The Best of Learning & Leading with Technology: Selections from Volumes 31–35

Jennifer Roland

The Best of Learning & Leading with Technology contains the most popular articles from ISTE’s flagship magazine. This collection is drawn from many of the recurring sections of the highly respected periodical, L&L. In addition to dozens of valuable articles, readers will find commentary and context around the articles, as well as short essays from the original authors. Like L&L, The Best of Learning & Leading with Technology is an excellent resource for new and seasoned educators, with information and advice on using technology tools to enhance education.

This excerpt from chapter 5 features a selection of articles from L&L’s “Learning Connections” column. The articles in this section include tips, tricks, and lesson plans for a variety of subject areas and topics. The articles are meant to be adaptable, allowing educators to use the ideas in their own lesson plans.
Learning Connections, the section of the magazine in which practitioners share their tips, tricks, and lesson plans, was known for years as “In the Curriculum.” In the early days, the projects were often complete, stand-alone lesson plans that any reader could replicate line by line in their classrooms. As technology use became more commonplace, schools and districts began prescribing curriculum, so it became less useful for L&L to include technology-supported lesson plans. The section evolved to include descriptions of how a teacher or group of teachers used technology to support a learning activity. The articles were written in such a way that teachers could integrate the ideas into their own curriculum, in their own way, rather than simply using a predesigned lesson plan.

The name change coincided with a further change in the section. We began to include shorter tips and classroom ideas. We also began to solicit articles dealing with curriculum areas outside of the core, such as business education, health and physical education, and music. This broadening reflected the increased use of technology throughout the school day and even in extracurricular activities.

We begin with an article from outside the standard curriculum areas: business education (“Simulations as Action Learning Devices,” Dan Smith, February 2008). Simulations are very powerful tools in the classroom, because they can provide experiences that are impossible to replicate under normal classroom conditions. They have been especially effective in science and math education, where they helped students visualize complicated ideas. Dan’s company, Management Simulations Inc., creates simulations used in high schools, universities, and businesses to better prepare future executives. The simulations he describes in his article provide students with long-term projects that simulate up to eight years of company management so that they can develop skills and strategies that will help them throughout their careers. Dan points to IT skills, leadership skills, self-direction, work
ethic, and social responsibility as direct benefits of the business simulations. His author’s update provides some specific examples of the simulations in use.

Next, ed tech expert Kathy Shrock provides tips to help students evaluate a website (“Trash or Treasure: Evaluating a Web Site,” December/January 2005–06). With the plethora of inaccurate and biased information available online, many articles over the years touched on the need to evaluate sites and ideas to help students do that. But this tool is a concise self-contained set of questions students can follow with each site they come across. By asking themselves the 5W questions—Who? What? When? Where? Why? —and using their current knowledge about the topic, students can tell whether a source is a valuable addition or something to be ignored. These tips are useful for all media, not just websites. And the critical analysis skills they learn by evaluating sites in this manner will help them throughout their lives, as they are presented with conflicting information and possibly unreliable sources in their work and personal lives and in the media. In her author’s update, Kathy discusses new developments in technology and how her tools hold up when students need to evaluate them.

Next up is a really fun activity that acclimates young children to the inclusion of technology in their learning while also allowing the hands-on learning so essential at that age (“Digesting a Story,” Stacy Bodin, May 2006). Stacy created activities around the holidays that incorporate video, word processing, and eating—how fun is that? Students take holiday treats (e.g., gingerbread houses at Christmas, chocolate bunnies at Easter) and write stories for them. They use their edible props to act out the stories, which the students videotape. Students then test each other on the concepts presented in their stories. Many teachers struggle with the need to use technology in early education. But Stacy proves here that not only are students ready for it, it can also prepare them for technology integration in later grades. In her author’s update, Stacy talks about the challenges she faced after moving to a different school and trying to do the same types of activities with her students there.

We move on to a quick tip for foreign language learning that combines multiple modes of learning to help increase students’ listening comprehension (“Improving Students’ Language Learning,” Lyn C. Howell and Robert Rose, March 2006). These authors saw improvements of, on average, 10 percentage points after their intervention. They combined the supplemental learning exercises in the Spanish textbook with an on-screen script to help students follow the conversations. This is the type of activity where technology shows its true power. With a quick retooling, pre-prepared activities become more relevant and usable. Technology allows multiple modes to be embedded in single activities, addressing the needs of all learners without having to assign separate activities. I remember how hard it was to learn conversational Spanish because the native speakers spoke too fast. This sort of tool would have helped me, as would the ability to listen at slower speeds to become more used to the cadence of native speech. Lyn and Robert provide the next steps in their authors’ update, a description of the follow-up activities they used with students in Robert’s Spanish classroom.

In our next Learning Connections piece, Ken Felker describes a tool that shows graphic and dynamic representations of human anatomy (“Dynamic Human Anatomy,” March 2007). This tool provides a compelling simulation of dissecting a human body, which is not really feasible or desirable in the average high school health classroom. It provides
the self-directed learning that allows students to learn at their own pace, following their own linkages between materials and ideas. It reminds me of the layered plastic anatomy diagrams from my old Encyclopædia Brittanica. Those were the most fascinating things I found in those dusty tomes, and I am excited that a similar, richer tool can provide an even higher level of exploration and interest in the inner workings of the human body—no cadavers required. Ken updates this article with an activity using Primal Pictures to enrich a high school health lesson.

The writing process is enriched when writers share their writing and get feedback on it. Rick Monroe created a judgment-free, technology-enriched method of incorporating critiques into his students’ writing (“Electronic Read-Arounds,” May 2007). His students use the classroom computers to post their writing, read their peers’ writing, and comment on it. One of the hardest things to learn in writing is the concept of understanding your audience. Many teachers have asked their students to post their finished writing in public forums. This helps students put their best foot forward because they know that their work will be read by a broader audience than just the teacher. Even if they post their work anonymously, they don’t want to be embarrassed by an inferior work. But how do these students learn what their final audience will want from their piece? Rick answers that question by adding the audience to the development phase, letting them ask the author for clarification and tell him or her what works or doesn’t, and why. Can this activity be done without technology? Sure. In fact, Rick tells us in his author’s update how he has continued this feedback loop without the access to technology he had when he wrote the article. And his students are still learning the fundamental lessons he needs them to learn. The addition of technology does not make or break this lesson, but is does make things more natural for the students. Students do a large portion of their research on the Internet, and they do their writing on the computer. Using the computer for gathering and responding to feedback is natural and appropriate. And, if Rick’s students are anything like me, they can type a response a lot faster than they can hand-write it.

Long-time L&L contributor Margaret L. Niess provides our next article. In “Dynamic Visualizations” (December/January 2007–08), she discusses the tools provided in Microsoft Math and describes how they can bring math problems into a visual realm. The tools provided by the computer are more visually powerful and easily viewed than those provided by the typical graphic calculator. Teachers can lead lessons where they input variables and show the resulting graphs using a projector. Or small groups of students can work together to test solutions to homework problems. Many technology tools for teaching math have focused on drills and practice problems. They have made these rote learning tasks much more interesting, and they have had proven effects on student learning. But the tool Margaret describes allows students to use higher-order thinking skills in math and tap the real power of technology. The visual representations again bring multiple modes of learning into the classroom, helping strengthen student understanding. In her author’s update, Margaret discusses the changes in math instruction and learning over the years.

Next up is a method to help students plan and conduct research projects (“Research, Deconstructed,” Leslie Yoder, December/January 2007–08). Leslie describes an open-source software tool that breaks the research process into manageable steps and guides students through the process. The tool is based on a university-level tool and the Minnesota Educational Media Organization’s Information and Technology Literacy Standards. The value of such a tool is in helping students plan their research and follow steps in a
timely manner. This ability will help them greatly as they pursue higher education—following a process with benchmarks and steps can prevent the ever-popular all-nighters and hastily prepared papers that don’t showcase actual learning or research skills. In addition, the teacher guide and lesson ideas ensure that the tool can be integrated into many different high school classrooms in a consistent manner. In the author’s update she prepared with Jane Prestabek, Leslie describes what has happened with the tool since original publication and discuss some uses and coverage it has received.

We move to a simulated science problem that puts students in the role of environmental researchers (“Students as Environmental Consultants,” Megan Roberts and Janet Mannheimer Zydnei, September 2004). I described earlier the power of simulations in placing students into situations outside of the classroom that provide a greater context and show how classroom learning relates to the real world. This lack of connection to the real world is a real problem for many subjects, especially math and science. In the simulation presented in the article, students help a company deal with an environmental crisis. As green topics become more and more mainstream, this activity remains relevant. It bleeds into other subject areas, with a social studies element as students investigate the structure of government agencies and the rules and laws they oversee, a language arts element as they prepare persuasive writing on the topic, and a math component as students assess the economic consequences of the company’s possible options. In the update, the authors discuss the use of the simulation with a different groups of students at a different level to assess the portability of the lesson.

We conclude our survey of the various curriculum areas with an example of students getting involved in the world around them (“Kids Galore Helping Kids in Darfur,” Wendy Drexler, November 2007). We know that involving students in designing their learning activities is powerful. In this case, however, the power extended beyond the classroom, as students created a resource that helped bring attention to a human rights issue, connect them with other students and classrooms around the world, and provide a template for other classes to share their feelings about current events. The students created a website that was recognized by Congress, Amnesty International, and the Florida Holocaust Museum, among others. In addition, the student work on that website led to further collaborations between Wendy’s students and older students, as she describes in her author’s update. The take-away for teachers is the ease with which you can harness student excitement about a topic and direct it into positive, curriculum-based projects.
Simulations as Action Learning Devices

In no subject is the effect of technology on the education process more apparent than in business education. Where textbooks and lectures fail to engage and teach business comprehensively to today's technology-oriented students, computer simulations provide logical and user-friendly platforms for learning.

Business simulations work by dividing high school business classes into teams that each manage a simulated company. The students, functioning as company managers, compete for market share and profits by making business decisions (from finance to marketing) that affect bottom lines.

In business simulations, students learn how to interpret financial statements and examine the competitive market. They devise business plans and make decisions in marketing. They hire and fire personnel and negotiate labor contracts. And they see how each choice affects the profitability of their simulated company. In short, they learn by doing—by far the best approach for young people.

"As an instructor of a college preparatory high school business management program, I use [business] simulations with students preparing for graduation to teach the big picture of how the separate functional areas, such as marketing and finance, fit together on a management team," says Wendt Howell, international business instructor for the satellite program of Eastland-Fairfield Career and Technical Schools located at Gahanna Lincoln High School in Ohio. "This knowledge helps students see how decisions affect other departments and how to run a business. The average business person does not have the opportunity to understand these concepts until later in their careers."

Business simulations involve basic knowledge—including reading comprehension and mathematics—and applied skills such as critical thinking, problem solving, and teamwork and collaboration. Depending on related activities planned by educators, business simulations also can improve oral and written communications.

Other applied skills addressed by business simulations include:

- **Information Technology Application:** Business simulations are computerized and on the Internet—a good application of information technology.
- **Leadership:** Each management team has leaders. Students either are leaders or are associated with leaders. Either way, they experience how leadership works.
- **Lifelong Learning/Self Direction:** Defined as acquiring knowledge and learning from one's mistakes. Business simulations allow students to do both. In addition, assessment tools can help demonstrate mistakes, and through that, help students acquire knowledge.
- **Professionalism/Work Ethic:** Defined as personal accountability, punctuality, working productively with others, and time and workload management—all requirements of a successful team member.
- **Ethics/Social Responsibility:** Incorporating integrity and ethical behavior, simulations teach students to act responsibly with the interests of the larger community. A management team requires each member to act with the interests of the team.

By Dan Smith

Continued
The learning process for Management Simulations, Inc.’s Foundation Business Simulation is broken down into four phases:

- **Phase 1: Individual Assignments**—Climb the learning curve. All assignments are done on an individual basis. “You are only as strong as your weakest link.” The more each person knows, the stronger the team will be.
- **Phase 2: Team Practice**—Next, students work in management teams, making decisions for their company, but in practice mode. It is about making mistakes and then learning the concepts.
- **Phase 3: Competition**—Student teams take over their company for a maximum of eight simulated years.
- **Phase 4: Boardroom**—At the end of their reign, the teams face their stockholders and the Board of Directors to explain how they managed their company. The real objective is having them explain what they did, why they did it, and what they learned from the experience.

See the sidebar of business simulations suitable for high school.

Business simulations arm students with enthusiasm, confidence in the decision-making abilities, and business acumen—powerful advantages they’ll need in the real world. And they enjoy learning.

Dan Smith, president of Management Simulations, Inc. (http://www.capsim.com) and adjunct professor at DePaul University, is a leading expert in the field of simulation. With more than 30 years’ experience in developing interactive business models, Dan condensed his broad business knowledge to create the specialized high school program Foundation Business Simulation.

### Business Simulation Resources

The Association of Business Simulation and Experimental Learning (http://www.absel.org) is an organization dedicated to developing and promoting experiential techniques and simulations in business education. According to ABSEL’s Web site, the group is “interested in the fields of business education and development, business gaming, experiential learning in higher education, online learning, distance learning, and professional training in national and international organizations.”

Knowledge Matters (http://www.knowledgematters.com) Virtual Business suite of simulations covers marketing, introduction to business, management, supervision, sports marketing and management, retailing, and entrepreneurship.

In Virtual Business - Retailing 2.0, students manage a convenience store, with control over pricing, promotion, merchandising, and market research. Students get to pick from a list of 20 products to sell in their store. A Quiz Generator CD allows teachers to create customized quizzes based on selected lessons. The program is based on research funded by the U.S. Department of Education.

LavaMind (http://www.lavamind.com) offers a series of business simulations. In Gazillionaire, players run a trading company in outer space, and must make decisions about supply, demand, profit margins, overhead, account balances, and so on. The program offers a tutorial with adjustable complexity levels. Zoomlash is targeted at older students who are ready to explore more complex math, business and economics, and in Profitania, higher-level students manage and operate a factory using advanced structures and concepts.

Management Simulations, Inc.’s (http://www.capsim.com) Foundation Business Simulation teaches high school students the principles of business research and development, human resources, finance, marketing, production, strategy, tactics, leadership and teamwork. Student-run companies operate in “Low Tech” and “High Tech” market segments. They begin the simulation with one product, but can develop a portfolio up to five products. In team competition, four to six teams run companies and compete against each other, while in individual competition students each run a company, competing against five computer-generated companies.

OakTree Simulations’ (http://oaktreesim.com) Micromatic is a medium to complex Web-based business sim targeted toward college undergraduate and graduate students in which players sell product through retail markets to the general public in three different sales regions. They decide the prices to charge for their products, the level of quality built into them, how to promote the products, and whether to sub-contract the manufacture of them to another company or produce the products themselves. In Team play, students are part of a group that manages a company competing with other companies in the same marketplace managed by other groups in the class. In the solo version of the game, students compete against companies managed by the computer.

—Davis N. Smith, Managing Editor, L&L
Here are two examples of how simulation is successfully being used as an action learning device in semester and summer high school business programs.

First, Vicki Fuesz of Haxtun School in Yuma, Colorado, reports increased engagement after using the computer-based simulation with her students (she had used a non-technology simulation the year before). She saw her students using higher-order thinking skills, predicting sales, reading and analyzing data and graphs, solving problems and correcting mistakes, as well as learning to listen to each other and resolve conflicts.

Second, we hear about the use of simulations at the National Student Leadership Conference, an annual gathering of students that focuses on specific curriculum areas and allows the participants to earn college credit. The students in the program use the Capsim simulations. According to the NSLC website, “The competition is intense and student teams are given only a few hours to make annual decisions for their company. This condensed format forces students to work together and to rely on teammates. This simulated environment not only builds their knowledge and exposure to business areas (accounting, marketing, human resources, finance, strategy, etc.), but also exposes them to the difficulties of working with others and building leadership skills—skills that can only truly be learned from ‘doing.’”
Trash or Treasure? Evaluating a Web Site

Every piece of information found on the Web needs to be looked at with a critical eye. Anyone can easily publish a Web page or blog or change an entry in a wiki, and the information can appear valid. However, students must have a knowledge base in a topic before they conduct a Web search. If they know a little about a topic, it will be much easier for them to choose (and eliminate) some of the sites and information they find. In addition, if they are familiar with the topic, they are able to conduct more productive searches using related keywords and applicable phrases.

Here are some questions (based on the 5 W’s) students can ask before they decide to use information they find online. You can post these by the computer(s) in your classroom or lab or hand out to students for home use.

When?
When was the site created?
When was the site last updated?

Where?
Where does the information come from?
Where can I look to find out more about the producer/sponsor?

Why?
Why is this information useful for my purpose?
Why should I use this information?
Why is this page better than another?

Standards: NETS•S.6 (http://www.iste.org/nets/)

Resources
Kathy Schrock’s Guide for Educators: Critical Evaluation:
http://discoverschool.com/schrockguide/eval.html
The 5 W’s of Critical Evaluation Handout:
http://kathyschrock.net/abceval/5ws.pdf

—Kathy Schrock,
Administrator for Technology
Nauset (Massachusetts) Public Schools and ISTE board member
author’s update

Kathy Schrock

I first developed these critical evaluation criteria in 1995, and they have withstood the test of time very nicely!

When web pages were the only type of online information students were evaluating, answering the posed critical evaluation questions was easy. Now that anyone can easily publish information on their own, and change it themselves (or have it changed by others), and with the proliferation of newer forms of web publishing, including podcasts and videos, there are additional aspects of critical evaluation to consider. Some of these other evaluation criteria are dependent on the format of the information being presented, including such things as RSS feeds and tags. The URL in the original article will lead you to lots of new resources and critical evaluation tools that I have developed including ones for teacher sites, virtual tours, blogs, and podcasts as well as updated student tools for the critical evaluation of websites.

Another thing that has changed since this article was originally published is the NETS•S standard that includes the aspects of information literacy. In the 2007 refreshed standards, critical evaluation falls under Standard 3, Research and Information Fluency.
Chapter 5  Learning Connections

May 2006

Digesting a Story

In this second-grade language arts unit, students help create edible props for a story setting, write an original group story, act out and film their story, create five original test questions that correlate with their story, and finally have a viewing party with the edible props as snacks. This project targeted a number of Louisiana grade level expectations and benchmarks.

We developed our stories around holidays, but they could be organized around any topic with edible or non-edible props and scene elements. Our edible props for a Christmas story included gingerbread people, mini marshmallows and powdered sugar for the snow, brownies for trees, candy, and cake decorations. For Easter, we used chocolate bunnies, marshmallow candies, and other Easter candies.

Once the settings were built, I asked students to create a story with a setting, characters, a problem, and a solution. I gave each of the groups story maps with a block of space for each of the four parts to record their brainstorming session. The groups then typed the information in story form on the classroom computers. Using the writing process, the students proofread and edited their word process work.

Once the stories were completed on the computers, copies were made and students mapped each other's stories by identifying the four parts (setting, characters, problem, solution). We used printed story mapping tools from Read Write Think (http://www.readwritethink.org). Finally each group typed five questions to test one another on each group story. Questions were factual in nature, such as, "Who was the main character?" or "When did the story take place?"

Students used their props and scripts to act out each story, which the kids videotaped using a digital video camera. I transferred the digital stories to a DVD that we shared with parents during Technology Week.

Find the complete lesson with story map, rubrics, and pictures at http://www.vrml.k12.la.us/dozier/FYE/EYE04-05/eyefeb05/tech/Digesting201/digestinglessonplans.htm.

Stacy Bodin is a second grade teacher from Dozier Elementary in Erath, Louisiana. Born with a hearing disability, Bodin feels that just as her hearing aids are tools that have helped compensate for her hearing loss, computers are tools that help students meet individual academic needs and challenges.

By Stacy Bodin
Without a doubt, the birth of my Digesting A Story technology lesson was a defining moment for me in terms of meshing multimedia tools, grade-level expectations, and higher-order thinking skills. Little did I realize how an epiphany during an early morning December shopping trip would embed a wonderful teaching experience in my heart.

After spotting gingerbread house kits on a nearby display table during my shopping trip, ideas stirred about a new technology idea using a video camera, computers, and food. Moments later, excited with the thoughts surrounding the project, I found myself literally running across the store grabbing edible Christmas treats to incorporate this new multimedia project into the curriculum.

In working with the actual project, I found myself impressed with the effectiveness of this technology-based lesson. Through an array of multimedia tools, I was able to productively target higher-order thinking skills in the students and have them excited about it.

On a personal level, I believe that writers place value in reading the final product of their creativity. With this project, technology helped bring it a step further. Eventually I realized what made this project more powerful, was a final visual and audio product that students took pride in. I thoroughly enjoyed the reactions of the students as they viewed their original stories brought to life on DVDs.

Not long after the birth of this project, my sleepy southern-Louisiana town was inundated with floodwaters in September 2005 from Hurricane Rita. Our school was lost to the floodwaters. However, I found that necessity really is the mother of invention. I worked with different ideas to implement the project despite the struggles of money, space, and different equipment.

Parents excitedly offered help by supplying us with the edible characters for the class. Due to lack of time, our first Digesting a Story that fall was an original group Halloween poem instead of the usual four or five group projects.

I also found that the use of a simple digital still camera, which produced MPEGs, extremely helpful at times when resources were limited. We also worked with still digital photographs in multimedia presentations. I think the beauty of the project for me, was that we could move forward even under different circumstances or given limited resources. Through my web page, I was able to post little segments to stream the segments.

Though health issues forced my retirement in September 2007, I had plans to try using this with podcasting and even student and parent blogging. I can see this type of technology-based project staying alive and productive in classrooms with emerging technologies at the fingertips of teachers.
Our Spanish textbook, like yours we’re sure, has supplemental listening exercises on CD. These disks are excellent, except that the native speakers are speaking at a normal conversational rate, which leaves most students unable to keep up with the discussion. So we converted the audio tracks into MP3s and used PowerPoint’s “Custom Animation” feature to insert the files into a presentation in which we placed the text being spoken. As the speakers converse, the script appears, similar to a karaoke machine, allowing the students to follow the conversation visually as they listen to the tracks.

The visual representation combined with the audio improved students’ grades dramatically. Before using this technique, grades were generally in the lower 80s even after students listened to the track three or four times. Afterwards, students consistently received grades of 90 or better after the first viewing/listening. The higher grades continued to be present on quizzes and exams when they did not have the benefit of the visual props. Those students who participated in both forms, with visual cues and without, insisted that this format is much easier to understand and to retain.

**Standards:** NETS•T III (http://www.iste.org/nets/), FL 1.2 (http://www.actfl.org).

—Lyn C. Howell, Assistant Professor of Education, Milligan College, Johnson City, Tennessee, and Robert Rose, Spanish Teacher, Andrew Jackson Elementary School, Kingsport, Tennessee
authors’ update
Lyn C. Howell and Robert Rose

The next step is to help students develop a comfort level in speaking a new language. To facilitate this, students in groups of two or three write a dialogue and practice speaking to one another. To extend the lesson, they videotape their conversation. Using Movie Maker, they create their own “closed captioning.” The teacher can then combine these clips so that students can watch and listen to themselves as well as their classmates.

The repetition as students create, practice, film, and caption their own conversation really helps ingrain those words and phrases in their minds and on their tongues. Listening to classmates perform gives students an opportunity to hear the words and phrases used in different ways, and the captions help reinforce the lesson for any students who need help.
Dynamic Human Anatomy

Human anatomy is a commonly offered health course or unit in a high school curriculum. It can provide a foundation to students who wish to become emergency medical technicians, teach health and physical education, or pursue a career in the medical field. The evolution of instructional materials used to teach human anatomy has included anatomical models, charts, and flashcards. In addition, there have been several publications, such as Gray's Anatomy and the Anatomy Coloring Book, that have become discipline classics. Although few would classify these learning resources as inspirational, they have served a purpose because of the lack of a better alternative.

Dynamic human anatomy software developed by Primal Pictures (http://www.primalpictures.com) has provided teachers with unprecedented opportunities to create highly interactive lessons. Students may chart their own virtual tour through the layers of the human body with the use of realistic graphic models that have been created from MRI scan data. The software includes images, animation, clinical slides, text, MRIs, and quizzes to support and enhance the learning process. Fully interactive 3-D animations show both function and biomechanics, and all content can be copied for use in PowerPoint and Word. The figure above shows layer 11 of 24 of a knee joint, and can rotate 360 degrees to reveal all bones and soft tissue associated with the knee. In addition, selection of a bone, ligament, or tendon will reveal the name and definition in the right hand margin.

Various versions are available. The complete anatomy edition contains the interactive hand, head and neck, hip, knee, pelvis and perineum, shoulder, spine, and thorax and abdomen. Other available software includes interactive functional anatomy, and the sports injuries series, which includes the foot and ankle, the knee, and the shoulder. Primal Pictures software is available as interactive CD-ROMs, DVDs, and as a Web-based subscription service. So if you want to add some interactivity and multimedia spice to your anatomy lessons, Primal Pictures might be just what the doctor ordered.

—Ken Felker, professor of health and physical education, Edinboro University, Edinboro, Pennsylvania
author’s update

Ken Felker

Since publishing this article, Ken Felker has created more activities using Primal Pictures. The following activity can be used to enrich a high school health lesson.

Many students participate in some level of athletics and, as a result, have been injured or have a friend who has sustained an athletic injury. For this project, students select an athletic injury and, using Primal Pictures, develop a presentation that explains the nature of the injury, possible surgical repair options, and rehabilitation techniques.

Let’s examine a knee injury. First, students enter Primal Pictures and capture a variety of screen shots that show a healthy knee. They can virtually dissect the knee to expose the muscles, tendons, ligaments, and bones and select from the most appropriate views as they rotate the knee joint 360 degrees. Next, they can browse the contents box for 3-D color slides of actual tissue, x-rays, and MRIs depicting such knee injuries as tears or ruptures of the meniscus, the anterior cruciate ligament (ACL), or patella dislocation. Also, they will find surgical repairs of the knee such as ACL reconstruction. The last step of researching the virtual knee is to examine the corresponding muscle groups, tendons, and ligaments that stabilize the knee in order to develop a greater understanding of the rehabilitation process, as well as the balance needed for corresponding muscle groups to work together. When this is complete, students combine all of the pieces (screen captures, MRIs, x-rays, text) and present them to the class.

This hands-on, active learning strategy addresses several of the standards from ISTE (NETS•S) and the National Association for Sport and Physical Education.
Electronic Read-Arounds

I like to use this activity as students are developing their position about something we've read or viewed. Normally, students respond to a prompt in their learning logs and then we go to the computer lab, where they elaborate on these initial thoughts. After everyone has had a full class period to express what's on their minds, we return to the computer lab another day to conduct what I call the electronic read-around.

Here is how it works. Students retrieve their file and then depress the caps lock key or change the font. Then, everyone moves to a different computer. The reader follows the same procedure we use in class, reading the draft all the way through. The reader then reads the text again, this time responding to the content, inserting comments after the original. The student responding to the initial draft writes his or her initials after each reaction. Because the caps lock key is engaged or the font is different, the reader's comments stand out from the writer's text. We shift seats about every 10 minutes or so. A writer can receive as many as three honest and detailed responses in a normal class period.

Near the end of class, students return to their computer. The writer now has several choices: save the file with the comments included, rename the file and save it so the original file remains unblemished, or ignore the comments and log off without saving the document. Rarely do students ignore their peers' comments. Most of my students rename and save the file replete with comments. The benefits are obvious. Besides being fun, students get to read pieces from classmates not in their writing groups. When they retrieve the files later, writers get feedback that points to where or how they might revise. In addition, the integrity of the original file is retained, provided it was renamed. I firmly believe in delaying premature evaluation. Electronic read-arounds accomplish this, because students are focused on development.

A natural extension to the above activity is what Jamieon McKenzie calls accordion writing, a term he coined in "Accordian Writing—Expository Composition with the Word Processor" (English Journal, September 1984). McKenzie talks about encouraging students to use the word processor to expand and compress text. Students arrange blocks of writing that seem related and then insert additional thoughts afterward. They delete ideas or comments made during the electronic read-around that are vague and develop what is more promising. Of course, the writer will have to decide which comments should be ignored and which should be expanded.

The point to the electronic read-around is to extend the conversation between the writer and the reader. This kind of feedback helps a writer test his intent against a reader's response. A mismatch reveals that the writer perhaps wasn't clear, the reader misread the piece, or some combination of both. Because comments are followed by a reader's initials, the writer can ask about any misunderstanding, again extending the conversation.

Students at all ages need to own their decisions if they mean to grow more sophisticated as writers and readers. This technique is only one way to encourage such growth. Of course, I don't abdicate my role, but I do believe it's important to shift the attention away from the teacher. Students are free to consult with me after they have reconsidered their piece. My intent is to get out of their way so they can take charge of their learning.

Rick Monroe began teaching English in 1978. Two years later he was using word processing with his students, and since then, has been an advocate for incorporating technology into the curriculum to help students articulate their thoughts.
My original lesson was predicated on having access to technology and on my firm belief that whatever I did with technology should be transparent. That is, everything I do with technology should work (within limits) with readily accessible tools such as pen and paper. One of my maxims has been that no learning should depend on electricity, and thankfully, this has held me in good stead, especially because I have changed schools where I now have less access to technology than at any time in my career.

Because I no longer have access to a computer lab or a class set of laptops at least once a week, I’ve had to get more creative about engaging my students as they develop a piece of writing. I can still get students to conduct read-arounds, but in my situation today, we’re using pencil and paper. In my new situation, I’ve been cast back to 1981, my pre-technology days.

So what am I doing now? How am I conducting this lesson? My students still respond to a prompt in their learning logs, but now students place their learning logs on their desk, and when asked, stand, and move around the room and read each others’ handwritten entries, handwriting their responses and signing their name afterward. After three to four rotations where students move around the room reading and responding to learning log entries, the writer returns to his or her seat. Now students use a highlighter pen to mark responses from peers they think helped them elaborate on their thoughts. Now students take their learning logs home and draft their essays on their home computers. Individuals are still getting suggestions about how to elaborate on or revise their ideas, but now I no longer get to walk around the room and coach my students as they develop a piece.

Do my students still conduct multiple revisions? Yes. The biggest difference today is that, without access to a computer lab, it takes longer to develop and revise a piece of writing. What I miss most is talking with students while they develop their thoughts.

What I’ve noticed this year is that students are less enthusiastic about making changes to their writing, because handwritten suggestions tend to harden like quick drying cement. Students simply cannot capture the immediacy of the moment after they take their word-processed piece home. Students can’t turn to me or a classmate and say, “What did you mean by…” In a lab students can make a change, have a peer or me read it, make adjustments, receive feedback again, and continue revising until the writer and reader are satisfied.

I’m still teaching writing and thinking, but without the consistent use of a computer lab or class set of laptops, the process takes longer, and unfortunately, my students are getting less timely feedback.
Dynamic Visualizations

By Margaret L. Niess

Microsoft Math is a mathematics tool that at first glance looks like a calculator with a scratchpad (called a worksheet) and a graphing space. The surprise is in the power that these features provide for a mathematics classroom for both teachers and students. Imagine being able to:

- dynamically manipulate graphs of both linear and nonlinear functions and equations. Microsoft Math provides the workspace for engaging in explorations of the effect of changes in the coefficients and constants for functions such as \( y = ax^2 + bx + c \) and equations such as \( ax^2 + by^2 = c^2 \).
- visualize systems of inequalities to identify regions for solutions to problems.
- conduct explorations in three dimensions. With Microsoft Math, teachers can guide students in developing spatial visualization skills as they investigate systems of three-dimensional (3D) equations, such as \( x^2 + y^2 + z^2 = 4, x + y = -2, x + y = -2 \).
- investigate data sets of ordered pairs. Students can enter multiple data sets and search for patterns from the visual graphics.

Teachers can use Microsoft Math as a tool for depicting visual images of many mathematical ideas, including linear relationships. They can guide students' analyses through active investigations of multiple graphical representations, connecting those representations with algebraic and tabular representations while also challenging their mathematical thinking and reasoning.

Initially, a teacher can invite the class in small groups to use their graphing calculators around an investigation of how the coefficient and constant values affect the function \( y = 3x - 2 \). Their challenge is to propose a description of a general linear function. Once the groups have developed their conjectures, the challenge is for the class to share their ideas. This sharing does not have to be a series of stand-and-deliver reports. The teacher can facilitate the discussion using Microsoft Math as a demonstration tool to present visual graphs of the ideas that students propose.

With the graph of the function \( y = mx + b \), the ideas can be demonstrated dynamically through an animation of the slider for \( m \) and \( b \) (See Figure 1). However, the students must identify the range for the slider. Retaining the default range of 0 to 2 for the slope \( (m) \) only presents increasing graphs; similarly, the \( y \)-intercept \( (b) \) would be bounded at the origin. Teachers can demonstrate the various proposals in conjunction with questions that challenge them to make, test, and even restructure their conjectures. Basically, the students instruct the teacher and the rest of the class as they demonstrate and explain their conjectures about the effects of the values on the graph.
Continued

Similarly, students can be challenged to explore many quadratic relationships—both functions and equations. How do the coefficients and constant affect the function $y=ax^2+bx+c$? What coefficients make the equation $ax^2+by^2=c$ circular and what make it an ellipse? (See Figure 2.) What is the effect of the constant? What happens with inverse relationships in the form of $y=\frac{a}{bx+c}$? What happens if you graph the general linear form ($y=mx+b$) and its inverse ($y=1/(mx+b)$) on the same axis, activate the sliders for $m$ and $b$, and use trace to find the points of the intersections? What about 3D functions and equations in which hand-graphical procedures are not only time-consuming but all too often significantly detract from the development of the mathematics concepts? Can you visualize the graph of the equation $x^2+y^2+z^2=4$? If $x^2+y^2=4$ is a circle, then $x^2+y^2+z^2=4$ must be a circular sphere. True. (See Figure 3a.) Now what happens if you add the 3D graphical representations of the equations $x+y=2$ and $x+y=-2$? Can you visualize the graph rotating first about the z-axis, then the y-axis, and finally the x-axis (See Figure 3b)? Such visual thinking is rarely considered in secondary mathematics classes because of the difficulty of visually exploring 3D representations meaningfully. Yet, “students’ skills in visualizing and reasoning about spatial relationship are fundamental in geometry” (NCTM, 2000, p. 237). The capabilities of Microsoft Math uniquely demonstrate 3D graphics and provide access that supports important experiences with spatial thinking and reasoning.

Microsoft Math is a learning tool for students to explore many problems graphically, but the program also supports them in looking at their representations in tabular form. For example, suppose students are asked to create as many ordered pairs in a data set table that fit this problem: On most days Zoey works on both her math and science homework. Math takes twice as long as science. Describe visually the amount of time Zoey might be spending on her homework. After students have developed an extensive data set of (minutes for science, minutes for math) and displayed the data visually in the graphing environment, their challenge is to propose an algebraic function to represent the relationship. Figure 4 shows students adding data points to the initial data set.

While mathematics is often filled with equalities, life is more aptly represented by inequalities. Thus, more realistically, suggest that the math homework takes up to twice as long as science and Zoey spends no more than 2 hours a night on homework. Students now can consider these inequalities.
Figure 5a. Request to find the solution.

Figure 5b. Displaying the solution steps.

Figure 4. Addition of more data points that meet the condition for the problem.

Graphically to display the area about which other questions can be asked. Are there any other constraints on the situation? (Yes, the hours for both math and science are greater than or equal to zero [0].) Where is the region of possible solutions to this problem?

Microsoft Math provides many other capabilities in addition to these visualization and dynamic capabilities that can be used in a variety of ways. Students can check their own solutions to warm-up problems where they find solutions to equations such as 25-4x=6x-15. Figure 5a shows a request for the solution, with the possibility for selecting the plus (+) icon to display the solution steps along with an explanation, shown in Figure 5b. This instructional tool capability frees up the teacher to work with individual students while other students check their work and try to answer their questions using the tool.

Microsoft Math provides additional benefits for teachers and students. As teachers and students work through the lessons, the Worksheet portion maintains a record of all input, output, and graphs created during the class activities that can be saved. The record provides valuable information for students who may have been absent or for those who were confused about certain portions of the lesson. In fact, teachers can prepare worksheets ahead of class to use to demonstrate other ideas.

A special note to teachers who are concerned that certain capabilities of Microsoft Math will detract from students learning mathematics is in order. In the 1960s I taught middle school 8th and 9th graders the square root algorithm. They dutifully found the square root of any positive rational number I asked. Today, I teach teachers to teach middle school students the concept of square root, how to estimate a square root, and how to use the appropriate tool to find more exact values as needed in their problem solving.

The challenge for today’s mathematics teachers is in teaching estimation and graphical sketching for thinking through possible problem solutions. These skills are far more appropriate for developing students’ abilities to think and reason mathematically in the construction of a more useful base of mathematical knowledge and skills.

Margaret L. Nies is professor of mathematics education at Oregon State University in Corvallis, Oregon. She is the volunteer Curriculum Specialist for mathematics for U.S.I.
I learned mathematics in the late 1950s. Perhaps the most vivid recollection of enjoying learning was a unit where we were asked to graph polynomial functions. The intent was to have us “discover” the effects of the variables in each of the functions and to give us graphing experience. For example, we were asked to propose a conjecture about parabolic functions in the form \( f(x) = a(x-h)^2 + k \). Could we describe from the symbolic form how the graph would appear? We made many graphs that displayed multiple values for each of the variables \( a, h \) and \( k \). The choice was ours such as beginning by comparing the graphical representations of \( f(x) = x^2 \), \( f(x) = (x-4)^2 \), and \( f(x) = (x+2)^2 \). Once we had mastered that idea we moved to creating graphs that varied \( a, h \) and \( k \) such as creating graphs of \( f(x) = 2(x-2)^2 + 3 \), \( f(x) = 2(x-2)^2 + 6 \), and \( f(x) = 3(x-2)^2 - 3 \). For two weeks, five days a week, one hour in class plus homework time each evening, our task was to create a notebook of different graphs. Imagine the tables of data (calculated by hand of course) and the mounds of graph paper over the two-week period. But, when we were finished, some of us had notebooks of graphs to support our conjectures.

Today, with the capabilities of computer-based, digital technologies, this same lesson can be accomplished in one class period in a very different manner. Technologies such as Microsoft Math provide for whole class collaborative exploration of the ideas with the possibility of students also working individually or in small groups. The slider capability in the graphical interface allows students to explore the transformations of the graphical representations dynamically, making multiple changes in the variable within seconds and visualizing the graphical representations almost instantly. The effect may perhaps best be described as an interactive video display of the changes where the student is the one directing the video. By the end of the class period, students are able to dynamically generate additional graphs to support their proposals.

The question is: What mathematical understanding have students lost and what have they gained using this technology? In both cases, the focus is on visualizing the mathematics. The dynamic capabilities of the newer technologies engage students more quickly into the idea of mathematical reasoning. The paper and pencil version takes lots of time, is often error-prone with many opportunities to lose student interest and engagement in the ideas. The dynamic version has the capability for multiple classroom organizations in the exploration. Of course it may progress too quickly for all students. And students may be losing the opportunities for graphing. Or will they? Maybe they are gaining a better sense of sketching the graphs as a result of the investigations. Rather than focusing on the concern of “ability to create graphs,” these dynamic visualizations may be providing access for more students to the mathematical ideas. Perhaps the argument is similar to the one about the importance of long division. “Dad, why do I need to know how to do long division by hand?” As indicated in an edited version of the cartoon character Adam’s response to his son: “I told you, in case some super strain of virus renders all technologies with dynamic capabilities, especially those in computers, watches, and cell phones, useless” (Oregonian, April 29, 2008).
Research, Deconstructed

“If we knew what it was we were doing, it would not be called research, would it?”
—Albert Einstein

One of the greatest challenges in guiding students through a research project is helping them break the complex research process into manageable steps. This is even more challenging today when information overload can be daunting to even the most savvy researchers. Teachers struggle as well with how to create and manage good research projects. To the rescue comes the Research Project Calculator (RPC) and Teacher Guide (http://elm/you.org/research). Based on the research process outlined in the Minnesota Educational Media Organization (MEMO) Information and Technology Literacy Standards, the RPC breaks the research process into the following five logical steps:

1. Question
2. Gather
3. Conclude
4. Communicate
5. Evaluate.

Students choose the format of their research product (essay, slideshow, or video) and enter the assignment due date. The calculator estimates the dates by which each step of the process should be completed and, using a question-based approach, provides a script for the information-seeking process. A simple and concise guide for the complex process, the calculator walks students through the five steps, providing resources for each step. Students can print a one-page version of the research guide with due dates or e-mail the document to themselves. They can also elect to have e-mail reminders sent.

A Teacher Guide has recently been developed and added to the calculator. Intended to assist teachers in guiding students through the research process, the guide includes detailed instructions for teaching each of the five steps, “dribbling” exercises (for skill practice), and tip sheets. Special lesson ideas are included for overworked teachers. The RPC also includes a glossary, a rubric, and a link to the MEMO Information and Technology Literacy Standards. The tool is open source software and can be downloaded to individual district Web servers and customized to access local databases and/or files.

Intended for high-school-age students and their teachers, the RPC was adapted from the University of Minnesota libraries undergraduate Assignment Calculator and funded by MINITEX/MnLINK. Content for the calculator and the teacher guide were written by MEMO members Jane Prestebak and Leslie Yoder.

—Leslie Yoder is an information literacy specialist for Saint Paul Public Schools in Minnesota, and is President-elect of MEMO.
author’s update

Leslie Yoder

“Research is formalized curiosity. It is poking and prying with a purpose.”

— Zora Neale Hurston

In summer 2008, we updated and published the Teacher Guide, with lessons for media specialists and teachers to use in teaching the research process.

The Research Project Calculator (RPC) is being used extensively in Minnesota high schools and many college and university library websites link to it. One university website reports that the RPC was “designed to help you plan projects so that you get it done in bite-sized chunks over time instead of pulling an all-nighter.” High school teachers appreciate the manner in which the tool helps prepare their students for college-level research. Though it is intended for high school-age students, Robbinsdale, Minnesota middle school library media specialist Dawn Nelson regularly introduces students to it as part of a collaborative process with teachers. She reports, “The value of the RPC to me is that it gives me a framework on which to build a common language and process of conducting research, regardless of the subject area.”

Some states have downloaded the tool and adapted it to meet their own needs and standard sets. This development is very exciting to us, as it proves the universal value of teaching the steps of the research process and of the tool we created.

—written with Jane Prestebak, past president of MEMO and media director for Robbinsdale Schools
As an eighth-grade earth science teacher, I (Megan) take every opportunity to incorporate the idea that Earth is a dynamic orb, constantly undergoing irreversible change. Of the myriad subjects that encourage students to contemplate environmental change, perhaps the most consistently thought-provoking topic is pollution. My students at East Side Middle School are amazed to find out that New York City, where we live, is home to one of the world’s largest landfills or that U.S. drivers produce trillion of tons of carbon dioxide by driving SUVs.

I met Janet in fall 2001, when she was a doctoral student at New York University and was developing an interactive multimedia program called Pollution Solution. Her goal was to bring a real-world problem into the classroom that would challenge and motivate students. Janet came up with the idea for the program while reading the front page of the November 4, 1999, issue of the New York Times. She came across the article, “7 Utilities Sued By U.S. on Charges of Polluting the Air.” She thought about how relevant this issue was to the topics students were studying in earth science. This article became the basis for the software, which presents students with a sticky environmental problem and challenges them to investigate the possible causes and probable effects and, ultimately, to recommend a viable solution. This problem seemed like a perfect fit for my students. We began our planning, and in spring 2002, we introduced my students to the project.

Assigning Students to Be Environmental Consultants

East Side was fortunate enough to have received a technology grant, and as a result, each of our students...
had his or her own laptop computer to use each day in class. Pollution Solution puts students to work at a fictional environmental consulting company. The consultants are given a client, a utility company, which is being sued by the U.S. Justice Department on behalf of the Environmental Protection Agency (EPA) for violating the Clean Air Act. Students are asked to research what caused this problem and how best to fix it. After several weeks, they prepared their culminating project: a recommended, viable solution for the utility company. The various aspects of this environmental problem were presented to the students from multiple perspectives, thereby encouraging them to draw their own conclusions.

Introducing the Problem
The challenge was how to bring this problem to life for students. Janet cleverly decided to videotape her husband, who acted in the role of vice president of the utility company that was being sued. He addressed students directly, explaining the problem as if they were actually in his office.

In the middle of a phone conversation, the vice president of the company looks up from his desk and waves you and the other consultants into his office. As you take your seat, he abruptly ends his phone call, slamming down the receiver. He immediately launches into his explanation of the problem his company is facing. "I assume you've been reading the papers lately," he says. "My company is being sued by the Justice Department on behalf of the EPA for violating the Clean Air Act." He gives the details of the lawsuit and his reasons for needing consultants to advise him on what to do. He then asks you to recommend a plan of action: Should the company fight the lawsuit and risk paying possible fines? Or should it make a settlement with the EPA and agree to find alternative solutions to reduce emissions?

Janet and I were excited by the students' enthusiasm for the project. The video clip of the vice president of the company is a powerful hook. To see if they understood their role and the nature of the problem, I asked students to tell us whom they would need to speak to first in order to give their client the best advice on how to fix its pollution problem. One student said she would like to visit a similar factory to see if it operates differently. Another added, "I want to speak to a scientist to find out how to prevent acid rain." Some students said they would need to speak with the EPA to hear its side of the case. Others felt that talking with engineers would help them to learn how the utility plant operates. Clearly, the class was beginning to get a sense of the complexity of the problem.

Developing a Research Plan
Over the next several classes, students researched the problem using the computer program and the Internet. Their virtual office included a filing cabinet with important documents about the company and reference manuals full of valuable information regarding environmental science issues, such as relevant technologies, environmental laws and policies, and basic economics. The information students needed was either embedded in the program or made available through links to the Web sites of various organizations, including the EPA, Department of Energy, National Park Service, and the Center for Renewable Energy and Sustainable Technology. To introduce students to these resources, I demonstrated a few of the sites. Using the LCD projector, I displayed a map of the United States from the U.S. Geological Survey that depicted the acid rain levels of various cities across the country. (Editor's note: Find this and other URLs under Resources on p. 25.) As a class, we hypothesized why the acid rain levels differed. One girl in the back of the class noted that the Northeast had higher levels of acid rain. The girl next to her noted that the wind might carry pollution from one part of the country to the other. To demonstrate this point, I showed an animation of the jet stream from the Baltimore Sun Web site. This animation clearly shows how the pollution can travel across the country.

While students worked on their computers, Janet and I maneuvered our way through the consultant teams to address questions, offer ideas, or provide technical assistance. At one point during the first week of our project, Janet asked me to check out the problem statement that a student had typed. It said, in part: "The activists have protested that the company is burning massive amounts of fossil fuels and therefore creating more sulfur dioxide. Then, when the sulfur dioxide reacts with water, it forms sulfuric acid mist. Eventually this acid is rained out of the atmosphere and falls to the ground. This sulfuric acid destroys our environment by destroying trees and killing fish." Impressed, Janet whispered with a smile, "I couldn't have said that better myself."

Playing Roles
In the second phase of this work, students were challenged to become experts on one of four perspectives related to this problem: an environmen-
### PROJECT TIME LINE

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<tr>
<th>Week 1</th>
<th>The Problem</th>
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<td>An electrical utility plant is out of compliance with the Clean Air Act and is being sued on behalf of the EPA because the plant is releasing dangerous amounts of emissions. The company needs to make decisions about how to handle this problem. Should it fight the lawsuit or settle? In the long run, would it be better for the company to convert to a different type of energy source? And if so, how do the company’s executives decide what type of energy will be best for both the environment and their ability to make money? The company has hired you, an environmental consultant, to find a viable solution to the problem.</td>
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<td>Students discussed and researched the causes and effects of acid rain, the details of the Clean Air Act, the government’s economic policies, and similar legal cases.</td>
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<tr>
<th>Week 2</th>
<th>Developing a Research Plan</th>
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<td></td>
<td>Using the Pollution Solution program and the Internet, students worked individually to develop their own problem statement, hypothesis, plan of research, and list of resources they planned to use in order to research their problem.</td>
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<th>Week 3</th>
<th>Comparative Analysis</th>
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<td>Each group of four students was assigned a type of alternative energy source to research from various perspectives.</td>
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<td>Each student in the group chose to become an expert in one of the four categories: an environmental scientist, a lawyer, an economist, or an engineer.</td>
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<td>Each student was challenged to research all the pros and cons of that energy source from his or her perspective.</td>
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<td>The groups presented their analyses of their energy solutions to the class.</td>
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<th>Week 4</th>
<th>Final Report</th>
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<td>Based on their presented analyses, the students discussed which solution would be the most viable for the company.</td>
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<tr>
<td></td>
<td>The students wrote up their final recommendations for the company.</td>
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tal scientist, an economist, a lawyer, or an engineer. Each consultant team (made up of each of the four experts) was assigned an alternative energy source to research and then present to the class their analysis of that alternative from the four different perspectives. To do this, the team members needed to understand the economic, technical, legal, and environmental effects of one possible energy solution, so they could scientifically argue the pros and cons of it.

Each consultant team discussed the problem quietly. In one team, a girl leaned over, pulling her computer earphones away from her ear and asked the girl sitting across from her, “How much money can the company afford to pay?” Her partner, who had slid her earphone back, answered, “It says here that the company makes a profit of $6 million per year.” Another student who was listening in pointed out, “But they spent $10 million last year to repair their plant.” The first girl responded, “Well, if they spent $10 million to fix their plant, why couldn’t they have installed something to reduce their emissions in the first place?” Students were clearly coming to their own conclusions.
about how this problem began and, as budding scientists, were eagerly seeking solutions.

Reporting Their Findings
As their final project, the expert groups wrote up recommendations for the utility company based on their research. Afterwards, the class discussed which energy source was the most viable solution for the company to choose. As we watched them discuss and share their opinions, it was clear to Janet and me that students were not only becoming interested in the effects humans are having on the environment but also becoming vested in making a difference.

Looking at the Benefits of Problem-Based Learning
This type of learning atmosphere is student centered and allows each child to navigate through the Internet as he or she seeks to learn about a specific environmental problem. With regular benchmarks of student performance and individual and group assignments made clear at the beginning of the project, students were able to move at their own pace. Although all the same end goal of finding an energy solution, each student was encouraged to be driven by his or her curiosity and self-interest as he or she sought to learn about how pollution affects the environment. In the end, we found that students learned a great deal about the scientific concepts, such as the cause and effects of acid rain, the cause and effects of the carbon and water cycles, and the effects different types of energy have on the environment. But possibly of the greatest importance, they also became more aware of how the way we live affects the natural world.

In talking with teachers of other disciplines, we realized that this type of project could be created for a variety of curricula. With relatively simple technologies such as video and the Internet, problems that we see in the newspaper can be brought to life in the classroom. Teachers could videotape their relatives or willing friends to introduce the problem or perhaps have their class create a newscast about the problem. This can provide a wonderful hook to motivate students and really bring the problem to life in the classroom. Teachers can also adapt the project that we did by using the Pollution Solution Web site, which provides information about the case as well as the necessary resources to research the problem. When given the opportunity to solve real issues, students rise to the challenge and clearly benefit from becoming personally involved with these issues and seeing the effects humans are having on the environment.

Resources
Baltimore Sun Weather Maps: http://weather.sunspot.net/maps.asp
East Side Middle School: http://www.eastsidemiddleschool.com
Pollution Solution: http://mypollutionsolution.com

Megan Roberts taught earth science at East Side Middle School in New York City, where she is now the regional instructional supervisor for science. She was a research fellow at both the Woodrow Wilson Foundation and the Fulbright Memorial Foundation. Currently, she is a doctoral candidate at Teacher's College, Columbia University.

Janet Mauzheimir Zdansky recently graduated with a PhD in educational communication and technology from New York University. This fall, she begins a post-doctoral fellowship with Dr. Ted Hanford at the University of Kentucky in special education technology. For more information on Janet's research on problem solving or the development of Pollution Solution, e-mail her at letters@iste.org.
authors’ update

Megan Roberts and
Janet Mannheimer Zydney

After using the Pollution Solution software in Megan’s classroom, Janet decided to try it out in a high school setting. These 10th-grade students were using the software to prepare for the New York State Regents Exam on the Living Environment. The same benefits of the software in middle school could be seen in this high school setting. The real-world case within the software prompted students to use their scientific inquiry skills to come up with creative solutions to the problem. For example, one student thought the company could use a sulfur dioxide recovery system. She wrote: “This system removes sulfur dioxide as it is leaving the plant and converts it into usable (and sellable/profitable) byproduct, with no waste byproducts.” This student’s solution considered not only the environmental issue but also ways the company could financially benefit from the solution. This is a sophisticated solution to this complex problem and shows that environmental solutions can also be the most cost-effective solutions to companies in the long run.

One interesting anecdote during this high school pilot: several students didn’t realize they were actually learning scientific facts during the project because the content was presented rather subtly within the legal case. In fact, a couple of students even complained to their teacher that they didn’t feel the project was preparing them for the Regents exam. However, several weeks after project, the teacher excitedly e-mailed Janet about how well her students did on the Regents exam. Overall, 90% of her students passed. On the exam, there were a number of multiple-choice questions on air pollution and an essay question about acid rain. Almost all of the students received full points for their answers. The graders for the Regents exam were impressed with the students’ complex solutions (e.g., scrubbers, low sulfur coal). Many of the students left the test saying that they felt confident about their answers and several mentioned how well the project prepared them for the Regents exam. Although they appeared unaware of their learning of factual knowledge during the project, it is clear that they later appreciated the knowledge they had gained. This type of instruction did not present content overtly in a manner in which these students were accustomed, but they did in fact learn scientific content along the way.

Pollution Solution continues to be used in high school and middle school settings. Since the project, the Pollution Solution website has also been moved and updated. Teachers can now visit http://homepages.uc.edu/~zydneyjm/PollutionSolution/ to try out the project in their classrooms.
Kids Galore Helping Kids in Darfur

Third graders use technology to think and act globally

If you don’t believe that young children can change the world, then read the persuasive reflections of third graders who are trying to inform others about genocide in the Darfur region of Sudan. “Kids Galore Helping Kids in Darfur” is a service-learning Web site complete with historical background, letters to Congress, a podcast interview, individual persuasive reflections, fundraising options, and a guestbook. It grew out of a brief class discussion about the United Nations and international situations in which the lives of children are threatened. At the end of that discussion one child asserted, “We have to do something!” Another chimed in, “Let’s make a Web site!” That’s all it took. The seed was planted. What started as a brief current events lesson evolved into something much more interactive and powerful, a movement owned by the children who conceived and created it.

The Darfur Web site gained recognition from members of Congress, the state legislature, Amnesty International, and the Florida Holocaust Museum. This recognition was the result of momentum that would not have been possible without the Internet. The class effort continues to achieve results even as they move on. Furthermore, the framework of the Kids Galore project can serve as a template for other service learning projects across all grade levels. Creative planning and diligent application of curriculum standards will help justify the time invested.

Finding the Time
The greatest challenge to this project was how to find the time to make it happen. The only solution was to integrate as many curricular areas as possible and assemble collaborative groups that could work on different areas of the site concurrently.

At first, this task seemed daunting. However, viewing the project as an experiment and deciding not to set an aggressive deadline removed a considerable amount of pressure. The next step was to consider the educational goals for the year. The project spanned a number of curricular areas, including technology, reading, writing, language arts, and social studies.

Integrating the Curriculum
Covering required third grade content was easier than originally anticipated. An Internet scavenger hunt provided background knowledge and age-appropriate information about the situation in Darfur. The children recognized that they would not be able to complete this project without becoming well informed. They were intrinsically motivated to learn as much as possible because they were working on a meaningful, authentic problem. The class related deeply to the concept of losing home, school, and family members while being driven into the desert. The situation was especially real to them because it involved children their age.

Recording and sharing the research facilitated a lesson in expository writing. It built upon the students’ prior knowledge of paragraphs. These concepts were extended further when each student wrote a persuasive paragraph to encourage site visitors to take the time to learn more or donate to UNICEF. As the class learned the parts of a formal business letter, these skills were practiced in letters written to Congress asking for attention from the U.S. government.

The children honed interviewing skills and questioning techniques via a podcast interview with a local volunteer for SaveDarfur.org. The process presented a perfect opportunity to differentiate between closed and open-ended questions and to discuss the value of who, what, where, when, and why in journalistic writing.

Basic technology skills improved as a result of the daily computer work. The technology instructor commented on the typing speed of this class in comparison to the other third grade classes. In addition, the children practiced guided Internet searches, online research, scanning, Web development, and audio recording.

Making It Happen
Bringing this all together effectively and efficiently came down to organization. Eighteen students were divided into teams of three, consisting of a researcher, writer, and illustrator. Students were assigned to these areas based on preference. Each team worked concurrently on one of the six main topic areas. All of the children had an opportunity to write a formal letter and include a persuasive paragraph.

Consider the following steps when contemplating a technology enhanced service-learning project.

1. Involve the students in selecting a cause.
2. Review your curriculum standards. Highlight those that can be addressed as part of your project.
3. Start with these topics. Add or change topics as necessary to meet the needs of your project.

Learn More—Provide historical background and information.

Write Letters—Most causes can be advanced through letters to local, national, or international officials.
Give—Many nonprofit organizations are creating Web-based options for fundraising that will allow you to keep track of the funds collected by your class. Consider this option or use this section to give visitors instructions on how to give to your cause.

Listen to Our Podcast—Podcasts can be informational essays, interviews, skits, or news programs created by the students. Video is also an option.

Reflections—This section gives students the opportunity to explain why the cause is important. This is a great place for blogs, persuasive paragraphs, or editorials.

About Us—Take the opportunity to let site visitors get to know your class. Explain what motivated your hard work. Be sure to get parental permission before posting pictures of your students.

Guestbook—Students enjoy getting feedback from site visitors. There are numerous free guestbook options that will give you moderation rights. It also gives potential visitors a way to respond to your work other than donating money.

4. Share your site link with the world. Send it to your representatives in Congress, local officials, related non-profits, news organizations, stakeholders, parents, and other media.

5. Revisit the site often with your students.

6. Celebrate their success!

Resources

Amnesty International for Kids: http://www.amnestyusa.org/individuals_at_roller/AI_Kids/page.do?id=110136&n1=3&n2=34&n3=67

Audacity: http://audacity.sourceforge.net/download/windows


Darfur Web site: http://www.shorecrest.org/Darfur.html

Free Guestbook: http://www.a-free-guestbook.com

SaveDarfur.org: http://www.savedarfur.org/content?splash=yes

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www.iste.org/LL
This project remains one of the most memorable of my teaching career. Former students and parents continue to talk about the educational impact of this experience. I believe this is because technology empowered the students and provided a foundation for learning as well as an authentic means to make a difference in the world. It’s not easy to top that.

As a new school year began, I wondered if there was any way to maintain the momentum started the year before. I pondered this well into the second semester. Something very interesting happened when I least expected it. I owe that chance encounter to Twitter, a micro-blogging tool on which members post what they are doing in 140 characters or less. I had tried Twitter a few months earlier, but didn’t give it the time needed to build an effective network. I didn’t quite get it. For some reason, I decided to give it another try.

Within a few weeks came a “tweet” from teacher George Mayo. He posted, “Look what eighth graders are doing to change the world.” To which I replied, “Look what third graders can do to change the world.” George’s students were blogging about Darfur. I sent him the link to the Kids Galore site. We were both impressed. Coincidentally, George and I ran into each other in person at the Educon Conference in Philadelphia a few weeks later. We started talking about Darfur and brainstorming ways to get our students involved.

We ultimately came up with the idea to create a 48-hour blog for Darfur. My students used the content from the Kids Galore site to learn more about the conflict. Mr. Mayo and I built a wiki on which anyone could post resources (http://stopgenocide.wikispaces.com). The Kids Galore link was included. We created three blog prompts to which students could respond over a specific 48-hour time frame. In order to promote the event, the third and eighth graders wrote press releases. They shared them on Skype. We posted invitations on Twitter for other teachers to participate. Soon George’s and my students were Skyping with Bill Ferriter’s students. More and more students and teachers posted content to the wiki.

On March 6, 2008, our classes launched the Many Voices for Darfur blog (http://manyvoicesdarfur.blogspot.com). There were 677 posts from K–12 students across the United States and beyond. The students were thoughtful, respectful, and genuinely concerned. There was not a single inappropriate comment.

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