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Universal Design: Accessibility for All Learners

Technology creates powerful physical, social, and learning environments for all students.

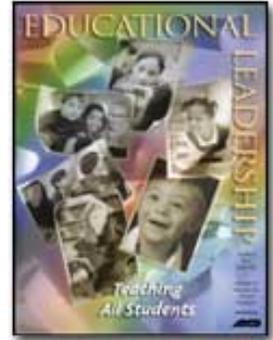
Cynthia Curry

The students in Lily Goldberg's middle-level social studies class are working their way through an interdisciplinary unit on the mountains of the world. So far, they have investigated mountain geography, climate, geology, and conservation. Together, the students have selected the Blue Mountains of Australia as the focus of their next project: examining how to balance tourism with environmental and community preservation. Through a strategic combination of educational and assistive technologies, all students are achieving appropriate learner outcomes.

Like the mountains in the study, Ms. Goldberg's students are a diverse group. Several have specific learning disabilities and Attention Deficit Hyperactivity Disorder (ADHD), and one student has cerebral palsy. Another student is a recent immigrant whose first language is Spanish. Learner profiling of all students indicates a wide range of preferences, skills, and abilities.

Ms. Goldberg opens the Blue Mountains study with a brainstorming session. She shares the goals of the investigation with the group and asks for comments, swiftly recording students' ideas by using concept-mapping software and an overhead projector that shows what is on the computer screen. When the session ends, Ms. Goldberg prints and distributes the concept map and also posts it on the class Web site. Throughout the investigation, students will periodically revisit the map and add to its content.

At the next class meeting, students form groups on the basis of common interests. Group members strategize about topics, resources, and the products and performances that will demonstrate what they have learned. Ms. Goldberg monitors the groups, prompting and coaching when needed. Later, group delegates tell the class about the products and performances that the groups have chosen. Ms. Goldberg summarizes students' remarks on an electronic whiteboard, which also captures the notes on her laptop. Because students can download these notes from the Web site after class, they focus on the discussion rather than on note taking.



October 2003

Ms. Goldberg listens carefully to make sure that the students' suggested activities will lead to and measure the intended outcomes of the unit. As necessary, she prompts students to suggest adjustments. She also adds products and performances that the class has not considered or that reflect specific learner profiles. Finally, Ms. Goldberg asks students to refer to the class's quality control checklist, which identifies unit-specific assessment criteria.

With Ms. Goldberg acting as advisor, tutor, coach, and advocate, the investigation gets under way. Students work independently on products or performances that match their abilities and meet their group's needs. All students rely on technology to support their learning and accomplish their goals.

Jeanne's group is examining the effect of urban development and tourism on the flora and fauna of the Blue Mountains. Because she has a cognitive disability, Jeanne works with a specialized word processor that combines text, synthesized speech, and graphics. She creates a booklet about rare and endangered animal species in the region. In the same group, Galit, an advanced learner, uses multimedia presentation software to explain how the region's bushlands help protect its biodiversity.

Hand coordination and verbal communication are difficult for Nick, who has cerebral palsy. His group is learning about the history of urban development in the Blue Mountains region. Nick's "head mouse," a hands-free pointing device, allows him to conduct online research about road development and the expansion of transport over time. He uses this same technology and an onscreen keyboard to type a report of his findings.

Marisol, who recently moved to the United States from Mexico, is an English-language learner. Her project assesses the effects of population growth on climate, comparing data from the Blue Mountains with data from her native region. Marisol uses specialized text-to-speech software that reads relevant electronic text resources, including Web content, aloud. The program allows Marisol to hear text read aloud in either English or Spanish with correct pronunciation and audible dictionaries.

Because of his ADHD, Travis is easily distracted. He uses the same text-to-speech software that Marisol uses, but it supports his learning in a different way. Wearing headphones as he works with the program helps him concentrate by blocking out classroom noise and activities. Travis is researching the conservation of regional recreational attractions. In an online discussion with an expert on the canyons of the Blue Mountains, he learns about "canyoning ethics" and how to educate those who visit these scarce resources.

The Origins of Universal Design

In designing the mountains unit, Ms. Goldberg consulted with content-area teachers, special educators, and technology personnel about her students' abilities, needs, and preferences. She and her colleagues are committed to a framework known as universal design for education, which combines best practices for teaching and learning with flexible, accessible electronic and information technologies. Unlike other models of technology in education, universal design transforms the education environment to provide almost all students with the same rigorous, progressive, and thoughtful curriculum.

Universal design, with its roots in the accessibility of homes and other buildings for individuals with disabilities, has emerged as a political and social movement over several decades. Although federal legislation (such as the Architectural Barriers Act of 1968 and the Americans with Disabilities Act of 1990) mandates accessibility standards and codes, universal design in architecture exceeds these specifications to create environments and products that accommodate as many users as possible (Mace, 1998). Universal designs feature

- Equitable use
- Flexibility
- Simple, intuitive designs
- Perceptible information
- Tolerance for error
- Minimal physical effort
- Size and space for approach and use (Center for Universal Design, 1997).

Universal Design for Education

Students vary in their cultural, socio-economic, and ethnic backgrounds, as well as in gender and ability level, and these differences significantly affect the way they perceive and process information (Feden & Vogel, 2003; Marzano, Pickering, & Pollock, 2001; Rose & Meyer, 2002; Tomlinson & Eidson, 2003). In universally designed schools, classrooms, and curriculums, all students have access to the resources that they need. Universal design for education also complements existing federal regulations, such as the Rehabilitation Act of 1973, which prohibits discrimination based on disability, and the Individuals with Disabilities Education Act, which mandates free appropriate public education, least restrictive environments, and Individualized Education Programs for students with identified disabilities.

Across the United States, legislators are increasingly holding administrators and teachers accountable for students' academic achievement. States have introduced content and performance standards, as well as tests to measure students' progress. In response, school districts must make important curriculum and assessment decisions that align with these new requirements. Universal design for education helps schools construct accessible physical, social, and learning environments for all students.

Universally Designed Environments

When schools introduce universal design, student diversity becomes a powerful component of the education environment. But implementing the universal design framework goes beyond accommodating individual learners. Because it makes education environments seamlessly and inherently functional for almost all students, universal design minimizes the need for individual accommodations. Educators select flexible, usable, and accessible tools and surroundings; provide collaborative and interactive learning opportunities; and develop learner-centered and constructivist curriculums. The framework's over-arching tool is technology, which supports the

physical, social, and learning environments by allowing physical access, facilitating the social construction of knowledge, and offering multiple means of assessment of learning.

The Physical Environment

Many schools present obstacles for students with disabilities, including inadequate classroom space, changes in floor elevation, stairs, narrow halls, poor ventilation, few electrical outlets, and unsatisfactory lighting (Rydeen, 1999). These same obstacles also create an impractical environment for students without disabilities. Universally designed schools have clearly defined, orderly spaces with centralized elevators and ramps. Helpful graphics feature large lettering, high-contrast colors, and easy-to-read fonts. Open, adaptable classroom spaces contain accessible furnishings and floor-to-ceiling bulletin boards, chalkboards, and whiteboards. All classrooms have individual heating, air conditioning, and ventilating controls (Rydeen, 1999).

Inaccessible electronic and information technologies can also obstruct physical access to education. In the universal design framework, assistive technology is readily available to support student access to such tools. For example, Ms. Goldberg's student with cerebral palsy uses augmentative communication and switch-scanning equipment to participate in the same technology-based activities as his peers. Other students may select alternative keyboards, or they may prefer a joystick or trackball instead of a mouse. Ms. Goldberg and her students also understand and make use of the built-in accessibility features of computers' operating systems (see Resources for Universal Design).

Resources for Universal Design

Software

- ***Built-in Accessibility of Operating Systems***
 - Apple Special Needs www.apple.com(search for special needs)
 - Microsoft Enable www.microsoft.com/enable

- ***Text-to-Speech Software Programs***
 - CAST eReader www.cast.org
 - Kurzweil 3000 www.kurzweiledu.com
 - ReadPlease 2003 www.readplease.com
 - TextHELP! www.texthelp.com
 - Write: OutLoud www.donjohnston.com
 - WYNN www.freedomscientific.com

- ***Speech-to-Text Software Programs***
 - Dragon Naturally Speaking www.scansoft.com

- IBM ViaVoice www-3.ibm.com

- **Accessible Multimedia**

- HiSoftware www.hisoftware.com

Hardware

- **Portable Word Processors**

- AlphaSmart www.alphasmart.com
- CalcuScribe www.calcuscribe.com
- DreamWriter www.brainium.com
- LaserPC6 www.perfectsolutions.com
- QuickPad www.quickpad.com

- **Handwriting Recognition Technologies**

- InkLink www.siibusinessproducts.com
- InkWell www.apple.com/macosx/jaguar/inkwell.html
- Logitech io Personal Digital Pen www.logitech.com
- PenReader www.penreader.com

- **Electronic Whiteboards**

- Mimio www.mimio.com
- SMARTBoard www.smarttech.com

Online Resources

- **Digital Text**

- American Library Association Great Sites for Children www.ala.org/parentspage/greatsites/lit.html
- Berkeley Digital Library SunSite sunsite.berkeley.edu
- The Children's Literature Web Guide www.ucalgary.ca/%7Edkbrown
- Internet Public Library www.ipl.org
- Project Gutenberg www.promo.net.pg
- University of Virginia Library Electronic Text Center <http://etext.lib.virginia.edu/ebooks>

Organizations

- **Technology in Education**

- Association for the Advancement of Computing in Education (AACE) www.aace.org
- Association for Educational Communications and Technology (AECT) www.aect.org
- International Society for Technology in Education (ISTE) www.iste.org
- Network of Regional Technology in Education Consortia www.rtec.org
- U.S. Department of Education Office of Educational Technology www.ed.gov/Technology

- **Accessibility**

- CPB/WGBH National Center for Accessible Media ncam.wgbh.org

—Cynthia Curry

The Social Environment

Learners are social beings, and effective education environments foster and promote learning as a social phenomenon (National Research Council [NRC], 2000; Wenger, 1998). In the universal design framework, students construct knowledge and understand content, one another, and the world through an emphasis on community. That is, the community is at the center of the education environment, and diversity is available as a resource. Along with collaboration and interactivity, democratic processes foster and sustain learning communities (Oakes & Lipton, 1999). Students propose and agree on norms and protocols that guide all classroom activities, including decision making. Ms. Goldberg's class relied on established procedures in selecting the Blue Mountains for their next study. Norms and protocols model equity and ensure that all learners have a voice in the community.

Technology facilitates the social construction of knowledge within and beyond learning communities. Innovative software, multimedia programs, and the Internet foster robust collaborative and interactive learning opportunities. Video- and computer-based learning programs challenge students to apply crucial concepts and solve authentic mathematical, scientific, and civic problems (NRC, 2000). In Ms. Goldberg's class, groups of students used atlases and digital charts of the world to identify mountain regions.

Technology can connect classrooms with the outside world. Electronic partnerships with international content-area experts provide opportunities for research, consultation, and mentoring. The Internet can also help teachers and students in geographically dispersed schools to collaborate on projects, learn about other cultures, and exchange information. Such "telecollaboration" can offer almost every student a social learning experience. Ms. Goldberg's students made electronic connections with schools, scientists, and local residents to collect environmental and cultural data about the Blue Mountains region.

The Learning Environment

Although community is the focal point of any universally designed education environment, educators must continuously collect data on individual knowledge, skills, and attitudes (NRC, 2000). This information enables teachers to monitor students' progress and make effective decisions about curriculum design (Marzano, 2003; Tomlinson & Eidson, 2003). In the universal design framework, curriculum strategically supports all students as they actively construct and reconstruct knowledge. Teachers in constructivist learning environments distribute the introduction of specific content and skills over time, and they routinely provide metacognitive opportunities through which students reflect on and assess their own learning.

Technology in the learning environment supports data collection on individual students and promotes active, purposeful learning at the same time. The universal design framework encourages educators to select technologies that not only support best teaching practices but also allow the greatest number of learners to participate in the same curriculum. Several organizations provide exemplars of the use of technology in curriculum (see Resources box).

The Digital Curriculum

Universally designed learning environments seamlessly integrate electronic tools into the curriculum. The foundation of these technologies is electronically available, or digital, text. Digital text is malleable and transformable and thus accessible to virtually all learners (Rose & Meyer, 2002). Text-to-speech software programs can synthesize speech and read text aloud; speech-to-text programs convert human speech to digital text (see Resources box). Devices are also available for converting digital text into Braille.

When traditional texts thwart a student's ability to learn, digital materials can help. Students with specific learning disabilities benefit from the scaffolding, feedback, and reinforcement that text-to-speech technology provides. English-language learners also profit from the multiple-language features that text-to-speech programs often include. Students with physical disabilities, fatigued by traditional textbooks, can access digital text with assistive computer hardware and software. Many digital text resources are available online (see Resources box), and scanners and optical character recognition (OCR) software can convert other curriculum materials to digital format.

Tools of the Trade

Once curriculum materials are available digitally, teachers can integrate additional technologies into the learning environment to benefit all students. Portable word processors allow students to capture classroom writing electronically (see Resources box). These simple, cost-effective devices contain a keyboard and a liquid crystal display (LCD) window in which the text appears. One popular portable word processor, the AlphaSmart 3000, features a spelling checker, a calculator, and multiple files that users can send to the text editor (including a text-to-speech program) of a desktop, laptop, or handheld computer. A model of universal design, the AlphaSmart 3000 has keys that pop off to create alternative keyboard layouts.

Handwriting recognition technology transfers handwritten text and drawings to a desktop,

laptop, or handheld computer. Similarly, electronic whiteboards capture text and drawings produced during whole-group lectures and activities, in color and in real time, and send them to a computer (see Resources box). Teachers and students can electronically share handwritten materials from class meetings by e-mail or on a class Web site.

Multimedia curricular materials in accessible form, such as audio transcriptions and video captions for learners who are deaf or hard of hearing, are common in universally designed environments (see Resources box). Video description, inserted into natural pauses in the dialogue, explains onscreen action for blind and low-vision students. Presenting information in multiple formats enhances all students' understanding of the content, including English-language learners and those with specific learning preferences.

Implementing Universal Design

The comprehensiveness of the universal design framework can overwhelm even the most ambitious school leaders. Schools and teachers who seek to create accessible physical, social, and learning environments for all must adopt a systemic approach to change and prepare to introduce individual components of the framework over time. Careful analysis of the current classroom, school, or district environment may help catalyze the initial stages of implementation. From there, educators can identify priorities and let the powerful possibilities of universal design take root, from which all learners can grow.

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