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Assisted Learning

How assistive technologies developed for people with disabilities will affect learning for everyone.

Most people have had little experience with assistive technology (AT). Or so they think. I suspect it is difficult for a person to go through an entire day and not encounter AT in some form. For example, in the past 24 hours, have you:

- worn eye glasses or contacts?
- watched a TV program with closed captioning?
- called someone on the telephone by pressing a speed-dial button?
- entered a store or office where a sensor opened the door automatically?
- used an Internet search engine to locate information you couldn't remember?

Each example illustrates how technology can be used to extend human abilities. Indeed, the essence of AT involves using tools to augment and extend ability.

AT Definitions

Special education is specially designed instruction to meet the educational needs of students with disabilities. An emphasis on assessment to determine the unique needs and abilities of each student provides a basis for designing individual education plans (IEPs).

Technology in special education seeks to identify appropriate assistive and instructional technologies to enhance the educational achievement of students with disabilities.

An example of an **assistive technology** for a student with learning disabilities is the use of a predictive word processor like Co:Writer (see Resources), which facilitates writing by trying to predict the word as it is typed so the word can be selected and inserted. This is a valuable tool for some users because it saves time by reducing keystrokes and allows them to select a word they may not be able to spell correctly.

An example of an **instructional technology** modification is Windows to the Universe (see Resources). If students are unable to read their textbooks, Web sites like this provide an important alternative since the learning material is written at three interest levels and includes a button to convert the text from English to Spanish (and vice versa).

Over a lifetime, each of us will personally encounter limitations due to aging, disease, accident, or disability. These limitations may impair basic life functions such as hearing, seeing, self-care, mobility, working, and learning. Whereas some of us may be born with a disability or disease that will require us to overcome limitations throughout our life, others will need to learn how to respond to challenges that arise from an accident or simply growing older. As a result, assistive technology has the potential to affect everyone, either directly, as a personal user of assistive technology, or indirectly, as a means of helping someone we know.

While the design and use of AT is historically associated with products for people with disabilities, the border between technology-enhanced performance for persons with disabilities and non-handicapped peers has become increasingly fuzzy. Early, clear crossovers came from AT developed for physical and sensory disabilities. Reading technologies developed for people who are blind, for example, have obvious applications for students with reading disabilities. AT developed specifically for learning disabilities is much more recent, so when the disability involves memory, thinking, problem solving, retrieval of previously learned information, etc., we know much less.

Two emerging issues in particular illustrate how creating products for people with disabilities can subsequently be beneficial for everyone: universal design and cognitive prostheses. One example of universal design (UD) is the curb cut. Originally intended to facilitate the ability of individuals in wheelchairs to independently navigate their community, the most frequent users of curb cuts today are children on bikes or skateboards and parents with baby strollers. Some current AT applications with the potential to morph into UD applications, and therefore have a profound impact on the general population, include text-to-speech (read the information to me), speech-to-text (type the

information as I dictate), and environmental control (remote control of lights, shades and blinds, heating and cooling, cooking appliances, etc.).

Current research and development focused on Universal Design for Learning (UDL), a specialized application of UD and a subset of instructional design, seeks to create environments and materials that are accessible to diverse learners. As defined by the work of David Rose and Anne Meyer at CAST, rather than focusing on the use of AT to help students with disabilities adapt to the curriculum, UDL draws on new brain research and new media technologies to build flexible options into learning materials that account for a wide range of individual learner differences.

A second issue blurring the face of assistive technology is the use of technology as a cognitive prosthesis—a tool that improves or extends one's thought and perception, that magnifies strengths in human intellect rather than corrects deficiencies. That is, technology as a memory aid (using Ask Jeeves and Google to look up things we don't remember), technology as a calculating tool (using online mortgage amortization or retirement-benefit calculators), and technology as an agent to perform specific tasks (using Web tools that search for the best price for a product). Despite limited research on cognitive prostheses, this application appears promising for many individuals with disabilities.

Advances in the areas of AT, UD, and cognitive prostheses suggest that in the future, many people will benefit from the use of technology to extend human abilities. But what will be the role of assistive technology in enhancing education?

The Tools of the Futurist

Predicting the future is risky business, but a number of authors have outlined scenarios that offer interesting implications for educational leaders planning for the future. While the process varies slightly between prognosticators, the general process involves reading widely to observe grassroots activities, recording notes, categorizing the notes, analyzing patterns, and creating future scenarios based on the patterns observed.

The work of futurists is often used to describe an orderly march into the future, given trends that will produce obvious change. For example, the demographics of an aging population plus assistive technology in the form of environmental control will yield an increased interest in home renovations that allow individuals with declining capabilities to sustain independent living in their own homes. Advances in medical technology mean that many medically fragile infants will survive and create new demands for specialized medical services and subsequent special-education services. These types of predictions lead to the development of reasoned business plans in anticipation of future change.

A cognitive prosthesis magnifies strengths in human intellect rather than corrects deficiencies.

In contrast, futurist Daniel Burrus contends that new futures are created by a mix of technological innovations and new rules that change the nature of the game. He uses the metaphor of a card came to illustrate what happens when the game is played by conventional rules (the future will be similar to life as it is now). However, Burrus periodically introduces new cards and new rules into the game, injecting the appropriate level of chaos that real change brings. Ever notice how hard it is to win a game when you don't know the rules? Focusing exclusively on trends may point to predictable change, but new rules and tools can fundamentally alter the way systems work—think about the decline of the steel industry or the growth of e-commerce. The real value of Burrus' framework is the concept that some developments

Resources

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will emerge from unpredicted and creative applications of trends, principles, and tools.

Change and Serendipity

Inspired by Burrus' work, the chart at right outlines trends that are unfolding with significant potential for the future of assistive technology and education. It also includes the rules—as we now know them—governing technology use and adoption. As a result of the interplay between the various trends and rules, assistive technology use in schools could look very different.

Creating future scenarios by selecting an instructional trend and aligning it with a technology trend and a rule illustrates the many predictable and unpredictable scenarios involving the changing face of assistive technology. For example:

- software agents prepare personalized lesson plans based on student progress-monitoring data in order to reduce special-education costs (accountability–agents–allure);
- daily attendance at school becomes optional as students use the Web to access digitized curriculum materials and have their time-on-task monitored to accumulate academic credits (engaged learning–data acquisition–technology-enhanced performance);
- IEPs are created for all students as teachers, parents, and administrators have ready access to what is being taught and summary reports of how students are progressing and achieving (accountability–on demand–adoption of innovation);
- assistive technology tools become ubiquitous and are introduced to all students as a means of encouraging them to determine their preference for the types of tools they use to complete various academic tasks (UDL–personalization–performance interaction);
- the role of technology as a cognitive prosthesis will evolve from simple applications like speed dial to sophisticated applications using a Web interface to manage personal calendars and send prompts via phone, pager, fax, or e-mail (AT consideration–cognitive prosthesis–conservation of energy);
- reading and writing will be reconsidered as technology is used to enhance these functions through text-to-speech and dictation (what's worth knowing–productivity toolkits–adoption of innovation).

And these examples haven't even begun to change the game by introducing new rules!

No matter how the specific uses of technology turn out, the core use of technology in special education will be to exploit the power of assistive and instructional technology to enhance academic performance by students with disabilities. Yet it's clear that the increased diversity of the American student body and the emphasis on students achieving higher levels of academic standards suggest an important paradigm shift—one that will morph the concept of AT for some into a concern for technology-enhanced performance for all. <

Education Trends

Accountability. Emphasis on evidence-based practice and reporting of student achievement levels is likely to continue in an effort to demonstrate progress in closing achievement gaps.

Assistive technology consideration. Federal law mandates AT consideration for all students with a disability. Questions about unserved and underserved students will likely stimulate new scrutiny of current practices to ensure that all who could benefit have access to appropriate AT devices and services.

Assistive technology outcomes. Little is presently known about the outcomes associated with routine AT use. Historical parallels to HMOs suggest a future where AT devices and services are managed on a strict cost basis.

Classroom demographics. American classrooms are more diverse than ever before. This trend will challenge the educational system to diversify its teaching staff and move beyond the one-size-fits-all curriculum model currently in place.

Differentiated instruction. Current educational practices which standardize 1) curriculum, 2) instructional methods, 3) assessment, and 4) time appear to be inadequate. New initiatives to differentiate instruction are likely to be embraced as new ways of managing differentiated instruction are advanced.

Engaged learning. Current attention is shifting focus from teacher-centered classrooms to learner-centered practices. New approaches for increasing student motivation, time-on-task, and depth of engagement are sought.

Qualified teachers. Teacher shortages in rural areas and some disciplines—notably special education—challenge the educational community to provide quality education for all students. New initiatives will be needed to attract and retain qualified educators.

School choice. The educational landscape illustrates a variety of innovations concerning school vouchers, charter schools, and virtual schools. While limited in impact to date, school-choice options are likely to increase.

Universal design for learning. Understanding human diversity in growth and learning provides important design principles for planning learning environments and instructional materials that anticipate differences and accommodate student engagement at an appropriate level of challenge. The investment in designing for the success of all students will pay dividends in raising educational achievement.

What's worth knowing? The current standards movement provides one answer to this critical question. Advances in technology will periodically require society to reexamine its response.

Technology Trends

Agents. The development of software and Web-based agents focuses on creating tools that execute specific tasks within parameters set by a user (e.g., comparison shopping). In special education, agents could be developed to assist students in conducting research or to assist teachers in modifying instruction.

Cognitive prostheses. Most technology applications extend human abilities. The use of a cognitive prosthesis will augment human memory, problem solving, and troubleshooting, and has tremendous potential for enhancing the performance of novices struggling to complete a task.

Control. AT has historically provided individuals with disabilities with control over their environment. As the technology is built into homes (i.e., smart homes), environmental control has gone mainstream. Biomedical advances in sensory stimulation and prostheses will yield new advances in control for individuals with physical and sensory impairments.

Data acquisition. A vast array of sensors makes it possible to collect data and transmit the information to computer systems for storage and analysis. It is already possible to build all sorts of devices that continuously gather data—known as data logging—about when, how, and by whom the device was used.

Data utilization. Data are available in many forms: bar codes, global positioning systems (GPS), and radio frequency identification (RFID). This abundance will lead to greater emphasis on tools that track and visualize data. A critical related issue is privacy, since data can be extracted to produce a transaction profile that illustrates where you have been and what you have done.

Digitized media. A considerable media shift is underway as information is created in or converted to digital format. Tools for creating digital materials (e.g., DVD burners, digital cameras, scanners) are selling well. Not only does digitized media offer high quality, it is easily stored, manipulated, and transmitted.

Distance education. Distance education is currently affecting the delivery of instruction by extending the range of traditional instruction. While questions of quality are currently raised, over time, quality of distance-education instruction should meet and exceed traditional instruction.

Design for diversity. Designing for diversity is more explicit due to awareness of disability needs (text-to-speech) and language differences (translations). Advances in universal design allow for branching between more- and less-challenging curriculum materials. Emerging evidence suggests it is less costly to design for diversity at the outset than to subsequently create modified materials.

Information management. The information explosion has created a new demand for information-management tools. Databases, information retrieval systems, and Web-based tools and services will be central to the future of education. Increasing attention is focusing on information filters, such as executive information systems and really simple syndication (RSS).

Personalization. Consider: the explosion of personal Web pages and blogs, personal MP3 players with which users create their own collections of their favorite music, and clothing manufacturers that customize clothing based on the sizes obtained from your body scan.

On demand. ATMs, vending kiosks, and on-demand video via digital cable illustrate this trend. An intriguing application in this area is the development of laser die-cut printers that use wood or metal instead of paper and enable users to assemble products from their printer.

Productivity toolkits. Ubiquitous software suites have facilitated the concept of productivity toolkits, expanding beyond word processing to include tools to manipulate digital images, design Web pages, etc. This trend has important implications for training students in general applications as well as industry-specific tools.

Wireless. The development of wireless technology means that work is increasingly unplugged. Moving beyond chair/desk computing has important implications for the design of learning environments.

Technology Use and Adoption Rules

Conservation of energy. People always seek an easier way to complete a specific task.

The Scrooge factor. Education is always underfunded. The conservation of funds is of primary importance. Free is always a tempting solution regardless of how well the product works.

Performance interaction. Performance is always affected by the interaction of the tool and the person. There will always be differences in human performance regardless of the tool being used. Just because I can purchase Master Craftsman tools does not mean I can produce professional-quality products in my workshop.

Adoption of innovation. The research is very clear about the developmental phases associated with adopting and implementing innovative tools. While the timelines may be compressed (e.g., the adoption of high-speed Internet access in homes), there are no shortcuts. Seldom does anything reach an adoption rate of 100 percent.

The allure of technology. The allure of time savings prompts most technology purchases. Often, this is a mirage: Technology has been accused of being a time-stealer given the unaccounted time devoted to acquisition, installation, training, maintenance, and troubleshooting.

Technology-enhanced performance. Some evidence suggests that technology accelerates the digital divide by increasing the achievement gap. That is, technology in the hands of skilled users increases the gap between those with poor skills and without technology. In contrast, technology that levels the playing field is embraced by those who have been marginalized, but protested by those who have been successful and view such status as entitlement.