'Whole Language' Gets a Critical Read

Rancorous debate over the best way to teach youngsters how to read currently focuses on the "whole-language" approach employed in grade schools throughout the United States, Canada, and elsewhere. Whole-language classes reject traditional phonics approaches, which teach sounds associated with letters that make up words. Instead, teachers read interesting stories aloud, and students write stories and read them aloud, often collaboratively.

Whole-language proponents hold that reading skill emerges naturally among children immersed in literature, just as speaking develops naturally among kids exposed to daily torrents of conversation (SN: 2/29/92, p.138).

But new research, presented at the annual meeting of the American Psychological Association in Toronto last week, suggests that educators should avoid relying exclusively on whole-language techniques, especially for children who start out with meager reading skills. Rather, psychologists argue, teachers must tailor lessons to each student's needs by weaving together appropriate strands of phonics, whole-language, and mental strategies for effective reading.

"I think we'll see a lot of research in the next few years on one-to-one reading instruction strategies, especially with poor readers," asserts Michael Pressley of the State University of New York at Albany. "We can design instruction that retains the best of whole language as it does much, much more."

A study of third-graders in Grey County, Ontario, where public schools employ a whole-language curriculum, finds that substantially more boys than girls display severe reading problems. Ineffective readers apparently try to glean meaning from the general context of a story because they fail to "sound out" individual words accurately, assert Janet Glasspool and Gretta Hutton of the Grey County Board of Education in Markdale.

Glasspool and Hutton studied 124 third-graders chosen at random from English- and French-speaking classrooms. They tracked the children's progress during the fall 1990 to spring 1991 school year.

Sixteen boys and four girls showed minimal or no comprehension of written material on a reading comprehension test.

Moreover, when asked to read out loud and then recount a story, 39 boys and 18 girls met criteria for ineffective reading. These students usually did not attempt to correct oral reading errors, even if an error made no sense. Yet about three-quarters of these children scored adequately on the reading comprehension test, indicating that they derive meaning from the general context of a story.

Teachers need to conduct vocabulary-building exercises with these youngsters and take more time for oral reading and group discussion in class, the researchers argue. Phonics instruction may also prove helpful in some cases, they add.

Whole-language classrooms typically emphasize the reading of fairy tales and other fiction, but Canadian boys generally reported much more interest in books about animals, science, and other nonfiction topics, Glasspool and Hutton note.

Other strategies can also aid particular children experiencing reading difficulties, they contend. These include placing visual aids, such as drawings, above words in reading textbooks and studying groups of letters that occur in different positions within different words.

Poor readers indeed benefit from such methods, holds Andrew Biemiller of the University of Toronto. A 16-week training program for ineffective readers designed by Biemiller and his co-workers, which uses phonics and taped reading selections so that students can hear the text as they read it, boosts reading comprehension in Toronto third-graders attending whole-language classes, he says.

Those who complete the program read much more on their own than classmates who read poorly and receive only whole-language instruction, Biemiller asserts.

Children tend to enter school with one of two strategies for oral reading, he adds. Some read all of the words in a passage and make numerous errors, whereas others skip words they do not know. The latter group makes much faster progress in reading accuracy and comprehension, according to Biemiller.

Successful readers first learn to understand individual words on the page and then move on to grapple with the context of sentences and stories, the Toronto researcher holds. "The ability to read words out of context is where the action is in early reading," he contends.

Phonics combined with the teaching of reading strategies greatly helps poor readers when offered throughout the school year, Pressley says. During the 1991-92 school year, Pressley directed a study of five second-grade classes receiving whole-language instruction and five second-grade classes emphasizing "transactional strategies" instruction.

The latter approach varies from one child to another, using a mix of phonics, silent and oral reading, story writing, and coaching in basic strategies for successful reading. These include using a rapid return sweep from the right-hand side of the page while reading, monitoring whether a passage makes sense, rereading difficult sections, and self-correcting reading errors.

Reading skills improved more among students getting strategies instruction, particularly among those who started out as poor readers, Pressley says.

This multifaceted approach, which many highly effective reading teachers already use, offers help to educators dealing with children from disadvantaged homes, where exposure to print is often minimal, he says. It may also prove successful with the increasing number of children who start school speaking a language other than English, Pressley contends. *– B. Bower*

Underwater eruption detected in Pacific

Armed with newly acquired access to the Navy's underwater sound surveillance system, U.S. scientists have for the first time detected and monitored the eruption of a deep-sea volcano. Information provided by such highly sensitive listening posts on the seafloor opens up a vast range of possibilities for researchers studying the 50,000-kilometer-long chain of volcanoes that winds through the world's oceans like the seam on a baseball.

Embley

Fresh pillow lava from an underwater eruption off the coast of Oregon.

"This is the first time that we can actually eavesdrop on eruptions on the deep-sea floor. And these techniques will really begin to answer some of the questions [we have] about the Earth's largest volcanic system," says Robert Embley, a marine geologist with the National Oceanic and Atmospheric Administration (NOAA) in Newport, Ore. Embley and his colleagues announced their discovery last week.

Two years ago, the Navy began granting NOAA researchers access to data from its classified network of seafloor hydrophones, which monitor ocean sounds ranging from the hum of submarine engines to the songs of marine mammals (see p. 143). NOAA oceanographers have a particular interest in catching eruptions along a line of volcanoes called the Juan de Fuca Ridge, which lies off the coast of Oregon, Washington, and southern British Columbia. Until this summer, however, NOAA's lab in Newport received the information two weeks after it had been collected, reducing the chances of detecting an eruption in progress.

In late June, NOAA researchers arranged to receive the signals directly, with no delay. "We got the system operational on Tuesday, June 22, and I honestly expected to spend many months or perhaps years looking for the opportunity to find an underwater eruption. But we installed it on Tuesday and the eruption occurred on Saturday," says NOAA's Christopher Fox.

That day, the hydrophone array picked up distinctive earthquake tremors caused by magma moving upward through the crust. The rumblings, which measured as much as magnitude 3.5, came from the Juan de Fuca Ridge, about 400 kilometers west of Astoria, Ore. Only the Navy's system could detect such weak quakes, which would not register on land seismographs, Fox says.

After locating the tremors, Fox and his colleagues alerted a Canadian research group cruising near that part of the ridge. Led by oceanographer Rick Thomson of the Department of Fisheries and Oceans, the group detoured to measure the water near the site of the tremors. The Canadians searched without success for two and a half days before finding a huge plume of water warmed by the eruption.

On July 9, a NOAA ship visited the scene and lowered a remotely piloted robot 2,500 meters to the seafloor to photograph the area and collect samples. Pictures taken by the robot revealed freshly hardened, glassy basalt with 50°C water seeping out from cracks in the newly erupted rock.

The Juan de Fuca Ridge forms a border between two of the tectonic plates that make up Earth's outer shell. The vast Pacific plate lies to the west of the ridge while the tiny Juan de Fuca plate lies to the east. Eruptions along the ridge occur when the two plates separate, allowing molten rock from the mantle to rise to the surface to form new crust. Over time, this process of seafloor spreading carries older crust away from the ridge.

Oceanographers worked out the general principles of seafloor spreading in the 1960s, but they have since struggled to understand important details, such as how often spreading occurs at any one spot and how much new crust forms at one time. Because the eruptions release heat and chemicals into the water, researchers also want to determine how this process affects the ocean and its denizens.

Even more than the actual detection of an eruption, their access to Navy data and the promise of more discoveries have electrified oceanographers. "It's tremendously important. The mid-ocean ridge system is the biggest volcanic system on the Earth, and we've never had a way of monitoring what's going on," says G. Michael Purdy of the Woods Hole (Mass.) Oceanographic Institution.

Embley and his colleagues are not the first to catch a mid-ocean ridge volcano in action. In 1991, oceanographers on board the Alvin submersible chanced upon an eruption while studying a portion of the East Pacific Rise 1,000 km southwest of Acapulco, Mexico (SN: 12/7/91, p.372). Several pieces of evidence, including still-living animals partially covered with lava, led the scientists to conclude that the eruption had occurred within weeks or days. It may even have been going on when the Alvin was down there, says Rachel M. Haymon of the University of California, Santa Barbara.

While Haymon and others praise the NOAA work, they say the discovery will probably widen rifts among research groups studying different parts of the mid-ocean ridge system. NOAA and other agencies advocate focusing attention, including a planned observatory, on the nearby Juan de Fuca Ridge. Haymon and others push for continued work on the East Pacific Rise, where eruptions occur more frequently and scientists have already mapped sections in detail.

— R. Monastersky

For distance, eyes see like ears hear

We take for granted our ability to judge the depth and distance of objects. To do that, the brain needs both eyes, so it can compute these measurements based on slight differences in how each eye perceives the object. A simple test, holding up a finger and looking at it first with one eye closed and then with the other closed, reveals that this angular difference, or disparity, does indeed exist, as the finger will seem to shift depending on the viewing eye.

Neurobiologists studying visual processing in the barn owl *(Tyto alba)* now report that the owl's brain perceives depth using the same computations it uses to determine the location of sounds.

To locate a sound, the brain assesses the difference in the time the sound takes to reach each ear. The brain pairs a signal from one ear with that from the other, and specific nerve cells respond depending on the length of the delay between the two signals. Consequently, each of these so-called characteristic delay cells winds up firing most vigorously when that sound comes from a particular place relative to the head. These cells create an auditory spatial map that helps the brain pinpoint sounds, says Hermann Wagner of the Max Planck Institute for Biological Cybernetics in Tübingen, Germany.

Though a hearing researcher, Wagner wanted to test whether what held true for ears also worked for eyes. So he and Barrie Frost of Queen's University in Kingston, Ontario, created visual signals that paralleled the audio signals — tones and noise — used to demonstrate how auditory processing occurs. These signals consisted of regular or irregular black-and-white stripe patterns. Wagner and Frost projected moving patterns in front of the owl and placed a prism over one of its eyes to create the illusion of depth or distance. At the same time, the researchers monitored the electrical impulses from 58 sites in the part of the owl's brain analogous to the visual cortex in other animals.

Different nerve cells there do respond to specific angular differences between two visual signals, Wagner and Frost report in the Aug. 26 NATURE. The owl brain contains visual cells with "characteristic disparity" just as auditory nerve cells have characteristic delays, Wagner says. Thus holding the finger 30 inches away would cause one of these nerve cells to fire, while a finger 10 inches away would set off a different one,

Bob Gress

In barn owls, eyes and ears work alike

thereby creating a three-dimensional view of the world.

The experiments help resolve a question that vision researchers have grappled with for years, says Curtis L. Baker Jr. of McGill University in Montreal. "The interdisciplinary aspect of making an analogy to the auditory system in order to get an idea for a new visual experiment shows the value of studying more than one subspecialty," he adds.

In addition, "We speculate that the brain uses similar algorithms to solve similar problems," says Wagner, citing hints that the brain may use this approach in memory, for matching.

— E. Pennisi