation	3	8
Career/Work	1	7

Results summarized in the table suggest that Scholars tend to provide information more than seek information in their messages. Also, most messages include personal information and the largest topic area is related to technology and the Internet.

Many Scholars praise the unique capabilities of CMC, including its speed, efficiency, and low cost. One Scholar points out: "Email is easier than writing and quicker and I can do it on my own if I need to and people ask questions about their disabilities so they can get extra help." Another says, "...email is a lot easier and it's usually faster and more effective this way to communicate information back and forth to each other."

Scholars report that CMC overcomes communication barriers related to their disabilities. For example, one of a pair of quadriplegic students who good-humoredly characterize themselves as the "The Quad Squares" and who regularly communicate on the Internet confides, "It's kind of hard for two gimps to get together." A deaf Scholar notes, "I like electronic communication because I don't need an interpreter on the Internet or my TTY." With CMC, it is not uncommon for a student who cannot speak with his voice to become the most vocal in a conversation. One participant notes that he appreciates that this type of communication "kinda hides what type of disability you got."

On the other hand, some negative characteristics of electronic communication are reported by participants in the study. "Sometimes you get misinterpreted; you are not able to show expressions or emotions." And, it's "possibly not private."

MEETING SOCIAL NEEDS

Personal topics represent the highest content area coded in Scholar messages. Scholars both seek personal information from others and provide personal information about themselves. As one Scholar noted, "It's just fun to talk with people and see how they are doing. I like sharing humorous things with them and telling about my life and hearing about theirs." Students often use electronic mail to get ideas and assistance from those in similar situations. Students disclose information about their disabilities and seek solutions to barriers they're facing.

Scholars report making and maintaining friendships with other disabled youth as the most significant benefit of participating in DO-IT, saying, "I like the fact I have made many good friends with various disabilities." One poignantly expressed this insight: "Just meeting and interacting with others like me has given me the realization that I'm okay."

The ability to meet people across time and space is emphasized by many in comments such as, "I like the Internet so I could contact lots of people in other countries; You can meet people from all over the place, whereas you couldn't meet them if you didn't have a modem." and "On the Internet I have access to a whole world of people and information. This is an experience that I will appreciate for the rest of my life."

Scholars also use electronic mail to sustain relationships once they have been established. "You get to

BEST COPY AVAILABLE

talk to people even though you don't see them that much and they're far away." One Scholar looks back on her life since joining the DO-IT community: "I have since made many friends world-wide. "I have a "family" via the net and have learned many things. I also have a whole group of unbiased people that I can communicate through a few strokes of a key. The DO-IT program has changed my life forever."

Messages about DO-IT activities document the value of social supports provided by non-Internet-related events sponsored by DO-IT. For example, one Scholar wrote to the group: "I've been thinking. It's been awhile since we've seen each other and we may not see each other until spring break. I personally miss hanging out with you guys. So, I was wondering, is there any way we can get together around Christmas and do something. I know this is rather short notice, but I don't think it would have to be anything complicated. Of course, I just may be complicated anyway. Anyway, if anyone has any thoughts on this, let 'em rip and maybe something interesting will happen."

Parents agree with Scholars when it comes to the value of social supports provided by peers. One parent points out that through DO-IT her deaf child "was afforded the opportunity to meet students from different parts of the country who struggle with a disability." Another parent said, "This program has given her self-confidence, friendships for a lifetime, and has opened the world of computers and the World Wide Web for her. Because of her profound hearing loss, [name's] world is silent. ...The students she met through this program have also become some of her best friends. I have never seen bonding like have watched [name] experience. I'm not sure why, but she became very close to her DO-IT family right away. Perhaps it's because all of these talented young people have experienced some sort of pain or misunderstanding because of their disabilities. Whatever the reason, they became very close friends quickly. [name] visits with friends clear across the country via the Internet and they help each other through difficult times. When she had her kidney transplant last summer, it was her friends from DO-IT who were the most constant and supportive."

One parent, who rated "The ability to communicate via the Internet and the ability to find a social connection at home" as the most noticeable benefits of the DO-IT project for her child, summarizes these sentiments, "...the high school years are years of learning about ourselves for everyone, and [adults and other students] don't make time for kids who are different...they are too busy with their own lives. DO-IT provides an outlet for kids who are 'different'." A parent of a student with a physical disability "observed [name] interacting with kids from all over the country. Each had unique physical challenges. I was pleased to see [name] become more social than I had ever seen him before. His confidence seemed to grow daily throughout the experience. He was learning that he was not alone facing the world as a disabled youth."

Scholars use electronic mail to discuss the importance of friendships and how to make and keep them. One Scholar graduate, now in college, shared her insights with younger Scholars: "I think I've learned from being with people. I'm not so self-conscious or uncertain of myself. Friends have also reintroduced me to things like crayons and taught me card games and so on. Not only is it fun to hang out with people, but it's emotionally uplifting. Life wouldn't be as worthwhile without friends." Scholars share challenges in socializing and successful strategies they have discovered. As shared by one Scholar, now in college, "I think that blind people face the particular challenge of not being able to walk up to someone with whom they would like to talk unless they hear their voice, or the person introduces him- or herself. In the dining hall, for example, I always asked someone to help me find a seat, but that person would not necessarily know the people I liked to sit with, so it was a game of chance. Sometimes, I met new people, sometimes I happened to sit next to good friends, and sometimes I was unable to join in the conversations around me. However, by making friends in certain interest groups and arranging to meet friends for a meal, I was able to keep in touch with the people I cared about."

PROMOTING ACADEMIC SUCCESS

Scholars discuss academic issues related to science, mathematics and other academic areas, as well as college transition and adaptation. Many Scholars report that access to Internet resources provides a way for them to obtain information which was previously hard to get due to their disabilities. One explains, "...one advantage of electronic communication is that you can acquire more information at a time. You do not have to work so hard to write things down while someone is talking to you since I have all the

information coming up on a screen, I can go back and refer to it whenever I need to."

The importance of information access is documented by one high school Scholar in an essay that won runner up in a national contest sponsored by the National Center for Education Statistics, the NASA K-12 Internet project and the National Science Foundation. He said, "... I have been blind all my life, and have never known anything different. I have been mainstreamed in schools all my life, and have always had to depend on others to get me school materials. If I needed or wanted a book for class, it had to be transcribed into Braille or put on tape. However, in August of last year a whole new door was opened to me. I am a member of the DO-IT (Disabilities, Opportunities, Internetworking and Technology) Program at the University of Washington ... Getting Internet access was the best thing that ever happened to me. In a way, my computer and access to the net has become my eyes to the world. I can read a newspaper, talk to people around the world, and get materials for class papers, unlike before when I had to depend on others to get the resources I needed. Upon receiving my access in August of 1993, I was able to read a newspaper for the first time in my life. This may sound trivial but to me it was a great accomplishment. I was not aware of the variety of topics covered by newspapers. I knew about the front page, feature articles, and sports section, for instance, but I did not know of the huge amount of stories in these sections. I was amazed. Before getting access I had to get sighted people to read me the paper. However, with the help of a screen reader and a host at the University of Washington called UWIN (University of Washington Information Navigator), I browsed through the paper, found just what I wanted to read, and read it. I can even mail myself the articles and save them; somewhat like how you cut articles that you like out of the paper to save for future reference. This was amazing to me. And not only can I read the Washington Post, but also the Moscow News, and several other papers mainly used by scientists. So, the Net has helped me get in better contact with the world via online newspapers."

The content of messages between Scholars indicates that these students are assisting each other through CMC in much the same way students informally help each other at school. For example, an exchange between several blind students includes the message, "I have a dilemma. Did you take Chemistry, and if so, where did you guys get the periodic table? Second, did you take Trig? If so, how did you use a graphic calculator?" Scholars use each other as academic resources. One Scholar confesses, "I like to communicate with other people to get some information for my research." Others wrote, "I learn a lot from [other Scholars]. I learn about activities that are coming up and I learn more about different electronic resources." "I can communicate with others asking questions about all different issues," and "I like getting opinions from them."

ADVANCING CAREER GOALS

A relatively small number of Scholar messages include content related to careers. Perhaps, because they are still in high school and focused on college transition, specific career choices seem too far off. Perhaps, this is an area better discussed with adults who have more career experiences.

Scholars recognize that being able to effectively use computers and the Internet are valuable academic and career skills in themselves. Some are planning careers in computing and many point out that computing skills are helpful in advancing any academic or career goal. The interest Scholars express in developing their computer-related skills is reflected by the large volume of messages between Scholars about "technical/Internet" matters (16% seeking and 43% providing technical/Internet information). A single question posted on a discussion list often elicits multiple replies.

Scholars inspire, tutor and act as role models for each other. They help each other gain career skills. For example, in a response to request from a Scholar for help with programming, another Scholar says, "I write programs in almost any language, but my favorite is called Visual Basic. I develop applications for anyone who wants them, but I also like to write educational multi-media applications. If there's anything else I can do, just let me know." A blind Scholar summarizes what he has gained from others: "By meeting new people, learning and using the Internet, talking through e-mail, and much more, I feel this program has made me more knowledgeable in more ways than I can say."

Some electronic communications support in-person events that advance career goals for Scholars and other students with disabilities. For example, after completing a summer internship at a scientific lab, a

Scholar arranged a tour of the facility for local students with disabilities; all of the planning was done via the Internet.

Scholars' parents also report that using computers and the Internet are valuable in developing their children's job skills. The impact on future employment is voiced in this way by one parent of a child with a mobility impairment: "until your program came along, [name] lived such a limiting life. The rural area we live in has nothing to offer. Your program gave [name] a sense of independence and self confidence she so desperately needed. She is very active on the computer now, thanks to you. She learned so much about the Internet and even began a disabilities group. [name] didn't have much hope about a future, but now, she can see a future of some sort of employment using the computer."

SUMMARY

Computer-mediated communication can help ease the social isolation and advance the academic and career goals of students with disabilities by connecting them to a community of peers who support each other. CMC between peers helps young people with disabilities build computer and Internet skills; gain access to people and resources difficult to reach in other ways; connect to peers with information, skills and knowledge to share; and receive opportunities to act as role models and mentors to each other. CMC provides many of the same benefits as face-to-face friendships and support. The mutual exchange of personal information and the longevity often exceed those of other relationships.

The CMC experiences of the DO-IT Scholars suggest that electronic peer support groups merit further study. Questions that could be pursued include:

> How do peer-to-peer CMC benefits compare with those of face-to-face peer groups?
>
> How do the benefits of peer-to-peer communication compare with mentor-to-protege communications on the Internet?
>
> How do the benefits of CMC compare between students who have different types of disabilities?

Without a doubt, DO-IT Scholars gain life-long benefits from meeting each other on the 'Net. As beautifully stated by a participant who has moved on to college and now mentors younger Scholars,"...I made some best friends along the way who I still talk to and confide in even now. I learned how much we are all alike in the mind. Our disabilities are only what most people see. As for what I learned about myself? I learned there are no boundaries. In today's world, a disability is no barrier. I saw so many people do so many different things. My friend [name] has cerebral palsy that affects her ability to walk, and move. Never have I seen such determination and love for life as I saw it in her. With the help of accommodations, she is able to do anything a person without CP can do on the computer and in everyday life. Another friend of mine uses a head piece to operate the computer because he is paralyzed from the neck down. He too, blows me away with his sense of humor and strength. I could go on and on but I think you get the idea. Looking at them, I am able to find within me what they have found within themselves. A quiet strength and love for life and myself."

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PROJECT GOLD: A CLUB FOR GIRLS WITH DISABILITIES

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ABSTRACT

Project GOLD provides hands-on science, mathematics, computer activities, role models, and opportunities to develop self-esteem, for Grade 4 - 8 girls with disabilities. The format includes Saturday workshops, a day camp, and an overnight experience. A concurrent program is offered for parents.

BACKGROUND

It has been well-documented that many children, notably girls, lose interest in science and math by the time they reach junior high school. Many reasons have been suggested for this. While a number of organizations (such as EASI) are working to improve the participation in science and math of students with disabilities, these students in particular often have reduced access to the type of hands-on science and math activities that are currently favored by many educators. There is a serious lack of comprehensive data on persons with disabilities - especially students - in the areas of science, mathematics, engineering, and technology (SMET).

The National Science Foundation (1996) suggests that there are several reasons for this:

> Varying definitions of "disability" are used in data collection.
>
> Educational institutions often keep data about disabilities in confidential files so it is not included in comprehensive institutional records.

Also, there is not likely to be records for those who do not request special services.

> Data are often from self-reported surveys and reflect individual perceptions rather than objective measures.
>
> Data come from small samples and may not reflect population values accurately.

Even less work has been done to examine the dual effects of disability and gender in science education on girls with disabilities. These factors conspire to keep girls from discovering their own abilities and maintaining interest in subjects that will prepare them for advanced coursework and careers in science, mathematics, engineering, and technology. Project GOLD is intended to help girls with disabilities overcome some of these barriers to full SMET participation.

It is becoming quite clear that students who do not take the appropriate mathematics and science foundation courses -- beginning in middle school -- are unlikely to be able to complete college majors in SMET. Project GOLD uses hands-on science, math, and computer activities to help girls with disabilities develop the skills and maintain the interest necessary to take courses that will prepare them for college and career options in science, mathematics, engineering, and technology. This project targets girls in elementary and middle school because of the pressing need to address appropriate educational planning, adaptive technology and equipment, self-advocacy skills, and family support before the girls are lost from the SMET pipeline. The remainder of this paper presents an informal description of the project.

PROJECT GOLD

Project GOLD is a model project funded by a three-year National Science Foundation Grant. It receives additional support from the General College, University of Minnesota. Laura C. Koch, Ph.D., a mathematics educator, and Kimerly J. Wilcox, Ph.D., a biologist, both from the General College, are the co-Principal Investigators. Rozanne Severance, M.S., is the Project Director and Curt Griesel is the technical advisor and computer educator for the project.

Project GOLD collaborators include the Minneapolis Public Schools, the St. Paul Public Schools, PACER Center (Parent Advocacy Coalition for Educational Rights (a coalition of Minnesota's disability organizations serving disabled clients and their families), and the Minnesota Department of Children, Families, and Learning, Interagency Office on Transition. Representatives from each of these groups and from the disability community, as well as parents of present and past participants, work with Project GOLD staff as members of the project's Advisory Board.

Participants are drawn from throughout the state of Minnesota, although most are from the Twin Cities metropolitan area. In order to qualify for Project GOLD, girls must have a documented physical, sensory, or learning disability; must be working at or near grade level for the project year; and must express an interest in science, mathematics, or computers. The girls, their parents, and their teachers must complete and submit an application for the special "club" called Project GOLD.

Identification of participants occurs in several ways. Teachers in the Minneapolis and St. Paul public school systems are asked to identify likely candidates. Public school teachers outside these two large school districts also are asked to identify potential participants by the Minnesota Department of Children, Families, and Learning (Office of Transition). Other families learn about the project through articles in PACER Center newsletters, which have large circulations within the state. A few find out by word of mouth. It is an imperfect system, but we are working to improve our recruiting in the private schools.

During the first year, 29 girls in Grades 6 through 8 participated the project. In the second year, 33 girls in Grades 4 through 6 participated. The third group of participants, from Grades 6 through 8, will begin attending workshops in January 1998. In addition, past participants are invited to attend any workshop or other project activity. A number of girls from Group I have attended Group II activities, and we hope that this will continue with Group III.

The participants are diverse in terms of disability, ethnic background, first language, age, and geographic regions of the state. It is interesting to note that those outside the Twin Cities metropolitan area have been among the most committed participants. Some families travel between 50 and 200-plus miles each way to participate. This underscores the participants' need for these types of activities and for contact with other girls with disabilities.

Seven or eight Saturday workshops a year bring both girls and their parents to the University of Minnesota campus. The girls participate in hands-on science, math, and computer activities, work with college-age women mentors who are majoring in the science, engineering, or mathematics fields, and take part in talks and activities designed to promote self-determination and self-advocacy skills. There is a concurrent workshop program for parents who bring their daughters to Project GOLD. Parents receive computer training, get the chance to network with other parents, and participate in informational sessions on resources, advocacy, and assistive technology. Language (including American Sign Language) interpreters are provided if needed for parents and participants.

The agenda for a typical workshop includes several segments for parents and for girls. For example, at one workshop, the girls investigated the pH of various household substances, used geometric shapes to create a design which was then applied to a T-shirt, and talked with a counselor from the University's Office of Disability Services who has a learning disability.

Parents saw presentations by a representative from PACER Center, who talked about PACER's services and resources for college, and from a General College academic advisor (who has a disability) on college and career resources. Parents also learned how to download software from the Internet. Each workshop has a refreshment break that allows everyone to come together, eat, and socialize.

In addition, Project GOLD includes a two-day summer day camp. On the first day, participants and their families visit the Minnesota Zoo, where they are treated to bird and dolphin shows. They visit the Zoolab to touch and learn about a number of animals, and eat lunch overlooking the snow monkey exhibit.

After the bird show, the girls talk with the women bird trainers, and after lunch, they go behind the scenes to areas not usually open to the public. Here the girls see some of the animal holding areas, meet women zoologists, and tour the kitchen where all the animals' meals are prepared. The zoologists and bird trainers talk about their jobs and the coursework they needed to prepare for them, and they answer lots of questions.

The second day of day camp is back on the University of Minnesota campus for a Geometry Day. Among other activities, this includes a campus-wide "geometry scavenger hunt," in which groups of girls and their mentors, use Polaroid cameras to capture images of as many geometric shapes as they can find in the surrounding buildings and environment. Some of these images are later scanned and added to the Project GOLD web site (http://www.disserv.stu.umn.edu/gold/).

This fall, Project GOLD had a "Camp-In" at the Science Museum of Minnesota, which included tours of the exhibits, special classes, a show at the Omnitheater, and a live presentation in the Science Theater. Girls, a few parents, personal care attendants, and project staff then retired to the luxurious camp-in quarters on the penthouse floor. After the requisite whispers and giggles (and two of the gigglers were deaf girls who managed to sign to each other in the little bit of light remaining in the room), we did get some sleep. An early breakfast marked the end of this adventure.

While Project GOLD was not intended as an experimental or research project, we are in the process of collecting evaluative data. Responses, while few as yet, have been quite positive. A Group I parent wrote:

> "Meeting both peers and adults who have challenges is great. It has been very worthwhile for [my daughter] to see the options that are available and what goals she can set for herself. She enjoys the mentors and it has allowed her to express her needs to other people. Before Project GOLD, [she] has always said that she was going to live with us all her life. Now she is talking about living outside of home after high school. I think this program has opened her eyes to possibilities available to her."

Our experience with Project GOLD has helped us realize just how many barriers exist for children with disabilities - especially girls - who want to pursue coursework and careers in the areas of science, mathematics, engineering, and technology. We also have become aware of how few data exist that explore the interactions between being a female interested in science, mathematics, engineering, and technology, and having a disability. Future plans include dissemination of the Project GOLD curriculum, obtaining grant support to continue and expand Project GOLD, and research to examine the female/disability interaction.

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PERSPECTIVES ON INCLUSION BY DESIGN: SCIENCE CURRICULUM REFORM AND SPECIAL EDUCATION

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The call for reform in science education occurs within the context of a curriculum revolution in American education designed to bring schooling in line with society's most pressing needs (Pugach & Warger, 1996). Curriculum is being sought that ensures congruence between what is taught and what needs to be taught, to ensure that students are productive citizens at the end of formal schooling. Reform in science curriculum is illustrative of this transformation that is occurring in schools throughout the United States.

How teachers construct and interpret curricula at the classroom level is determined by years of experience as students and as teachers. The lenses through which teaching experiences are viewed have been shaped by educators' recollections from childhood, as well as a certain amount of nostalgia for the past. The underpinning of these recollections of experience include assumptions and beliefs about how students learn and about how schooling practices "should be" in order to facilitate student learning. Assumptions must be examined in order to facilitate change in how curricula is developed and enacted, as well as to create opportunities for meaningful learning by all students.

The purpose of this paper is to describe a novel approach to the preparation of science and special education teachers in the construction of curricula for science classrooms that include Grade 4 - 8 students with disabilities. Our basic mission is to include students with disabilities by design and collaboration, rather than by modification of existing curricula or lessons.

Specific objectives include: (a) describing the activities of the project, (b) describing current research trajectories with respect to the effectiveness of the project, and (c) discussing implications of the research trajectories for science and special educators as they relate the dual processes of science curriculum reform and inclusive special education service delivery.

PERSPECTIVES AND RATIONALE

As the body of knowledge about child development, psychology and human learning expands, the expectations for educators to respond to this knowledge with new and different teaching practices are increased. Tenner (1996) defines a "revenge effect," as classroom teachers - armed with increased awareness of the individual needs of their students - try to cope with the increased demand this knowledge implies.

This expanded knowledge base and the increased expectations for teachers come at the same time as the widespread adoption of educational policies that place increasingly gr er numbers of students with significant learning disabilities in general education settings for a large rtion of the school day (Turnbull, Turnbull, Shank & Leal, 1995).

The task of responding to this understanding places special demands on general education teachers as well as on special education teachers. Often classroom teachers who assume the major responsibility for teaching children with disabilities along with the other students in their classrooms, report that they receive no special training related to undertaking the task of teaching a diverse set of students (Scruggs & Mastropieri, 1996). In an attempt to address the learning needs of individual children, students with disabilities are put in general education classrooms that have a team of general and special education co-teachers (See Paul, Roselli & Evans, 1995). Such partnerships often involve additional challenges related to "turf" and classroom ownership (Pugach & Johnson, 1995). In other cases, general educators

have the entire responsibility for addressing the demands of teaching content and facilitating the learning of diverse groups of children.

One apparent difficulty that West Virginia special educators have experienced while responding to the need for more inclusive practices, is a lack of role definition. The changes in role and responsibility are often accompanied by considerable anxiety for special educators who describe a lack of "ownership" for their students and a feeling that they are taking on an inferior role in classrooms where they are asked to assist rather than co-teach. Often they are asked to modify curricula that they have had no part in selecting or designing. Under such circumstances, the reciprocity between equal partners implied in co-teaching models is lacking.

At the same time, the need for students to learn science, particularly in the elementary grades, has become more critical than ever. The recent National Science Education Standards (National Research Council, 1996) have emphasized the need for all students to have a basic science foundation, regardless of their ethnicity, socioeconomic status, or disabilities. The essential place of science instruction in the elementary and middle grades is particularly emphasized.

Changes to West Virginia education policy (re: Policy 2510) mandate that science be taught daily to students in Grades 3 and higher. General education teachers who face the stresses of teaching reading and mathematics to students with disabilities will now be faced with the additional task of teaching science to those same children everyday as well. Furthermore, special education teachers, who have been attempting to mitigate students' deficiencies in reading and mathematics, will now be asked to do the same for science instruction.

While special education teachers may realize that science instruction often provides a unique context for students with disabilities to achieve success (because it presents many opportunities for hands-on learning), they often have little background in the content of science instruction and they often lack the appropriate knowledge to make use of this opportunity to address individual learning needs. Without appropriate assistance in developing effective strategies, both science and special education teachers will experience increased frustration without much prospect of students with disabilities showing improvement in science.

Many West Virginia teachers are aware of their shortcomings in dealing effectively with the challenges that this situation presents. For instance, during the initial training of Project CATS (Coordinated and Thematic Science) science mentor teachers in West Virginia attended a disability equity session conducted by WVU faculty. Feedback on the session, which focused mainly on physical disabilities, was favorable. Several of the teachers, however, made comments such as, "I wish that the presentation had been geared more for the common classroom situations: learning disabilities, ADD, behavior disorders, mental impairments...These challenges are the daily life of every classroom teacher."

One teacher went on at length:

> "I agree we need to be more aware of the student population which has special needs BUT [emphasis original] the deaf and physically handicapped makes up a VERY small percentage of the student population. Why wasn't someone there to talk about the learning disabled or the behavioral disordered child? They make up over 60% of the special needs students. We as science teachers have always overlooked this population."

Such arguments are compelling and have not gone unnoticed. The American Association for the Advancement of Science (AAAS) has produced a series of publications under the heading "Barrier Free in Brief." These documents focus almost entirely on the physically challenged, with scant mention made of students with mental and developmental disorders. AAAS recognizes this need. Virginia Stern, Director of AAAS's Project on Science, Technology, and Disability, stated:

> "...We are frankly weak on learning disabilities (although we are trying) and have so little specific experience with students with behavioral and developmental disabilities -- even though we are quite aware that these students are being included and that teachers want and need help to teach them along with the non-disabled students in their classes." (V. Stern,

personal communication, 8/28/96).

Thus, it becomes apparent that neither science teachers nor special education teachers are adequately prepared to meet the needs of students with disabilities. Yet both groups of teachers possess, as professionals in their fields, unique bodies of knowledge in terms of definitions, strategies, and content-specific pedagogy. Such information is accessible to all teachers, but for most teachers, there is limited time to develop an expert understanding of content or special learning needs.

INCLUSION IN A CLIMATE OF REFORM

Inclusion in a Climate of Reform (ICOR) was developed and implemented as part of a project funded by the Dwight Eisenhower Mathematics and Science Education Act (DEMSEA). It was conducted in West Virginia in the summer and fall of 1997. Little was found in the described initiatives that included science and special education teachers as teams of "change agents" with respect to inclusion and science curricula reform. ICOR was therefore experimental and emergent, and it continues to develop.

The 12 participants were Grade 4 - 8 science and special ed teachers from five counties in North-Central West Virginia. The participants were divided into four teams. ICOR emphasized a front-end approach to science instruction, whereby modifications for students with special needs are addressed up-front, both in planning and in lesson implementation.

Case studies of students with disabilities developed by project staff and participants were used along with the state science curriculum to guide the teams in developing integrated plans for science instruction. One product constructed by the participants was a set of lesson plans that incorporated the needs of the prototypical students. More important was the facilitation of the process of personal rationale development as it relates to inclusion, co-teaching, and the continued development of curricula that reflect the West Virginia Instructional Goal and Objectives (IGOs) and the Individual Education Plans (IEPs) of real students.

During the course of the summer workshop, participants kept daily journals of their experiences as co-planners and co-teachers. Lesson plans and modifications with respect to real and prototypical student IEPs were collected in order to provide feedback on change and growth by participants. The teams used observations about their classroom interactions and the lesson plans as a guide to analyze their roles as special and science educators. In order to help the participants become change agents at the local and state levels, participants were encouraged to take part in two state-level professional meetings. Planning sessions for the preparation of state-level professional presentations were used as an opportunity to re-focus on project activities. The evaluation of the project is ongoing. The lessons learned thus far are preliminary, pending the completion of the grant period and the academic year.

LESSONS LEARNED THUS FAR

All ICOR participants who examined their own teaching and curricula construction appreciated the opportunity to engage in the change process. The change process, however, was dependent on each teacher's unique instructional circumstances and experiences. Several change trends have emerged.

The first trend typifies the approach that each team has taken with respect to the process of co-teaching and planning for inclusion up-front. For example, the participant teams initially adopted (a) linear approaches to inclusion, developing the full lesson plan first and then incorporating child modifications, (b) personal approaches to inclusion, where the participants adopted a personal stake in the IEP development and implementation, according to their experience in observing students in the classroom, (c) mode-shifting, so that the lines between the special educators and the science educators were blurred and that each shifted from a special educator to a science teacher mode and back again, and (d) merging, such that mastery of the science content served as a general endpoint for each student, and the participants constructed curricula that converged on the content.

A second trend emerged that relates to the format of co-teaching. During the course of the field visits, focus groups, and professional meeting sessions, three co-teaching roles emerged. The first role type saw

the special and science educators act as interchangeable units during instruction, such that either could assume the role of the other for short periods of time. The second role type was exhibited by the special educator acting as a distant "shadow" to the science educator in planning and implementing appropriate instruction. Administrative structures (scheduling, hall duties, etc.) precluded direct interaction between the science and special educators, but planning focused on particular content was enacted in the physical absence of the special educator. Finally, the roles of the special and science educators could be merged into a single individual, such that the classroom teacher carried out both the regular and special education instruction. This role was reinforced by both the school setting as well as the capacities of the teachers.

The third trend that emerged depended upon factors that act in support of, or as barriers to, co-teaching. In general, participants felt that it was easier and more meaningful to consider inclusion by design as opposed to simple lesson modification after plans for the class were developed. Initially, it was difficult for the participants to overcome preconceived ideas about inclusion that focused solely on lesson modification. The approach that evolved allowed participants to examine both the mandated science curricula and students' IEPs in a critical and pragmatic light. Participants described or acted in ways that demonstrated the importance of (a) trusting relationships for stakeholders, (b) the need to include models of co-teaching into pre-service teacher education, (c) the need to critically examine the administrative structure that supports continued teacher territoriality, and (d) the need to overcome the assumption by general educators that the "special" in special education means that those students cannot learn.

Despite situation-specific constraints, the participants remained enthusiastic about the project. To a large extent, their focus on front-end inclusion has validated what they have come to believe as self-selected project goals. As change agents, their expectancy of success and the value attached to that success are the basis of continued motivation to develop science curricula and instructional approaches in support of students with disabilities. The most difficult hurdle, however, remains the administrative climate. Without proper support by the school-level administration, science and special educators will face difficulty in any form of inclusion in the science classroom of students with disabilities.

CONCLUSIONS

The preliminary results of this study thus far indicate that inclusion by design in science instruction is an effective means of approaching the needs of all learners, regardless of whether they have an IEP or not. What underscores this apparent effectiveness is the belief of the teachers involved that it is efficient, pragmatic, and more representative of the daily demands placed on teachers. As many teachers in the elementary grades are self-contained and many junior high schools transition into middle schools, the increased numbers of students identified as having special needs places an overwhelming burden on the teachers as they attempt to meet the needs of all of their students. Models such as "inclusion by design" described here offer one solution to the problem and will act as springboards in the process of science education reform.

As the project progresses, focus will be placed on the student-level effectiveness of the project, as measured by state achievement tests and attainment of IEP goals and objectives. Based on the initial trajectories determined thus far, there is every reason to believe that the experiences gained by the teachers will directly and positively impact all students under their charge.

ACKNOWLEDGMENT

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K-12 WEB RESOURCES FOR SCIENCE, ENGINEERING AND MATH

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INTRODUCTION

The World Wide Web holds the promise of being the most powerful tool for accessing information in a wide range of subject areas. Because our nation places a high value on education, particularly in the areas of science, engineering and math, knowledge of Web-based resources in these areas is essential for people with disabilities.

Researching this article has lead this author to two disturbing conclusions. There are very few specific special education resources in the area of science, engineering and math (SEM), and many of these resources are not offered in an accessible format. Many of the urls listed here are given as potential resources with comments as to why they were chosen.

Plane Math

http://www.planemath.com

This site was created with help from NASA and was developed with special needs students in mind. A text version of the page is the first item that one encounters upon retrieving the page, which makes it accessible to all users. Math problems are designed around situations that might occur in dealing with airplanes.

Frank Potter's Science Gems

http://www-sci.lib.uci.edu/SEP/SEP.html

If you visit this site, make sure you pack a lunch because it is packed with information in each of the areas covered in this article. The developer does a nice job of categorizing areas by subject and grade level. Although the site was not designed with access in mind, it is relatively user-friendly.

Smart Elec Page - Calculators

http://www.geocities.com/CapeCanaveral/5510/index.html

Although this page is not user friendly, it deserves mention because there are a number of calculators here that show promise for use by special needs students.

Blue Web'n Mathematics

http://www.kn.pacbell.com/wired/bluewebn/fr_Mathematics.html

This site would be difficult to access for users who have difficulty navigating frames, but there are a number of resources linked from the page that have real value. The KQED Center for Life Long Learning is one of these resources.

MegaMath

http://www.c3.lanl.gov/mega-math/menu.html

This site deserves mention both for content and accessibility. The url given is for the textual menu version of the site. There is a rich graphical version as well. Some unusual lessons, such as the mathematics of knots, are featured.

The Math Forum

http://forum.swarthmore.edu/

The Math Forum is valuable for the resources in higher math. The site is organized around four basic components which helps the user navigate successfully and quickly. The four parts are: Student's Center, Teacher's Place, Research Division, and Parents and Citizens.

The MIT Biology Hypertext Book

http://esg-www.mit.edu:8001/esgbio/

While it takes some time to get where you are going here (which is the actual hypertext book), the route is fairly clear. Once the user locates the book chapters, the Biology Hypertext Book is well done. Each chapter has some graphics, but the book is primarily textual.

Science Learning Network

http://www.sln.org/

Funded in part by the National Science Foundation, this site has enough to keep you clicking for a long time. The science of cycling and the science of hockey are two of many interesting features of this page. All images have proper html coding, which makes the site speech-friendly.

Chemtutor

http://www.chemtutor.com/

This is truly a text friendly site and the best site I have seen for an introduction to chemistry. Great for upper high school and beginning college students. This site does not get caught up in graphic overload.

Karl's Calculus Tutor

http://www.netsrq.com/~hahn/calculus.html

This site is similar to Chemtutor in its user-friendly layout. The site developer gives his email address and welcomes those who need help to write him.

Conclusion

There are hundreds, perhaps thousands, of Web resources in the area of science, engineering and math. While it sounds promising, the truth is that for the special needs student, the news is not all positive. While the Web holds the opportunity to access SEM information, unless Web developers consider access for ALL people, opportunity will fall into a black hole. This is particularly true for blind and low-vision users.

What can be done? On almost every page on the World Wide Web, there is a link to a human being who either has created the page or who is responsible for page content. Visitors can comment on what is available or suggest ways that the page might be improved. If every visitor who is concerned about

access to the Web would become an advocate by writing to Webmasters or contact people, it would make a difference.

There is a great deal of information on the Web about how to make pages accessible to all people. The EASI link to accessible design resources is a good resource to recommend to developers.

In most cases, access is not a consideration in page development because of lack of awareness on the part of the page designers. I have found that once Webmasters are made aware that their pages pose problems for people, they are open to considering accommodations for the population of Web users with special needs. I hope that readers will become advocates for universal access to the Web, so that an important segment of our population can reap the full benefit of this powerful information resource.

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VIRTUAL REALITY TACTILE SYSTEM FOR ACCESS TO GRAPHICS

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STATIC DISPLAY

It is widely recognized that blind people have a problem accessing any kind of information in graphical form. In the usual approach, tactile graphic "hard-copy" images are produced using swell paper or molded plastic. One advantage of this system is that there is no cost associated with actually reading the image; the user merely scans with a finger over the surface. But there are a number of disadvantages:

- the images are static - they cannot be changed once produced;
- they are low resolution - with limited information content;
- labeling by Braille takes a lot of space;
- the choice of information is not selectable at the time of use;
- the images are not scaleable;
- they require special, expensive equipment to be produced;
- each image has a production cost per copy;
- the image is bulky, and unwieldy to carry around;
- an image, once -produced cannot be easily marked or annotated.

The information content of such hard-copy can be boosted by having audio output of text annotations stored in a computer, and mounting the image on a touch-sensitive tablet. This is the ingenious approach of the system known as Nomad [Parkes 1988]. However other disadvantages remain, and there is now a cost associated with the reading system - the tablet and computer.

DYNAMIC DISPLAY

A dynamic display is one generated at the time the user wants to access the information - by direct output of the computer - where the medium is re-used or refreshed for the display of successive images. For text display, the medium is typically an array of cells, reproducing a Braille pattern. The display corresponds to a window on the visual display - typically one line of text on the screen.

A dynamic display should not have any of the disadvantages of a purely hard copy image, as listed above. But the cost of dynamic display systems has been a problem, especially for a system with reasonable resolution. The cost is necessarily very high if a whole image is to be reproduced in the chosen medium. For ultimate resolution one would need a pin (or other moveable element) for each pixel of the graphic image.

VIRTUAL REALITY DISPLAY

In dynamic Braille, only a small part of the screen is displayed at any moment. Similarly tactile graphic systems have been proposed that only display limited tactile information at any moment, but they present this information directly to be felt by the user's hand. The "reality" of the graphics is in the computer, and the system tries to simulate this reality, hence the term virtual reality. As the user's hand moves over the simulated surface, a corresponding window moves over the image on the screen or stored in the computer. What the user feels is directly related to what is in that window.

There have been three approaches tried thus far. In the first approach, that of the Optacon, there is an array of a large number of small pins, each pin corresponding to a pixel in the window. The pins act over

the surface of a finger-tip, while a hand-held camera is moved over the graphic image, and sees an area of the image, which is the window. The user needs to have a sensitive finger and a lot of training to detect shapes under the finger. The solution is expensive because of the number of pins and precision engineering involved, each pin being operated by a separate piezo-electric device.

A second approach has been to use a virtual reality display with a tactile glove incorporating position sensors and actuators. This has also proved very expensive.

In a third and recent approach, that of the device known as FeelMouse, the button on a mouse has been modified with tactile feedback, so that the user can feel a force related to what is at a point on the screen. This is a much cheaper solution, but provides only limited sensory input to the user - that is, the channel for information flow to the user is very narrow, and the user would require a long time to build up a mental image of a large or complex graphic image.

THE PROPOSED SYSTEM

The proposed system is a virtual reality display in which tactile information is presented by a small number of pins over the surface of the hand, for example the palm of the hand. A prototype of the hardware has been built using an array of seven pins: six in a hexagon around a central pin, and over 1 cm apart. The pins are operated by relays and can be easily felt even by an elderly person. The hardware is intrinsically cheap and robust. The pins are far enough apart to be easily distinguishable.

The array is mounted on a pointing device, such as a mouse. As the mouse is moved, the window is correspondingly moved over the virtual surface representing the graphics.

The proposed method of finding a particular object and its shape is as follows. Consider first a point object such as bus stop. While the window is not over the object, the pin or pair of pins closest to the object are activated periodically, with a period proportional to distance. The user can then move the window toward the object, and the frequency of activation increases as the object is approached. When the window is directly over the point, the central pin is activated. The user can request a spoken description of the object.

Next consider a line object such as the center line of a pavement along a street. While the window is not over the object, the pin or pair of pins closest to the object are activated periodically. When the line is reached the pins over the line are activated. The user can then follow the line. While exactly over the line, the central pin is operated.

Now consider objects that have an area (not just points lines). The same procedure is followed to find the edge of the object. However if the window is moved inside the area, the central pin is continuously activated, and the pins nearest to the nearest edge are periodically activated.

Of course if a large number of different kinds of objects are to be displayed in the same image, the user will be confused. But the user can change the image at will, selecting different objects to be displayed, and gradually building a composite mental image of the whole graphics construction, zooming into detail when necessary.

OBTAINING IMAGE DATA

The images for tactile display can be easily obtained for mathematical functions or from computer graphics applications. Simple line drawings can be scanned in and displayed. However obtaining appropriate image data for maps presents a problem.

No map presentation device, however ingenious, has any value without appropriate maps to display. Of most interest to blind people are maps at a scale that can show pavements and routes to walk from point A to B. Map data with such detail is expensive. There is also a problem of obtaining maps in a suitable vector format, with objects and object descriptions. Ideally the data would be obtained freely from the Web. Unfortunately there is no generally and internationally accepted vector format for publication of

maps on the Web. However a promising emerging source of data employs VRML, which is suitable for two or three dimensional modeling, and it is possible to project three dimensions onto two to obtain a map.

CONCLUSIONS

The virtual reality system can claim the following advantages over static systems:

- the images are dynamic - they can be changed at will;
- they are as high a resolution as required - with unlimited information content;
- no image space is taken by labeling, as the labels are spoken;
- the choice of information is selectable at the time of use;
- the images are infinitely scaleable;
- there is no expense to reproduce images;
- there is no hard-copy production cost;
- there is no hard-copy to carry around;
- an image can be easily marked or annotated.

A question still remains over speed of use. We still need to experiment to find how mental images can be most quickly built up by users of this type of display. But the system seems open to almost unlimited possibilities for the presentation of 2-D information.

REFERENCE

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*INTRODUCING _INFORMATION TECHNOLOGY AND DISABILITIES_*

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*_Information Technology and Disabilities_*

INTRODUCTION

Late last summer, several members of EASI (Equal Access to Software and Information), began discussing the possibility of creating an electronic journal devoted to applications of information technology by individuals with disabilities. EASI already had a number of information-disseminating activities underway, including two electronic discussion lists and a directory on the St. John's University gopher (see Zenhausern and Holtzman's article, this issue, _ITD_). In addition, EASI has a regular column in _Library Hi Tech Newsletter_, published by Pierian Press. With general guidance from Norman Coombs, EASI Chair, and technical support from Dick Banks, adaptive technologist at the University of Wisconsin, Stout, and Dr. Bob Zenhausern, professor of psychology at St. John's University, a core group of EASI members began "meeting" on a private listserv established to coordinate all aspects of this fledgling journal.

The first order of business was to select an editorial board, composed of experts in education, librarianship, campus computing, as well as rehabilitation and job accommodations for individuals with disabilities. Assembling the editorial board was easy enough; virtually everyone asked to participate accepted the invitation. Once the private listserv, EASIPUB, became operational, members of the editorial board were able to work out details through meetings held via e-mail. In this article, I will describe the go of _Information Technology and Disabilities_, at various points asking for your participation and input for future issues; if _ITD_ is to achieve its goals, we need your help in the form of news items, notices of meetings and new or forthcoming publications, research-based and case study articles, as well as ideas for articles or theme-based issues.

The first issues addressed by the editorial board included title, frequency of publication, intended audience and scope of coverage. After considerable debate over several alternatives, _Information Technology and Disabilities_ was chosen as the title and work began on designing this international, multidisciplinary electronic journal. It was decided early on that the journal would appear quarterly, and that our target audience would include users of adaptive technology as well as the many service professionals who are interested in applying new and emerging technologies in their various fields; the latter group includes librarians, educators at all levels, rehabilitation professionals, campus computing and disabled students' service personnel, and others who wish to realize the potential of information sources and technologies by individuals with disabilities.

SCOPE OF COVERAGE

Each of the groups mentioned above, from librarians to academic computing staff, has at its disposal a number of professional journals providing timely information on a wide variety of topics in their field(s) of coverage. Scattered throughout this body of literature are the few items of interest to people who need to know what's happening in the world of adaptive technology, accessible information and other vital news of increasing importance to individuals with disabilities. _Information Technology and Disabilities_

intends to address issues relating to information technology in its broadest sense. While our focus is largely upon practical uses of technology by individuals with disabilities, _Information Technology and Disabilities_ will, in future issues, hopefully include historical, sociological, and legal analysis and commentary.

One of the issues we encountered early on, and which at this writing is still an issue on the editorial board's agenda, is the technical knowledge level we should expect the majority of our readers to have. While it is expected that most will have basic computer literacy, we do not expect that the majority have anywhere near the technical expertise of, say, a professional computer programmer. In response to our first call for articles, we received one highly technical paper which describes in detail a computer scientist's work in the area of access to machine- readable documents. That article is being revised, and has not gone through the process of review. The editorial board is leaning toward including such material in _Information Technology and Disabilities_. We are working with authors to make their work as accessible as possible, but there will be articles in _ITD_ which will be comprehensible only to a limited audience.

While some articles may be extremely technical, others will appeal largely to the novice. We will attempt to provide overviews of specific technologies, written in plain language and intended as information pieces for those whose experience is minimal. For example, "What is a TDD and How Does it Work?" might cover the history of telecommunications for the hearing impaired, describe the current state of the technology, and discuss ADA requirements. Whether highly technical, very basic, or somewhere in between, each of the feature articles in _Information Technology and Disabilities_ will be annotated in the Table of Contents, alerting readers to the article's level of technical sophistication.

DEPARTMENTS

In addition to articles, _Information Technology and Disabilities_ will have a number of regular "departments." These sections will present major news of interest, including notices of new discussion groups, publications, conferences, seminars, and more. Editors of these sections are identified in the table of contents; please keep them informed of news as you hear it (or as you make it!).

Anyone who subscribes to one or more listservs is aware of the meaning of the expression "information overload;" with each quarterly issue, it is our intention to present the MAJOR news of national importance. Think of _ITD_ as a quarterly, selective listing of news obtained from listservs, professional associations, and just as important if not more so, from _ITD_ readers themselves.

In closing, I would just like to say that _Information Technology and Disabilities_ will only be as good as the articles submitted to it for publication. Please, if you have work in progress, or if you're willing and able to do an article on a topic suggested by the editors, contact me, preferably via e- mail.

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