In the Curriculum

Multidisciplinary

Learning about Learning

Students role play how the brain processes information.

Technology gives students access to information they need in researching brain chemistry and learning theory.

Students used desktop publishing software to create newsletters to share results.

Students test their brains' ability to learn.

PHOTOS COURTESY OF JAN GARDNER.

By Jan Gardner

Subject: PBL, science, art

Audience: Teachers, technology coordinators, library media specialists

Grade Level: 5–8 (Ages 10–14)

Technology: Web, desktop publishing, digital imaging

Standards: *NETS•S* 3–6 (www.iste.org/standards)

Supplement: www.iste.org/L&L

Set against a backdrop of farms and ranches, Brady Elementary School serves a socioeconomically diverse student body, with many students growing up in poverty. Despite this, Brady is a consistently high achieving school, and the Texas Education Agency has recognized our school district for outstanding academic performance.

How have we achieved this? Many teachers are familiar with the words of Confucius: "*I hear and I forget, I see and I remember, I do and I understand.*" In my experience as a self-contained classroom teacher and as a teacher of gifted students, I have found that when students are actively engaged in meaningful learning experiences, they are more likely to grasp significant concepts and to develop important skills. Participation in project-based learning (PBL) and group investigations allows students to develop problem-solving techniques, acquire specific skills; locate, evaluate, and use information; and apply their learning through the development of authentic products.

In a state that places significant emphasis on the results of standards-based tests, Texas teachers feel compelled to direct much of their time preparing students for the tests. PBL experiences involve the integration of several disciplines, which allows teachers to address a variety of curricular objectives within one investigation. Emphasis on the state standards is shifting from factual to conceptual understanding, and PBL experiences provide an ideal vehicle for helping students apply the higher-level thinking skills that support concept development.

Through our Shutterbug Authors unit, students improve writing skills, acquire knowledge of photography, and learn more about themselves and their world. Other activities were based on student interests. For example, students were looking for a project that would provide a service to the school and a significant learning experience for them. They decided to plan, design, and help create an Outdoor Learning Center. This center taught my students a variety of skills, and it is used for all types of activities in all disciplines by other teachers in the school. The project was a finalist for the 2001 Scotts Classroom Gardener of the Year Award. Later, my students asked what it was really like to live in prehistoric times. This question led to an outdoor Archaic Adventure study of prehistoric people who lived in central Texas, which culminated in students spending a day in the country in a simulation of how ancient Texans might have lived. Through these and many other PBL experiences, students *do* and they *understand*.

During a lively discussion about students' different responses to their teachers' instructional styles, one student commented in frustration, "I don't know how you can sit and listen through the entire class—my brain just doesn't work that way!" A classmate's joking reply, "Just how *does* your brain work? Or does it work at all?" initiated discussion about how learning happens. None of the students knew how the brain learned, or what factors might influence learning. The students were intrigued by the idea of studying the brain, and together we developed the essential questions that guided their study: "Can I improve my own learning by finding out how the human brain learns? If so, how?"

Although I have only one computer in my classroom, my students do have access to two computer labs in our school. Both labs have classes scheduled throughout the day, however, so it's necessary for me to be flexible and persistent to find time for my students to use the computers. I check the class schedules of both labs and take advantage of the times when the computer teachers have breaks in their schedules. Fortunately, they are very cooperative and graciously allow me to use the labs in their absence. I can usually manage to have access to a lab for an hour each day, if needed.

YOUR OWN ODYSSEY

This article was adapted from one by Suzie Boss that ran online as part of the Intel Innovation Odyssey project, launched in January 2002 (www97.intel.com/odyssey/index.asp). The Odyssey project is soliciting stories that involve student learning in K–12 settings and in which technology use clearly enhances the learning. The site features a new story every school day and as of press time, was on Day 238. That's 238 ideas for integrating technology into your curriculum! Jan Gardner's story ran on Day 148, and Cynthia Thomas's story, which you can read on p. 40 of this issue, appeared on Day 21.

Teachers are not expected to write their own stories. Instead, they complete and submit a project description using an online form that's used for story development by the Intel team. Teachers also submit digital photos they take in their own classrooms. As an acknowledgment of their time, teachers who complete the submission process receive their choice of a digital camera or a handheld microscope. (Not every submission will be featured on the site.) —*The L&L Editors*

One method I use is the Big 6 process for solving information problems. The steps include task definition, information-seeking strategies, location and access, and use of the Big6 Web site to help students learn to evaluate the information they find, for usefulness and reliability. (*Editor's note:* For this and other relevant URLs, see Resources on p. 39.) The Web site also includes links to other sources.

Students decided to begin by gathering information about the anatomy and functioning of the brain. Thanks to a resourceful, dedicated library media center director, our school's library contains several books about the nervous system and the brain, providing information for students' initial research, which motivated them and prompted more questions: "How do scientists know what's happening inside the brain? If brains are basically alike, why do we learn differently? What is memory? Why do we remember things that aren't important and forget some things we need to remember? Why do I learn better from some teachers than from others?" These and many other questions led the students to seek additional information from other sources, which was a key purpose for the use of technology in this project.

Not surprisingly, the students extended their research to the World Wide Web, where they explored sites from a "hot list" I had created, and they discovered other sites through their own searches. Access to information on the Internet is particularly valuable in a field such as brain research, in which knowledge may be outdated before a book can be written and published. In the computer lab, I frequently heard excited comments, such as, "Wow! This is awesome! Everybody come look at this!" as they discovered amazing photographs or fascinating facts. In our one-computer classroom, students were able to share favorite Web sites by using the multimedia projector.

How the Brain Works Activities

Next, working in a small group or with partners, students enjoyed a variety of experiences designed to expand their limited knowledge of how the brain works. They conducted experiments to help them understand the function of each lobe of the brain, such as solving logic puzzles (frontal lobe), playing word games (temporal lobe), analyzing optical illusions (occipital lobe), and identifying the contents of a bag by touch (parietal lobe).

Art and construction projects provided visual representations of neurons and the parts of the brain. Some students chose to create three-dimensional models with an interesting array of materials including yarn, clay, and Styrofoam balls, while others painted their artistic representations of neurons. One enterprising student built a battery-operated model of the connection between neurons; sparks flew between wires as he turned a crank. (We videotaped his demonstration and edited the tape on our video editor to be broadcast on the school district's education channel.)

How We Learn Activities

The students compared the effects of different types of music on their ability to concentrate as they worked in the classroom. They discovered that their responses to the effects of the music were varied, which stimulated additional questions about what differences in their brains would explain their different reactions. They also enjoyed singing several songs they found online at Neuroscience for Kids.

The students created a simulation of the path of information through the brain that had all of us running around the room as neurons fired and dendrites connected. This activity was particularly useful in helping the students to understand the role of the amygdala in processing emotional information. A rowdy outdoor game of "Neuron Tag" (also discovered at Neuroscience for Kids) further enhanced students' understanding of the process of neural connections.

The author of Neuroscience for Kids, a university professor, invites readers to e-mail him questions. This connection to an expert in the field was valuable for my students because our rural location does not allow easy access to human resources. The questions they posed (and the answers) were posted on the Web site, along with many others, but my students felt that they had personally communicated with the professor. They also discovered that other students shared their interest in the human brain.

As they began to extend their knowledge about the human brain, students decided to observe in different classrooms to discover the ways students learn most effectively. They used a digital camera to capture examples of teachers applying the concepts of effective teaching the students had learned about in their research. The projection system connected to the computer once again was instrumental in allowing the students to share their research.

The students were extremely thorough and amazingly perceptive in their classroom observations. I was impressed and pleasantly surprised at how well they connected what they had learned about the brain to what they saw happening in the classrooms. "I've always known I learned a lot in second grade," commented one student. "Now I know why I learned so much!"

I taught successfully for many years without the use of computer technology, and I saw no reason to change my ways. Fortunately, I "saw the light" and now enthusiastically embrace many forms of technology as additional and highly effective instructional tools.

My students often choose to use these technology tools as they develop products to share their learning. I'm convinced that technology is an integral component of today's classroom, and evidently, my students agree.

By providing activities that addressed a variety of learning styles, I had facilitated student learning as they experienced different ways in which the human brain learns. At the end of the study, the students noted this. They realized that I had attended to *their* needs as learners while they were learning about learning. This led to an awareness of metacognition. After the classroom observations had been completed, the students decided they had learned enough to produce a video of "Tips for Teachers." Time constraints prevented the idea from becoming a reality, which was probably fortunate!

As a final product, the students created newsletters using desktop publishing software to demonstrate what they had learned in their study. A rubric provided specific criteria for evaluating the newsletter. I found the rubric for evaluating a newsletter at Teach-nology, and the students made some revisions to the criteria. We saved valuable time by using a previously generated rubric, and I was able to model my use of technology. (*Editor's note:* Find the revised rubric in the supplement at www.iste.org/L&L/.)

The study of the human brain and learning was enlightening for the students in many ways, and the use of technology enhanced student learning significantly. Students acquired knowledge about how the human brain processes, stores, and retrieves information; made observations about learning styles; and formed generalizations about the factors that influence learning. They concluded that they certainly could improve their own learning by applying their new-found knowledge about the human brain. Using technology allowed students to explore a variety of ways to gather information, document their observations, share knowledge, and evaluate their products. The students were enthusiastically and productively engaged in learning throughout the entire project, and they successfully demonstrated that they had met the objectives of the study. After several minutes of celebration, one student said, "Well, so what's our next project going to be?" He and his classmates eagerly began to brainstorm ideas for their next investigation, which would be an outdoor project. As they left the classroom, I overheard the comment, "We're going to need laptops for this project!"

Because I am a strong proponent of technology integration, students find it amazing that I had to be dragged into the Age of Technology, kicking and screaming, "I hate computers! I never want a computer!" I taught successfully for many years without the use of computer technology, and I saw no reason to change my ways. Fortunately, I "saw the light" and now enthusiastically embrace many forms of technology as additional and highly effective instructional tools. The increased use of technology has added another dimension to the learning experiences I am able to offer my students, and technology supports my teaching on a daily basis. The Internet connects our rural school to the world and is a valuable source of information. Through the regional education service center, I have access to online videos, which expand and extend student knowledge. I use the computer, a multimedia projector, and a document camera frequently. Much of what I previously wrote on charts or on the board I now project on the big screen. Video cameras, editing equipment, and a digital camera also provide ways for my students to learn. I have recently begun to use eBooks (digitally formatted books, designed primarily for on-screen reading), which provide yet another method of presenting information. My students often choose to use these technology tools as they develop products to share their learning. I'm convinced that technology is an integral component of today's classroom, and evidently, my students agree.

Resources

Scotts Classroom Gardener of the Year Awards (description of Brady Elementary School's Outdoor Learning Center): http://2001.scotts.com/community/GBTGAwardsWinners_Jan_Gardner.cfm

Teacher Sites

Big6: www.big6.com
Teach-nology: www.teach-nology.com

Brain Sites for Kids

Amazing Brain: www.tqjunior.thinkquest.org
BrainConnection: The Brain and Learning: www.brainconnection.com/
BrainPOP: www.brainpop.com
BrainSurf: www.sahs.uth.tmc.edu/brainsurf
Discover Magazine: www.school.discover.com/neuroquest/neuroquest.html
FunBrain.com: www.funbrain.com
Mind Over Matter: How Does the Brain Work?: http://school.discovery.com/lessonplans/activities/mindovermatter/
Neuroscience for Kids: http://faculty.washington.edu/chudler/neurok.html

Jan Gardner has been an educator for 32 years and has taught first, second, and third grades. For the past 12 years, she has been teaching students in Grades 1–5 who have been identified for participation in the district's program for Advanced Academic Services. Past awards include regional Texas Elementary Teacher of the Year, regional Teacher of the Year by the Texas Association for the Gifted and Talented, and Wal-Mart Teacher of the Year.

What projects get your students excited about learning? How have you made limited technology resources work in your classroom?

L&L wants to hear from you. Drop us a line at letters@iste.org.

Newsletter Rubric

(an online supplement to "Learning about Learning" by Jan Gardner, from L&L 30[6])

Name: _____

Teacher: _____

Date: _____

Title of Work: _____

Points	1	2	3	4	
Criteria					
Content	Contains only one story and one other article that provide information about the brain and learning.	Contains two stories and at least two feature articles; content is accurate but minimal.	Contains two stories, three featured articles, and accurate content	Contains two or more stories, four or more featured articles, and information is accurate and detailed.	_____
Design and Layout	Poorly organized, confusing to reader, hard to read.	Information is somewhat organized and easy to read.	Design is attractive, text is easy to read, content is organized.	Design is creative and attractive, content is well-organized and easy to read.	_____
Writing and Mechanics	There are several mistakes in spelling, capitalization, and/or punctuation.	There are two or three mistakes in spelling, capitalizaion, and/or punctuation.	There are no more than one or two mistakes in spelling, capitalization or punctuation.	There are no mistakes in spelling, capitalization, or punctuation.	_____
Graphics and Pictures	There are no graphics, or they do not seem to go with the text.	Graphics go with the text, but there are not enough.	Graphics go well with text, but there are too many.	Graphics go well with the text and there is a balance of text and graphics.	_____
			Total		_____

Teacher Comments:

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The stand-alone version of this supplement is offered in Rich Text Format (RTF) in order to provide flexibility in content and layout. The PDF of the article has an example of a finished version of this supplement that is not easily edited. The RTF file provides easy editing to meet your needs and has minimal layout treatment.