DIRECTIONS

Technology in Special Education

Vol. 9 , No. 4 **December 2002**

Clinton, Kennedy Call for More Money for Education

Source: today, Council for Exceptional Children, November/December 2002 Vol. 9 No. 4

In impassioned addresses before the Committee for Education Funding (CEF), Senators Hillary Clinton and Ted Kennedy called for immediate additional funding for education. The Sept. 17 meeting brought together educational organizations to mobilize efforts to increase funding for all of education. CEC is a key member of CEF.

Sen. Clinton, the keynote speaker, blasted the administration for its failure to fund the No Child Left Behind Act.

"If we don't support the No Child Left Behind Act with funding, we have played a cruel hoax on our schools," she said. "...We have set up a system of failure. Without funding, high standards and accountability are beyond the reach of many schools."

Clinton also stressed the need for more money for special education, pointing out that we are not "even half way" toward full funding of the Individuals with Disabilities Education Act. Full funding of special education would be of "enormous help to communities across the nation," she continued.

Clinton next addressed the need for additional monies to help students go to college. Rather than helping students from low incomes attend college, we are turning our backs on them, she said, stating that it is more difficult for students from low incomes to go to and stay in college today than it was 20 years ago.

As she wrapped up, Clinton warned that we should not succumb to claims that we don't have the money for education because we need it for national defense.

"I believe we are a great county that can do more than one thing at a time!" she exclaimed.

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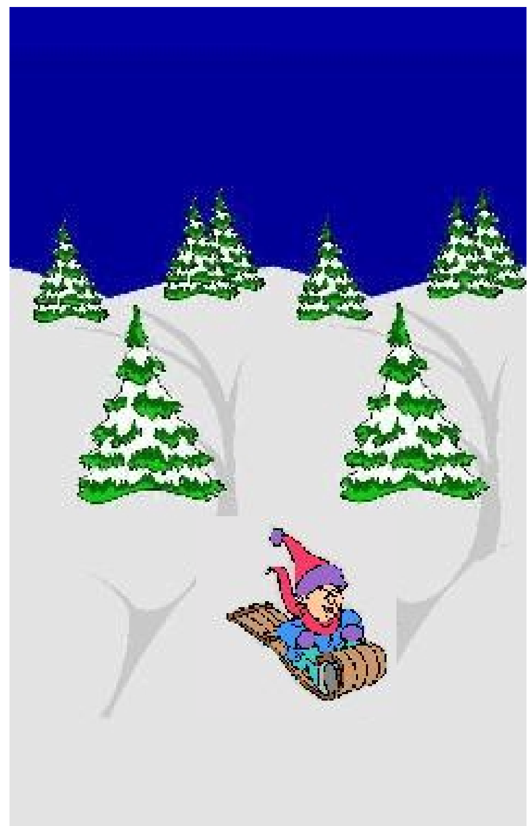
Happy Holidays !!!!



Inside

Computers in Education

by Dr. Neil G. Scott

Source: The Catalyst, Spring 2002, Volume 18 #3

Part Four

Overall Requirements

Combining the requirements for the students and the teachers leads to an over-all system configuration like that shown in Figure 1.

In the configuration shown in Figure 1, the local classroom server handles most of the classroom activities such as serving educational programs to the class, printing and projecting materials. The teacher and students each have similar portable computers that can accommodate a wide selection of input and out-put devices through built-in USB and/or TAS ports. The teacher has the option of operating the system from the keyboard, mouse and screen on the classroom server or from the portable computer labeled "teacher's computer" in Figure 1.

In addition to supporting all of the standard educational software available on the system, the portable student computers will also accept a wide variety of plug-in modules for controlling experiments and capturing data in the laboratory or out in the field.

Portable educational computers will benefit from research that is currently linked to improving access for individuals with disabilities. Most of the user interfaces found on existing equipment are still extremely basic in that they monitor on/off switch actions generated by the keyboard and mouse buttons, and they track simple hand movements via the mouse. Computers don't yet have the capability for detecting subtle cues like the facial and hand gestures that play a significant role in person-to-person communication. This situation is gradually beginning to change, however. Archimedes researchers are developing a new TAS interface that uses neural net processing to monitor physical activities such as facial and hand gestures, natural language processing to interpret what is meant by the gestures within the current context, and intelligent agent technology to route the commands or text data to the correct target system.

Incorporating neural nets, natural language processing and intelligent agents into the TAS will lead to a system that learns how to interpret movements and gestures performed by the user, determines the user's intentions and conveys those intentions to the device that is being accessed. Specifically, Neural Net Processing enables the system to detect a broad range of user actions that can be used to control different aspects of the computer system. Inputs can be derived from all manner of discrete and analog sensors, audio signals and video signals. One of the advantages of using neural nets is that they learn by observing the inputs. This reduces the design and development effort substantially by eliminating most of the programming effort required for conventional solutions.

Natural Language Processing can be used to disambiguate user inputs. This is particularly useful for interpreting messages produced by a speech recognizer since the natural language processor can recognize a user's intention without the requirement that

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Designing Adaptive Technology

for Those with Learning Disabilities

by Daniel Gillette

Source: The Catalyst, Fall 2002, Vol 19 #1

Dan Gillette is a research associate at the Archimedes Project at Stanford University, as well as an independent learning specialist, curriculum developer and researcher. Mr. Gillette's work has involved counseling students of all ages, curriculum development and the design of educational programs for schools, colleges and community centers. Currently, Mr. Gillette is focusing most of his attention on how to re-render visual environments to other media and exploring how technology can aid children with autism in communication.

Introduction

Over the past 30 years, there have been many technological attempts to aid those with learning disabilities, or LD, in their academic and professional pursuits. Although there are some standout solutions, in general, most technological interventions have met with only moderate success. Some of the limiting factors of adaptive technology have been reliability, portability, complexity/too many features, cost and interfaces that directly stress the individual's weakest skills. Over the past decade, we have seen technology start to overcome most of these issues, but there is yet to be an effective consolidation of these solutions that affords the sort of trust and ease necessary for adaptive use. In this article, I will discuss some new trends in adaptive and mainstream technology that, if adopted by the design community, could mean greater autonomy for those with learning disabilities and better tools for all.

Understanding the Problem

To discuss the strengths and weaknesses of adaptive technology for the learning disabled, one first needs to understand the nature of learning disabilities. Though there is some debate over what exactly is a learning disability, I have found the following to hold true:

*Learning disabilities are likely to have a physiological component at their core, but an organic root is not discernable or severe enough on its own to cause the disability; learning disabilities are caused by a all innate cognitive deficit that is profoundly impacted by the environment.

*Learning disabilities are socially defined. For instance, in western cultures there are learning disabilities related to difficulty with numbers but none related to a lack of musical skill: a skills deficit is only a learning disability if the culture deems that skill as universally I important to success.

*Almost all learning disabilities have features that equate to a breakdown in the cognitive translation of information from one mode to another, such as print to speech or images to words.

*To be diagnosed as learning disabled, an individual must have a mean intelligence that is considered to be average or above average; though cognitive eficits are present in the individual with LD, in most situations, strengths outweigh weaknesses, at least to the result of average performance.

*Learning disabilities are permanent; the individual may learn to work around difficulties, but the root problem cannot be remediated. [*This statement is still considered to be true, but some new interventions, such as the FastForward reading program, which uses computers to retrain the brain to be more aware of the sounds that make up words, may lead to a change in this perception. Suffice it to say that this statement will hold true for the majority of learning disabilities for some time to come.*]

*Learning disabilities are highly idiosyncratic in nature and require that workarounds (procedures for working around one's weaknesses so that one's strengths can be employed in a broader range of situations and environments) be custom tailored to the individual.

Physical, cognitive or emotional stress can have a profound effect on the severity of learning disabilities; if the environmental stresses that exacerbate a weak ness are reduced, the presence of the learning disability can often become undetectable in day-to-day life. A typical example is the difference in the degree of difficulty someone might encounter with a teacher who insists on only one way of completing assignments, versus that of a teacher who allows the student to choose from a few different methods for going about the work, increasing the likeliness that one of the options will most align with the student's natural thinking processes. Learning disabilities, at their core, limit access to information, communication with others and the ability to be an autonomous agent in the world. Where technology can be most effective for the learning disabled is in the modal translation of information, assisting in communication and cataloging data for later retrieval. Unfortunately, it is difficult to create tools that realize these goals when interfaces tend to be rigid in their structure and one-dimensional in their representation of data. To understand this better, I will provide an example of a class of adaptive computer software that is meant to help individuals with reading difficulties to both consume and generate print-based information.

The Adaptive Word Processor

There are many adaptive word processors on the market geared for those with print-based learning disabilities, such as dyslexia. [*The main feature of dyslexia is a slowness in correcting reading errors. It has been shown that dyslexics make no more mechanical reading errors (misjudging the print) than the typical reader. The difference between the two is that the typical reader corrects his mistakes so quickly that a mistake and its correction are not consciously noticeable. The dyslexic's error correction mechanism is in some way impeded, slowing the process to the point where the reader becomes aware of difficulty and a break in reading rhythm occurs.*] Some typical features are:

Speech Synthesis Text-to-Speech:

The text is read aloud by the computer, either as a full document or at the end of each sentence while typing. Some programs have speed listening capabilities.

Word Completion/Prediction:

While typing, a list is displayed of possible words that begin with the already typed letters. The user can then pick from the list without having to type the whole word. The best word predictors use statistical analysis to suggest words that are contextually appropriate. This feature can be useful for poor spellers and those with word finding problems.

Alternative Outlining:

The ability to use graphical outline forms, such as mind-maps, and then switch to an all text, hierarchical outline.

Color Coding of Parts of Speech:

Parts of speech are rendered in different colors to aid in the construction of sentences.

Alternative Interfaces:

The program allows for the changing of interface elements so that buttons are read whenever moused over or pictures are used in menus.

Scanner Links and OCR:

The program can be used with a scanner to import the text from printed material to allow for the use of find, note taking and speech synthesis features. Some programs allow for continuous scanning and speech synthesis so the user can listen to one page while scanning the next.

Note Taking Tools:

Tools that allow for onscreen highlighting and annotation of imported text as well as templates for different situations, such as a class or business meeting.

Voice Annotation:

The capability to record voice annotations anywhere in the text.

Grammar Checkers and Spell Checkers

File Compatibility with Industry Standard Word Processing Programs

As one can see, this class of word processor offers many wonderful features to those who have difficulty reading or writing text; in fact, many of these features are useful for the average writer. Unfortunately, there are painful limitations to the effectiveness of many of these programs. To pack such an array of features into one program drives the cost up considerably, making it difficult for individuals to own their own copies and for institutions to make the tools widely available. Also, though the standard operating interface of the word processor is adaptable, the print, import/export, error reporting and save settings usually are not, making it very difficult for the targeted user to customize the application or do standard tasks.

Perhaps the most difficult barrier to overcome for the LD user is that these programs run on standard PC or Macintosh computers. The penalty for this is that the user must interact with an operating system that has its own interface that is inconsistent with that of the word processor. The result of these inconsistencies is that many users cannot setup the software on their own, have difficulty dealing with errors and the number of useable features is greatly reduced. Unfortunately, this limits the actual potential of the application. There are ways to make these tools more useable, but it takes a new way of thinking about consumer software development and the handling of computer interfaces.

The Argument for Componentization

As I stated above, one of the key

features of learning disabilities is that they are idiosyncratic. Additionally, learning disabilities, unlike most physical disabilities, are hidden from view. Where an occupational therapist can make somewhat exact physical, strength and range of motion measurements when fitting a prosthesis, the learning specialist is never able to fully understand the exact nature of a learning disability. For this reason, the usual method for adapting technology for those with LD is to provide an array of solutions for the individual to choose from and customize. Unfortunately, most adaptive technology for the learning disabled is designed to be customized by subtracting features: you start with all the bells and whistles turned on, and as one becomes familiar with the tool, the unnecessary features are turned off. This method is in stark contrast to the general method of creating workarounds. What the learning disabled need is a bunch of tools from which they can mix and match to create systems that truly fit their needs.

There have been many attempts to use a building block metaphor for the customization of feature rich software applications, but I have yet to see one that comes close to actually achieving this. The reality is that complex systems (in this case, advanced software applications) cannot be rendered to appear simple; though we can hide the appearance of complexity under the proverbial hood, it is at the cost of direct control over the tool or interface fluidity, ultimately inhibiting intuitive or prosthetic use. Though it is theoretically possible to overcome these pitfalls, it is not worth the energy in program development. Instead, the design community should focus on creating discreet building blocks that the user can transform into total solutions. For this to work, the "blocks" must interconnect in a straightforward fashion, allowing for the easy connection of outputs to inputs, both in software and hardware. Though many argue that this is an unachievable goal, there are many technologies that have appeared over the past decade that prove such a thesis wrong.

The most notable technology that has acted as a standard for interoperability of independent components, be they hardware or software, is the Internet. With the Internet acting as a common communications protocol, a huge variety of hardware, operating systems and consumer software is able to interconnect without custom tailoring the I/0 structure of the devices. We have also begun to see the ability to have content custom tailored by Internet servers to meet the capabilities of target devices, transcoding the data, for example, from text-to-speech for access via telephone or rerendering graphics and page layouts for handheld computers. Another method for interoperability is the Total Access System (TAS) that we have designed at the Archimedes Project. [http://archimedes.stanford.edu/ /front97.html]

Seeing a need to create accessors for computers (speech recognizers, force feedback mice, head trackers and eye trackers, for example) that do not require special software to be installed, Neil Scott created the Total Access System [see his discussion earlier in the last two issues of The *Catalyst*]. In a nutshell, the TAS acts as a translator between accessors and a computer's standard input ports of mouse and keyboard. With the TAS, I may be using a speech recognizer to type and a head tracker to control the pointer, but as far as the computer is concerned, I may as well be using a keyboard and mouse, as that is what the signal coming into the computer looks like. By using the TAS, the user can employ his favorite methods for physical interaction with a computer without worrying about software compatibility; the user and computer are both dealt with on their own terms, with the TAS mediating the interaction. In addition to easier setup, expanded configuration options, reduced costs and enhanced reliability, the TAS also makes adaptive solutions portable, since they can quickly and easily be plugged into any computer.

Current work at the Archimedes Project is making the modal translation of a computer's output (video and sound to sound and touch, respectively) a reality, allowing for the wholesale mediation of the computing environment, providing a consistent and coherent user experience across all applications and OS interface elements. As this work progresses, the hurdles to translating the entire environmental experience of an individual are being overcome, which means that someday all information found in our environment may be transformed into media more to our liking, not just digital data.

Though it is probably not desirable to live in a fully mediated environment, which by its very nature would be completely virtual, it may be helpful to mediate parts of the environment. For example, a dyslexic person could benefit from having prices in the grocery store read aloud by a reading assistant, or maps having tactile feedback added to their representation by a travel assistant. Another example would be the serialization of complex data for those who have attentional difficulties. This may mean converting directions into a set of tasks that can be checked off while working on a complex project or the transcoding of a deli wall menu from its broadband random access state (translation: a big mess of items displayed across an eight by three foot board) to text displayed on a shopping assistant that only shows one or two items per page view. Remember, if the environment can be properly modified or re-rendered, most learning disabilities become non-issues.

The Future: Environmental Mediation

There are two steps that we, as technologists, can take to improve the quality of life for the learning disabled. The first is to create mix and match tools that have interfaces that can easily be modified to the user's needs. The second is to create tools that assist the individual in making sense of one's entire surroundings, not just printed or electronic data. In addition to the examples given in the last section, some possibilities are:

*A device that captures all stimuli in the classroom - such as the speech of the teacher, presentation materials and student comments - and archives them against a time code. The student's annotations and notes would also go into this archive. The student would then be able to mark shifts in dialogue and take fewer notes, so he may focus more on understanding the content and participating in class, instead of transcribing data. The student would later be able to perform a phonetic speech driven search of the classroom dialogue to find pertinent data, match presentation materials to multimedia curricula on the Internet or review portions of the lesson in its entirety, varying the speed of playback to suit his abilities. It is also possible that this data could later be transcoded to text and other media.

*A translation and memory assistant that mediates reading or verbal communication by providing alternative media presented on an eyeglass mounted video display or outputted through an earpiece. For instance, while talking to a collaborator about others on a project team, images of the other individuals could be displayed to a person who has trouble connecting names with what people look like or do. Another possibility is to have a map displayed that contextualizes an address or landmark while reading a history book.

*A work assistant that has learned regularly repeated tasks through observation and prompts the individual with the correct order of steps whenever the environment and actions of the individual match closely enough to what has been observed in the past.

These are just a few very simple examples of what is quickly becoming possible as new technologies emerge. Though the untrained speech recognition required for many of these applications is probably years away, intuitive image recognition hardware and software that can contextualize environmental elements are emerging right now. There are also prototype data archivers that can convert conversations into storyboards, with scene changes being placed at points where the topic of conversation shifts. Work in artificial intelligence is yielding powerful language translation software that actually does a pretty good job of understanding the intent of commands given in plain English. Though universal social adoption of such tools may be a long way off, for adaptive uses, one can expect to see these technologies in stable products sometime in the next four years. Though emerging technologies are exciting, it is important to not fall into the same traps designers have in the past. These tools should not be used to put a simplified skin over a complex world, or to usurp the autonomy of the user by acting independently in novel environments (i.e., deciding what information should be presented without user input). Though much of this technology makes it easy to discard stimuli lacking in salience, whether or not to discard that data must remain the domain of the user; the technology should be used to help the individual understand data so informed choices on what to keep and I throwaway can be made. Only then will the individual have tools that can be trusted, allowing for the full adoption of their capabilities.

Conclusion

The best tools are usually not the simplest or those with the shortest learning curve, but the ones that connect so well with the methods of the user and the environment being acted upon, that the user is able, after some practice, to use the tool subconsciously as an extension of the self, allowing for the focus of attention to be on the task at hand and not the tool in hand. For this to happen, feedback from the tool needs to be immediate and presented in a way that can be processed deeply. The tool also needs to respond to input from the user in a consistent and manageable way. To meet these needs, in some situations tools need to be specialized

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Kennedy's rousing presentation built on the facts Clinton presented. He decried a country willing to underfund education, saying the nation is abandoning its core principles. Of particular note were his comments on the lack of full funding for special education.

"If a child was one-year-old when he started in special education, he would be 67 years old before IDEA received full funding," he said.

As did Clinton, Kennedy called for additional funding for higher education. He also emphasized the need for funding for early intervention and the arts.

Kennedy concluded by saying that education should be front and center, as essential to the country as national security and defense. §

New CEC Resource Kit on No Child Left Behind

Because of the importance of NCLB, CEC has prepared a comprehensive set of resources concerning the law and its implications for special education. Included in this package are the following:

*CEC's Summary of NCLB.
*An Overview of the Regulatory and Guidance Processes.
*Key Policy Letters and Policy Guidance.
*Regulations Final and Proposed.
*Announcements from the U.S. Department of Education.
*CEC's No Child Left Behind Act of 2001.
Implications for Special Education Policy and Practice.

The resources will be updated regularly as new policy letters, policy guidance, or regulations are added.

You can find the CEC NCLB resource package on the CEC Web site, www.cec.sped.org.

You should also refer to the Department of Education's NCLB Web site, www.nochildleftbehind.gov/, for ongoing information, training, and technical assistance materials.

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the user must follow a predefined script. Speech recognition will become much easier to use and more reliable when this capability is available.

Intelligent Agents allow the system to be represented as a group of objects, each of which performs a specific task. This provides a great deal of flexibility for defining how the different parts of a system interact with each other, and with objects in the outside world. The TAS provides the means for automatically connecting intelligent user interfaces to any target computer system or information appliance. This has application beyond providing interfaces for individuals with special needs. The TAS provides a very convenient way for emulating research instruments and capturing experimental data.

Conclusions

Computers in the classroom must perform several different roles. In the educational role, they have the potential for making learning fun, exciting and memorable. They also have a role as a personal organizer where they keep track of personal information, schedules, phone lists and the like. Then there is an entertainment role in which they enable the user to play interactive games, listen to music or watch movies. The teacher's computer has additional roles such as preparing class materials, presenting lessons, presenting and administering tests and examinations, and gathering information required for class records.

Currently available desktop computers designed for office and home applications do not do a very good job in the classroom. They require an inordinate amount of work to set up and maintain. They are unreliable. They are bulky, and they take far too long to boot up at the beginning of a class. Notebook computers overcome many of the shortcomings of the desktop computers but they are still too complex, they don't run for a sufficiently long time between battery charges, and they are too heavy for children to be lugging back and forth between home and school.

A new type of portable computer is needed for school applications. It should reflect the simplicity of the Palm Pilot but have a larger screen and faster processor. Wireless connections must be provided and the battery must have sufficient capacity to keep the system running for a full day. This system will most likely be in the form of a tablet weighing less than three pounds. Users should have an option for using a stylus and touch screen or the keyboard and mouse for inputting commands and information. Speech recognition may be provided as an input that can be used when it won't annoy other people. In addition to the stylus and mouse, pointing strategies could include moving the tablet in 3-D space, head tracking and eye tracking.

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For figures mentioned in this article contact DREAMMS for Kids, Inc.

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to certain tasks, while others can be adaptable to a wide range of uses.

Adaptive technology needs to follow these design principles, providing single purpose devices for certain situations and do-it-all machines that can be expanded through software, for other circumstances. By giving the user choices in what tools to use for a specific job, that person also gains control over his environment and can utilize his strengths to achieve his goals. Designing such tools not only helps the learning disabled find more autonomy and satisfaction in life, but makes the tools easier for all to use.

Additionally, the user will be able to combine these tools in novel ways to attack new problems, which is the skill that probably makes us the most different from the rest of the animals. By making it possible for everyone to achieve such ends, we will truly level the playing field, relegating the majority of learning disabilities to nothing more than unique personality/traits, not impediments.

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