Harvard Education Letter
Research Online

Past Issues

January/February 2002

Curriculum Access in the Digital Age

New technology-based strategies offer hope that students of all abilities will have the opportunity to thrive in school

By David T. Gordon

In a school north of Boston, a dozen 7th graders are enjoying a novel experience. They are reading a book from the district's required reading list, the same book that their peers have been assigned. *Hatchet*, written by Newbery–award winner Gary Paulsen, is an adventure story about a young man's two-month survival in the Canadian wilderness following a plane crash. Most of the students have learning disabilities, so they relate well to Brian, the protagonist, because they too have felt lost in the woods—when trying to read books written for kids their age.

They sit at computers, each wearing headphones, and read a digital text of *Hatchet* using a program called Thinking Reader. For some, the computer simultaneously highlights each word on the screen and reads it aloud. Students who don't understand a particular word can get a definition with a click of the mouse.

Occasionally, a cartoon genie appears on screen and prompts them to stop and think more deeply about the text. It may ask them to summarize what they've read, predict what happens next, formulate the kinds of questions teachers might ask, and seek to clarify confusing passages. If they forget what those strategies entail, the genie offers hints. The students type their responses into a box at the bottom of the screen—a journal that will later help them and their teacher assess their progress. The teacher moves among the children, answering questions the genie can't and prompting them further—to be more specific in their responses, perhaps, or to consider another point of view. The class will eventually gather off-line to discuss the book with their teacher; they do this about once every two weeks.

Thinking Reader employs elements of "reciprocal teaching," an instructional method for teaching reading comprehension developed by reading specialists Annemarie Palincsar and Ann Brown in the 1980s. The idea is to get students to be active readers using a four-part strategy: formulate questions, summarize, clarify, and predict. In one-on-one or group sessions, teachers and students take turns leading a discussion about the text. Although the method takes both teachers and students considerable time to master, research shows that it can lead to dramatic improvement in the performance of poor readers.

Still, it's labor intensive for teachers, and students in a traditional reading class can get inadvertently left out of the discussions, especially in a

May/June 2003

large class. Technology makes it possible for each student to directly engage the text through prompts embedded in the story itself and various decoding supports—supplemented, of course, by interactions with the teacher, who spends his classroom time monitoring student progress and providing targeted guidance to individual students.

New Expectations

Why is access to age-appropriate books from the general curriculum so important? For one thing, researchers say, such books are interesting to students and relevant to their lives, a key to motivation. Also, those who are excluded from the general curriculum because of disabilities have less in common with their peers, a blow to self-esteem. Then there's the law. Under the 1997 Individuals with Disabilities Education Act (IDEA) reauthorization, special education students must be given a fair opportunity to learn what their mainstream peers do in the general curriculum. Schools are expected to accommodate students' individual needs so that they can progress at a pace that is cognitively challenging to them. Also, many state standards ask schools to improve learning outcomes for all students, including those with special needs. To accomplish this, such students need fresh methods of engaging and responding to the curriculum.

Even before the 1997 IDEA amendments, researchers at the Center for Applied Special Technology (CAST)—where Thinking Reader was developed —anticipated this change in thinking. Cofounders Anne Meyer and David Rose started CAST in 1984 to explore the use of technology for students with disabilities. By the early 1990s, they realized that, rather than using technology to help students work with inaccessible materials (such as books), the materials themselves, as well as the curricula they supported, had to be reconsidered.

Meyer and Rose began using the name Universal Design for Learning (UDL) to describe their work. The term *universal design* comes from the fields of architecture and product design, where it refers to built-in accommodations such as ramps, sidewalk curb-cuts, and automatic doors that benefit users of all abilities. The CAST team began thinking about K–12 curricula in a similar way. In any classroom, the abilities and learning styles of students can vary widely. If such differences are not considered and accommodated, can we really say all students have equal access to the curriculum? Thus the idea of UDL began to take shape, a model in which the diverse needs and abilities of students are met by providing them with a variety of ways to learn what they need to know, demonstrate that understanding, and be assessed.

"UDL expands the number of opportunities kids have to succeed," says Rose, who also teaches in the Technology in Education Program at the Harvard Graduate School of Education. "It can be a daunting prospect for schools because it doesn't just say every child needs to do well—everyone agrees with that—but that we need to broaden our thinking about what success is and how we measure it."

Brain Networks

In their writings, Meyer and Rose point to recent brain research to bolster their argument for multiple approaches to teaching and learning. They note that neurologists such as Richard Cytowic have identified three distinct

but interrelated brain networks at work in every learner. Glucose —the sugar that fuels the brain—burns at varying intensity in the front, middle, and back of the brain, depending on which system is being taxed the most. The recognition network identifies certain patterns (letters, words, sounds, objects, etc.), the strategic network generates patterns such as plans and actions (spelling words, playing a trumpet, solving an algebra problem in sequential steps), and the affective system produces a feeling response to those patterns (pleasure at hearing a tuba, boredom in writing essays, excitement about a novel) and therefore has a lot to do with stoking or dampening motivation.

Because of this, write Meyer and Rose, a particular lesson or classroom task will challenge students in different ways. If, for example, a group reading assignment aims to improve comprehension skills (the strategic system), what happens to the student with low vision who wears herself out just trying to decipher the words on the page (the recognition system)? She gets discouraged and certainly can't benefit from the lesson on comprehension strategies. Why not provide additional help decoding, at least for the moment, so she too can focus on comprehension?

Most schools can't accommodate multiple learning styles because they rely almost exclusively on print media. Writing in the *Journal of Special Education Technology*, Rose explains: "Print presents information one way for everyone, yet students' varied learning needs and styles call for alternative formats. For example, a bright student with dyslexia may be capable of understanding history and science concepts, but his inability to decode words prevents him from learning these concepts from printed books. A student with a visual impairment who cannot see standard-sized text is excluded from examining the concepts that are cognitively accessible to her."

Because the words of a traditional book are fixed on the page, they cannot be easily adapted for use by students who can't otherwise read them. Digital text is far more flexible and, with the right computer programs, can give students access to materials that otherwise would require expensive and time-consuming adaptations. For example, to aid a student with low vision, a teacher could spend hours making large-sized photocopies of textbook pages. With digital text, the student could simply increase the font size to suit her need or use the text-to-speech function to listen to the text being read.

Promising Results

CAST recently wrapped up an evaluation of Thinking Reader funded by the U.S. Department of Education's Office of Special Education Programs. More than a hundred students reading in the lower 25th percentile read books like *Hatchet* and Yoko Kawashima Watkins' *So Far From the Bamboo Grove.* Sixty-three read a digital version on computer while a control group of 39 used traditional books and engaged in regular small-group and class discussions using reciprocal teaching. All 102 students took the Gates MacGinitie reading assessment—a paper-and-pencil standardized test—before and after the seven-month instructional period.

The results were promising, says CAST's chief education officer Bridget Dalton. After controlling for gender and pretest reading scores, those who used Thinking Reader gained, on average, approximately a half-year in grade level in reading comprehension; those in the control group averaged

only slight gains. The half-year improvement was a notable achievement for kids whose reading in the past had not improved very much from year to year.

Beyond the standardized test, other assessments revealed some advantages of Thinking Reader. Measurements of “time on task” showed that students using traditional texts were more likely to lose their focus and become distracted. Those using Thinking Reader did not get as much time in group discussion as those in traditional reading classes, but they did have more opportunity to dig into the text and try to make meaning of it than their counterparts, some of whom could drift out of group conversations or get distracted by other struggling readers. Says Dalton: “Students who were on the computer managed to stay glued to the text for long stretches. Some of them had never demonstrated such concentration before.”

Interviews with students and classroom observations suggest that Thinking Reader gave students a sense that they were in charge of the learning process and understood what strategies could help them make sense of their reading. Interviews also suggested that reading the same books as their peers both encouraged and motivated them. “So many have been shut out of reading engaging literature because of their reading difficulties,” says Dalton. “Access to good, age-appropriate books helped them buy into the work of reading and responding.”

CAST researchers are reluctant to draw too many conclusions from this initial study. Indeed, like a lot of education research, it may raise more questions than it answers. For instance, why did some children make little progress using Thinking Reader? Was technology in their particular cases actually a hindrance? And why did some students make dramatically more progress using the computer than the group’s average gain? Also, why did girls in both groups outperform boys on the final standardized tests? Did the fact that Thinking Reader is a new, exciting product affect the outcomes—and would children still show improvement a few years down the line, once the novelty wore off?

A new three-year federal grant to perform more studies and make improvements to Thinking Reader may answer some of those questions. That work will contribute to a small but growing body of research demonstrating the benefits of digital texts with helpful, built-in resources such as changeable fonts, glossaries, concept maps, multimedia tools (video, sound), illustrations, tutorial aids, e-notebooks, etc. These resources are showing positive effects on students’ achievement and motivation among special needs and general education populations alike.

If universally designed innovations such as Thinking Reader are to take root, giving all students access to the general ed curriculum, one thing will certainly have to change: the way information is presented in the classroom. For that reason, CAST is leading the National Center on Accessing the General Curriculum (NCAC), a collaboration with the federal Office of Special Education Programs, the Council for Exceptional Children, Harvard Law School, Boston College, and the Minnesota-based Parent Advocacy Coalition for Educational Rights. The group is working to increase awareness of the benefits of digital materials.

In a related project, CAST is creating a web-based depository of digital curricular materials and professional development resources called the

Universal Learning Center. The resources will be offered in a variety of formats and will include search capabilities so that educators, parents, and students can access them with ease.

Such a resource will be welcomed in districts like Concord, New Hampshire, where teachers and parent volunteers scan textbook pages into computers to make them accessible to students with disabilities. “It’s time consuming and requires constant upkeep to scan your own materials,” says Donna Palley, special education coordinator at Concord High School. “Somebody’s always having to wait for another chapter to be scanned.”

William Henderson, principal of the Patrick J. O’Hearn Elementary School in Boston, has a similar hope. “I’d like to have [an online] library where we could get not only books but also creative lesson plans—redesigned for those with all kinds of disabilities,” says Henderson, whose diverse, inclusive school of 220 students serves more than 50 special needs students. “That would enable teachers to spend more time teaching and less time adapting lessons to individual kids.”

CAST’s chief technology officer, Chuck Hitchcock, says he expects to have a “reasonably well-established” online service in place by the end of the year. But he cautions that it is just a beginning. The real challenge will be to get the cooperation of publishing houses, which are skittish about licensing digital materials. “None of the publishers are eager to do this,” says Hitchcock. “They’re nervous. So we’re going to have to work hard to devise a system of digital-rights management that gives schools the materials they need while protecting publishers’ products and copyrights.”

To some, the promises of UDL and programs like Thinking Reader may sound Pollyannaish, especially when the resources needed for such innovations are scarce in many schools. Without enough of the right equipment or the right training, technology’s leverage is lost. Yet as the work of CAST and organizations with similar missions demonstrates, digital technologies can be powerful tools in the hands of teachers who use proven, research-based teaching strategies, have high-quality professional development, and the support of administrators who are committed to finding fresh approaches to meet the needs of all students. n

For Further Information

Center for Applied Special Technology (CAST), 39 Cross St., Peabody, MA 01960; 978-531-8555; cast@cast.org.

R.P. Dolan and T.E. Hall. “Universal Design for Learning: Implications for Large-Scale Assessment.” *IDA Perspectives* 27, no. 4 (2001): 22–25.

K. Kelly. “New Independence for Special Needs Kids,” in *The Digital Classroom,* ed. D.T. Gordon. Cambridge, MA: Harvard Education Letter, 2000.

A. Meyer and D. Rose. *Learning to Read in the Computer Age.* Cambridge, MA: Brookline Books, 1998.

A. Meyer and D.H. Rose. “Universal Design for Individual Differences.” *Educational Leadership* 58, no. 3 (November 2000): 39–43.

L.M. O'Neill. "Thinking Readers: Helping Students Take Charge of Their Learning." *The Exceptional Parent* 31, no. 6 (June 2001): 32–33.

R. Orkwis. "Curriculum Access and Universal Design for Learning." Special Report of ERIC Clearinghouse on Disabilities and Gifted Education. Reston, VA: Council on Exceptional Children, 1999.

Reading Online is a peer-reviewed journal of the International Reading Association dealing with K–12 literacy research and practice.

D. Rose. "Universal Design for Learning: Deriving Guiding Principles from Networks that Learn." *Journal of Special Education Technology* 16, no. 2 (Spring 2001): 66–67.

Digital Fluency: skills necessary for learning in the digital age. Dr Gerald (Gerry) White is a Principal Research Fellow at the Australian Council for Educational Research (ACER) . Keywords: learning, teaching, ICT, education technology, skills, elearning, safety, curriculum, digital skills, digital fluency.Â So, how has the impact of digital media affected curriculum? Curriculum in schools has often been defined as the knowledge, skills and attitudes that have been planned for student learning. However, Marsh (2009) gives some indication of the real problems that are faced in agreeing a definition of curriculum. He argues that some definitions are so broadly based as to be ineffective where others are narrow and restraining. This was the first comprehensive digital citizenship curriculum, and at the time "digital citizenship" was not a well-known term. Digital citizenship is the responsible use of technology. to learn, create, and participate.Â Kids and Digital Media: Changing Issues. In the decade since the launch of what is now called Common Sense Education's Digital Citizenship Curriculum, digital and social technologies have become increasingly pervasive and now are arguably indispensable tools for navigating our world. Today's young people lead profoundly connected and networked lives.Â Kids develop their identities with access to digital media as spaces to express, curate, broadcast, and record their lives. This immersion in digital information and access, often leads the creation of a virtual reality. In view of these interactions with digital technologies, it is critical to prepare children and the youth to effectively access educational information to support their varied educational inquiries.Â Providing children with tools which may assist them on the use of technology as a creative substance can help their development in the digital age (Buckingham, 2013a). It is noted that as long as the adaptive process goes together with consistent surveillance under a guardian or parent, the potency children have can develop well in utilizing the digital devices and media information platforms.