Virginia Society for Technology in Education

Journal

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VSTE Publications Update

The New Look of VSTE Publications

Greetings to our members across the Commonwealth and beyond! We trust the start of 2004 has been fruitful and enriching for each of you. We would like to take a moment to inform our members about the changes to VSTE publications. Over the past year, a number of exciting developments have resulted from the continued growth of the Virginia Society for Technology in Education. Responding to the feedback we received through the VSTE Publications Reader Survey we conducted during Summer 2003, combined with the goals of the organization's leadership, VSTE has adjusted its approach to the Journal and added a new publication, which we call the VSTE Edge. In the last section we ask for your help and input, which is vital to our mission!

VSTE Journal

Many of us on the VSTE Journal editorial committee have been or are classroom teachers. We are well aware of the need for articles to be first and foremost pragmatic, containing information that is useful for teachers, administrators, and staff development personnel. But pragmatism should never override the necessity of scholarship. Therefore, we are also convinced that articles appearing in the Journal must be well researched to give them a credibility that can only come from an adherence to what others have found.

For this reason, the editorial committee of the VSTE Journal decided in 2002 to increase the prominence of peer review. We instituted procedures and policies that would require articles appearing in the Journal to first pass muster with experts on the committee. This, we felt, would ensure the balance of scholarship and pragmatism. After all, we do not want to waste pages with material that is neither useful to educators nor neglects a connection to the wealth of information and research about educational technologies. If you have questions about the process, feel free to contact us.

The Journal will now be published two times per year, rather than three. We will have a Fall/Winter issue and a Spring/Summer issue. This particular issue is being published later than future issues will be (mid-November is our target date). The Spring/Summer version is planned for June. We feel that two issues per year will allow more time for the

The VSTE Journal is published by the Virginia Society for Technology in Education.

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development of the type of quality articles we would like to see. The extra time also gives the peer review process more time to work.

The look of the Journal has changed slightly for this issue. We want to be as efficient as possible in our use of page space for the sake of saving the number of pages needed to print individual articles or entire issues. Readers might also notice that the archiving of articles on the VSTE website has also changed. Rather than only being able to access entire issues, readers will now be able to select individual articles to download.

VSTE Edge

The Edge is a new publication that will be delivered directly to subscribers' e-mail addresses at least three times per year. Those subscribing to the Edge (it is free for all members, and membership is free too, so it is quite a bargain!) will receive a concisely formatted "letter" that contains descriptions and links pointing to useful electronic resources for the classroom, insightful articles, and "how-to" tips concerning educational technologies. Whereas Journal articles must include ties to previous research, information in the Edge is more anecdotal in nature.

The Edge is not peer reviewed, per se, but information published in it will be what we call "peer approved." Links, summaries, reviews, and articles must first be approved by at least one member of the Edge editorial committee, which is separate from the Journal's editorial committee.

Archives of the Edge will also appear in PDF format on the VSTE web site, even though the original version will be formatted for electronic mail. The first issue of the Edge is planned to appear around the VSTE Annual State Technology Conference.

Your Help is Needed

So where do these articles and materials come from? They are written by people like you – educators who are committed to ensuring that their students get the best possible education through exposures to a number of unique, creative ideas and methods. The talented group of experienced educators on our two editorial committees is not enough to create a quality publication. We need your help.

For those of you interested in teacher-based research, or if you have an interest in a particular area of instructional technology research for teachers at any level (K-Higher Education), we invite you to submit articles to the VSTE Journal. Articles about technology in staff development or educational administration are also welcome. If you simply have a few resources to share, or if you simply want to write up a classroom experience or lesson plan, we welcome your submission to the VSTE Edge. If you are unsure of where an idea fits, please contact one of our two editors and we will be happy to help.

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But perhaps you are also interested in getting more involved with VSTE publications? We are always interested in hearing from those who would like to get involved in the editorial process. You need not have vast publication or editorial experience, but you should have a desire to produce quality publications for use by your peers in Virginia and throughout the nation. Please do not hesitate to contact us if you would like to be a part of the publications committee.

So, whether you would like to contribute an article, idea, or volunteer to work with us, we look forward to hearing from you! Our contact information is found below.

Best regards,

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Right-Here, Right-Now: Real-Time Technology Staff Development

by Tammy Pandina Scot and Diane Harding

Your school has just received some new probeware. How should you introduce it to the staff? A quick plug at a faculty meeting? A show-and-tell demonstration by your technology super-teacher? An after-school workshop? There is an alternative—a real-time, project-based model that will get the whole school involved as a community of learners, students and teachers alike!

Rationale

Most of us have realized that technology integration is more than opening boxes of shiny, new toys. It is about helping teachers to know how to use technology to teach in powerful ways, harnessing the potential of 21st century tools for teaching and learning. This requires staff development that looks at content-specific applications of technology and new pedagogical applications for teaching and learning.

Helping teachers learn to integrate technology into curriculum is a critical factor in the successful implementation of technology in schools (Sivin-Kachala & Bialo, 2000). When teachers integrate technology into the curriculum, changes in teaching and learning can take place (Mann & Shafer, 1997; Page, 2002; Christmann, Gadgert, & Lucking, 1997; Ryan, 1991; Kelley & Ringstaff, 2002). Research suggests that teaching with technology facilitates pedagogical changes in teaching, to a more student-centered, constructivist approach (Tiene, Luft, 2002; Trilling & Hood, 1999; Penuel & Means, 1999; Silverstein et al., 2000; Statham & Torell, 1999).

Teachers need to know how to use technology before it will have any impact in the classrooms. A report examining the results of over 300 studies of technology use concluded that teacher training was the most

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significant factor influencing the effective use of educational technology to improve student achievement (Sivin-Kachala & Bialo, 2000. Many interesting, authentic learning opportunities are possible for students when their teachers embrace technology as a mindtool (Jonassen, 1995), but first, teachers need to develop new technological, pedagogical and content-specific knowledge. How can this learning be facilitated?

Problem

We are back to our original question, how should we introduce our new technology to the staff? Research shows that our most frequently used training techniques are ineffective. Workshops are the most commonly employed method for instructing teachers about technology. While many teachers have participated in this type of training, most report that it was too short in duration and too limited to be helpful (National Center for Education Statistics, 1999b; Ringstaff & Kelley, 1999). Research demonstrates that when staff development opportunities for teachers employ workshop methods only 10 to 15 percent of teachers actually use the new skill in their classrooms (Joyce & Showers, 1995). As Fullan and Stiegelbauer (1991) observed, "Nothing has promised so much and has been so frustratingly wasteful as the thousands of technology workshops and conferences that have led to no significant change in practice when the teachers returned to their classrooms."

Our Solution: Real-time Staff Development

Staff development can be authentic and delivered in a way that teaches both students and teachers alike. We are experimenting with real-time staff development in which technology leaders spearhead school-wide, project-based learning with an inquiry approach. Introducing technology through a project that has a school-wide appeal insures community involvement and promotes the use of technology in an appealing, non-threatening way. It is especially useful as an introduction to new hardware and software while simultaneously modeling project-based learning. Whether you are introducing new hardware like digital microscopes, cameras or probeware, or new software such as a graphing program or a database program, this staff development model can be used to promote powerful uses of technology in your school.

The advantages to real-time staff development are many. What do classroom teachers have the least of? Time—time to learn new technology and new approaches to teaching. And, time to teach. Real-time inservice lets teachers learn and teach at the same time. They learn what they need to know about the newest technology tools and techniques where and when they need them. Right here, right now, right in their own school. When a technology liaison steps in to teach in tandem with classroom teachers, teachers and students both get real-time, in-sync teaching and learning. A technology liaison could be a technology resource teacher, an administrator or a classroom teacher with a special interest in or expertise with a "piece" of technology.

Staff Development, continued

Background

We work in a large elementary school in Albemarle County, Virginia. Our access to technology has been growing in recent years and our teachers are open-minded about its use in their curriculum but they are constantly looking for ideas and examples for how to incorporate technology into their lessons. Some teachers have taken after-school technology workshops but with many competing initiatives—literacy, a new math curriculum, and Standards of Learning, to name a few, most teachers feel very protective of their after-school and planning time. In order to provide the technology support that our staff needed, the school administration has allocated staffing funds for a part-time technology resource teacher for the past three years. The technology office is a small room connected to the media center, off of the main hallway. This is a central location, a significant factor in our story.

It began when the new gifted teacher asked if she could place a bearded-dragon lizard on the table outside of our door. After a few hours in his new home, this lizard began to draw crowds and attention. This attention has not waned since September. Classes notice him on their way to and from music, PE, and lunch. Students and parents comment on his habits and growth during drop-off and pick-up times. Teachers, administrators, even the cafeteria personnel, visit the lizard's cage, talking to him like he is a wise counsel in a whirling world of activity. Literally, every person in the school stops outside of the technology office for a minute or two each day. How can this attention be harnessed for learning? With a little creativity and ingenuity, the possibilities are endless!

The first project was to find a name for the lizard. A few "how-to make-a-database for voting" sessions were held with interested teachers and a very simple, easy-to-use database was created. The prototype was field tested with a class of kindergarteners, some minor adjustments made, and we were ready to roll. A cadre of 4th grade students was trained to be on call as database helpers, and teachers were given hard-copy voting instructions with a screen shot so they would know what to do. Voting began the day after election day, a nice current-events opportunity. We borrowed an iMac from the lab and set it up on the table next to the lizard's cage. Classes came by on their way to Music, PE or lunch and within 5 minutes the whole class was able to cast their votes. Most of the teachers voted and several parents as well! We made sure that everyone knew what type of program they were using and were able to pepper the conversations around the computer with database terminology—*fields*, *records*, and especially *save*! When the voting was complete, we used the power of spreadsheets to display the results. From that week on, our lizard was no longer just a reptile in the front hall. He was Zipper, the pet that belonged to us all. Several classes used the database results to create graphs and many classes used the results to get some "real-life" SOL math practice by analyzing data and reading charts. Two fourth grade teachers were inspired by the database software and have taught their children to

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create databases to survey their classmates. The projects range from, "What is your favorite sport?" to "What genre of books do you read most often?" One class is taking on a whole school voting project for a spring naming of the garden guardians, scarecrow-like figures in the children's garden. The technology modeling inspired technology integration in several classrooms and increased the comfort-level throughout the school. What else could we do with this engaging lizard?

Several years ago, a parent bought an InTel digital microscope and a refurbished computer to donate to the school. That year, one teacher used this during a unit on cells and then it was put away into a science closet never to be used again until we set it up next to Zipper's cage. Now students frequently bring their parents to the Intel Play microscope and explain in English or Spanish that the picture on the computer screen is a "close-up" of Zipper's skin that he shed recently. Teachers stop by with their students to look at the collard greens that Zipper eats and and point to the cell walls, explaining how only plant cells have this structure. The microscope and computer are on a rolling cart so teachers can take them to their rooms, but most just use it where it is. Our lobby is becoming a community classroom.

We recently acquired probeware and were debating how to introduce it to the teachers. We quickly threw out the idea of a faculty meeting or a workshop and turned to Zipper for help. How about a school-wide science experiment that would introduce everyone to the digital probes and inspire some project-based inquiry?

We began with an appealing, easy to understand question. Is Zipper warm enough? How can we find out? We approached a third grade teacher, asking her class to design the experiment. Her enthusiastic response got this project rolling. We spent an hour team-teaching in her class modeling the process of scientific inquiry and using project-based learning techniques. The students focused the question to find out if Zipper's cage stayed warm enough when the temperature in the building was turned down on nights and weekends. In groups of three and four, they used laptops to research the habitat of the bearded dragon lizard on the internet, interviewed the custodian to get the facts about the building temperature and presented their findings on the wall above Zipper's cage for the whole school to discuss as they pass by. A fourth grade class has made a hypothesis voting database so that every student can record his or her hypothesis about the outcome of the experiment.

A 5th grade class has scripted the morning announcements and created posters to hang around the school so that everyone is aware of the experiment. This inquiry project is currently underway as of the writing of this article. The plan is for the temperature probe to be placed in the cage and hooked to a computer which records the temperature every half-hour. We expect that there will be a great deal of interest as the data grows before everyone's eyes and are anticipating that this will inspire many

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other uses for probes in the classrooms and around the school. For example, during their unit on sound, the 5th graders may design experiments to monitor the noise in the cafeteria, in the media center, and in the classrooms. Second grade students may use the probes to record changes in temperature, barometric pressure and humidity during their weather unit. Fourth grade students may discover how warm the soil needs to be before certain types of seeds will germinate as they study plants.

Zipper, the lizard, has been quite a technology emissary for our school, but the use of real-time, project-based learning extends beyond the boundary of his glass cage, beyond the walls of the school, to embrace the community at large. According to the principal, Matthew Landahl, "At a big school like this, it's great to see every child engaged. I see this as a community-building event where students are having cross-grade-level discussions and teachers are being made aware of new technology opportunities. The excitement is contagious. It would be almost impossible not to be involved."

Technology can be a powerful tool for teaching and learning. Sometimes all it takes is a shared vision and the promise of shared support to venture in new directions. We plan to turn our entire lobby into an interactive, museum-like community learning space. Please write or make plans to visit us (contact information below).

Conclusion

While this staff development technique is new for us, we do have a wealth of experience in teaching teachers to use technology. The first rule is to make it authentic and make it engaging. Keep the risks down. The joy of learning new things is contagious. Be respectful of teacher's time; there is never enough of it. This is the power of this staff development model. It is part of the curriculum and it is happening in real-time. Learning for both students and staff is taking place during the regular teaching day. If you want to try this in your school, we offer the following suggestions:

- Find a community location.
- Pick a project that has whole-school appeal.
- Model technology use that is integrated with the curriculum and powerful pedagogy.
- Communicate well—electronic and hard copy communication.
- Advertise to the school community.
- Get several classes at various grade levels involved in different aspects of the project to increase buy-in.
- Read about project-based learning.
- Give classroom teachers a major role in directing the project.
- Let students generate the topics for inquiry and search for the knowledge they need.

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Next time a new box full of technology "toys" arrives at your school, don't just unpack it, record the serial number, and then put it "out there" for check out. First, find a way to model its integration into the curriculum so that your whole school can experience the learning power that box contains.

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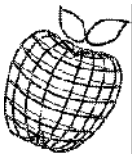

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Teaching Enhanced by Technology:

One novice teacher's experience with integrating technology into science teaching

by Jackie McDonnough and Ryan Templeton

Technological advances have ushered in myriad changes for our economic, social, and education institutions. The changes brought about in education have the potential to inextricably alter instruction within the next generation. These changes, though far-reaching, cannot be fully realized unless the gatekeeper of education, the classroom teacher, is willing to embrace these transformations. Teachers in essence have to transition from traditional instructional delivery modes to modes that include instructional technology. Use of textbooks and teacher lectures, the primary modes of content delivery, is no longer able to serve the information needs of students, especially in science education. Thus, teachers of science have to make a transition towards greater use of instructional technology to enhance students' access to current, relevant instructional resources.

The field of science is continuously changing and instructional technology can be used as a valuable tool in assisting teachers to stay abreast of new findings. Teachers have to seek out unique ways to keep content information current while maintaining academic rigor and sound science education pedagogy. The need is especially urgent in honors and advanced placement high school science classrooms. This population of students is generally technologically savvy in addition to being academically advanced. Thus, technology use for this population has to be woven seamlessly and meaningfully into instruction.

This paper will document one novice science teacher's use of technology for instructional and classroom management. He teaches both

Teaching Enhanced, continued

honors and Advanced Placement Biology at a specialty science and mathematics high school. Through the use of PowerPoint, video streaming, a self-developed technology nerve center and a class website, he has been able to increase students' access to current content, high quality graphics, and class materials.

Current Research

It is important for teachers to integrate technology into their classrooms because of its ability to provide instruction that accommodates various types of learners and to increase student academic achievement. Students may view pictures and animations, listen to sounds, and read and answer questions through the use of computers (Ostiguy & Haffer, 2001; Loegering & Edge, 2001-2002). Several textbook companies have CDs or Internet sites available for students to access, and they often include graphs, tables, pictures, and practice quizzes (King & Hildreth, 2001). The World Wide Web opens new realms to students and teachers by offering access to current scientific data, from databases, satellites, museums, online libraries, research institutions, and other science classrooms (Bodzin, 1997). Therefore, technology allows teachers to vary instructional methods through the use of multiple resources.

Increased student achievement is by far the most significant outcome of instructional technology use. Various studies of technology use in secondary and college science classrooms have confirmed this benefit (Siegle & Foster, 2001; Loegering & Edge, 2001-2002; Mantei, 2000).

Despite the obvious benefits, some teachers may need more motivation to make the drastic changes that use of instructional technology entails. The words of Paul Hurd, the eminent science educator, make the case that "those who see a reinvented curriculum recognize that science and technology have become the driving force in our nation's quest for a better society", and that we must "recognize that the nation is moving from an industrial age to an information age." Educators do not want to be left behind in the move that has already begun. Thus, teachers need to find ways to begin the process of change necessary to integrate technology into their instruction. Teaching Enhanced by Technology (TET) offers the novice educational technology user an avenue through which change could occur.

Teaching Enhanced by Technology

Teachers with little or no experience with using instructional technology will be more likely to make the transition towards fully integrating technology use into their instruction if they are allowed to make changes in small, incremental steps. The logical place to start is to focus on the 50% of class time that is devoted to content delivery. If guided by the following question: "How do I make instruction more engaging, current, and applicable?", they can then begin to seek out instructional technology components that can enhance their teaching.

Teaching Enhanced, continued

There are some basic guidelines that should be followed by these novice technology users to incorporate technology into their instruction. According to work done by Flick and Bell (2002) with pre-service science education teachers, the objective should be to integrate technology into science instruction in an authentic context that harnesses the unique features of the technology without sacrificing sound pedagogy. Flick and Bell suggested that teacher educators keep the following in mind as they design science methods instruction:

1) technology should be introduced in the context of science content;
2) technology should address worthwhile science with appropriate pedagogy;
3) technology instruction in science should take advantage of the unique features of technology;
4) technology should make scientific views more assessable; and
5) technology instruction should develop students' understanding of the relationship between technology and science.

Although these guidelines were developed for using technology in the preparation of science teachers, I contend that they are applicable to technology in the K-12 science classroom.

Teaching Enhanced by Technology supports sound pedagogical practices advocated by Flick and Bell while keeping the needs of the novice teacher foremost. The path to success of the novice technology user when incorporating technology into science instruction necessitates developing a plan that allows for acquisition of new skills in incremental steps. Teachers should begin by reflecting on their instructional needs and choosing a technology tool that would satisfy that need. Once a tool has been selected, the teacher will need to acquaint herself with the tool through professional development, peer or self-instruction. After a period of practice, integration into the classroom should begin on a limited basis. During this transitional period, the teacher should create opportunities to reflect on the success of the tool. Reflection, to be of value, should involve both an individual and a peer component. The individual component can take the form of reflective journaling focused on teaching practices and modifications based on those experiences. The discussion with peers of issues encountered while using technology may provide valuable insights and supports. The experience of one novice will now be explored.

Mr. T's Class

The participant is a novice science teacher at a specialty science and mathematics high school. He began his third year of teaching the fall of 2002. His began using technology during his second year of teaching after observing more experienced colleagues' use of presentation software and grade management tools. He now uses technology for instructional and classroom management in both honors

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and Advanced Placement Biology. Through the use of PowerPoint, video streaming, a self-developed technology nerve center and a class website (URL at end of article), he has been able to increase students' access to current content, high quality graphics, and class materials.

PowerPoint presentations are used on a regular basis to present lecture notes, announcements, and quizzes. Graphics and streaming video are downloaded from the textbook publisher and integrated into PowerPoint presentations. Notes for the honors classes are available for downloading after the class lecture. Advanced Placement students have access to class PowerPoint presentations after the daily lectures. PowerPoint presentations are also used for the administration of daily quizzes based on assigned readings. Daily quizzes, which do not need to be photocopied before class, are displayed using PowerPoint. The questions are presented one per slide and the final slide contains all five questions. These questions are short-answer, and answers are often one to two sentences. For example, a question might be phrased as "How is the energy in adenosine triphosphate released?", or "What is the sugar produced from photosynthesis?"

Streaming video is a new media format available form the Internet. Video clips on most science topics at all grade levels can be accessed on the web (URL at end of article). School systems or individuals contract with the company, United Streaming Video, to have unlimited assess to their materials. The material can be downloaded and used in segments by inserting them into PowerPoint presentations or as stand alone video clips. This media can convey in a unique way specific content that cannot be shown in still pictures. An added advantage to time-strapped teachers is that the technology provides easy access to high quality video segments without having to reserve a video, VCR, and monitor ahead of time from the school's media center.

For example, in a typical lesson concerning cellular division, students may not be able to visualize the significance of the mitotic events if shown only four or five "snapshots" depicting prophase, metaphase, anaphase and telophase. A short video can show these stages as they truly are: critical actions within a dynamic process that is not easily broken into individual points. Students can see through motion that the steps of mitosis are not simply isolated stopping points, but in fact sequential phases that mesh together and accomplish a common purpose.

An LCD projector is used to project computer, VHS, and DVD images. The larger screen allows for more dramatic visual presentations. Sound quality is enhanced through the use of purchased speakers. This setup is also used to present video segments to introduce topics, stimulate discussions, and summarize topics.

Mr. T's use of the Internet is multifaceted. He accesses the web to show animations

Teaching Enhanced, continued

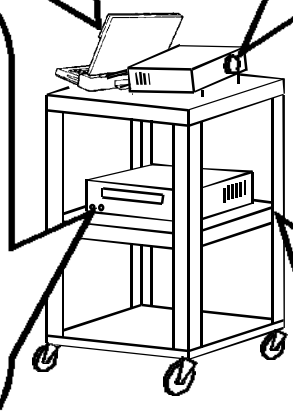
of scientific processes from the textbook web-site. He also copies and pastes test questions from the textbook site for use in class tests and quizzes. Virtual laboratory experiences are made available for AP classes.

To make the use of these different forms of technology convenient and trouble free, Mr. T has assembled a cart of equipment he has dubbed his "Technology Nerve Center" (TNC). The TNC consists of a utility cart with a desktop or laptop computer, an LCD data projector, and a VCR (see Figure 1). The TNC allows the instructor to seamlessly navigate among the variety of technology tools needed during a lesson.

Teaching with a Technology Resource Cart (Figure 1)

Computer Desktop/Laptop – ($699-$1000)
- Fits onto cart or nearby desk.
- Can fit a desktop tower on lower shelf if necessary.
- Recommend 1 GHz or higher processor with 256 MB RAM, CD-ROM/DVD drive.
- Allows access to Internet websites using school network.
- PC or Mac compatible.
- Use with Computer Speakers ($30)

LCD Data Projector – ($1400-$2000)
- Projects everything students need to see:
  - Notes
  - Video (VHS, CD-ROM, DVD)
  - Internet Website
- Speakers connect for flexible sound control
- Remote allows for quick transitions
- Choose appropriate lumen intensity



VCR – ($129)
- Primary use as a VHS player
- Play video series, news segments from TV, movies, or classroom videos made during presentations.
- Sound may be routed from VCR using an adapter available from electronics store.
- Input/Output may be reversed to tape a presentation.
- No more TV! Big screen feel and very mobile.

Media Cart – ($50)
- Whatever you use, allow space for it to fit on the cart.
- Mobile, convenient, accessible.
- Have it equipped with a power strip, only plug one cord in when traveling.
- Components may be affixed with plates and screws for security.
- Computer and projector usually equipped with safety lock port. Cables can then be looped around cart supports or desk.

Lighting – Dark rooms put students to sleep and make note-taking hard. Position your projector as close to the screen as possible so that it projects the maximum amount of light. Remove fluorescent bulbs directly over the screen if necessary.

File Transfer – Saving files on floppy may be difficult. Consider using a rewritable CD-ROM, Zip drive or other large capacity drive. Alternatively, files may be stored on the network and retrieved when needed. Save files to the hard drive for faster performance. And no matter what, back-up often!

Substitutes – You may consider training a student in each class on the use of the VCR with the projector, in case you ever wish to leave a video with a substitute.

Teaching Enhanced, continued

Students can access the class website to download handouts, laboratory assignments, pre-tests overviews and links to pertinent content information. They also have a direct link to their instructor's email to ask questions as necessary. Parents are encouraged to access the website to keep abreast of students' assignments or to contact the instructor. The site is linked to a grade level Research website. This website contains information specific to the yearly-required research assignment.

A typical day in the classroom would begin with students entering the classroom, where a large screen displays the words "Quiz 4-3". Students would take their seats and begin to review their notes before the tardy bell rings. Once class is underway, the instructor would use an infrared mouse or keypad to advance the slides to the quiz questions, pausing two minutes on each slide. During this time, the instructor may take role or monitor students as they take their quiz. At the end, a summary slide would display all questions and students would review their answers for correctness. The instructor would shutter the projector and collect the quizzes.

The instructor may then engage the students in a few minutes of discussion about the lesson plan for that day. This might be followed by ten or fifteen minutes of note-taking from instruction using the projector and a PowerPoint presentation. Students would be able to see vivid color slides that show more than they tell. Students are expected to make notes on what the projector displays and what the teacher says. During this period of instruction, a streaming video clip could be shown to reinforce the topic.

A laboratory experience would be prefaced by a pre-lab discussion, which could include digital pictures of what the students are about to see, again projected by computer. For example, if students are working with Drosophila flies, the instructor could show details that would aid the students in identifying males and females, as well as mutation phenotypes. In this way, the instructor can interact with all students at once, rather than individually at every microscope. The size and detail of the digital pictures enhance question answering and the files could be displayed later on a website for student review. Depending on the preferences of the teacher, class notes and lab handouts could be posted on a class website.

Mr. T. has increased his use of instructional technology dramatically since his first year of teaching but this change came about in small steps. He began by using grade management software to decrease the amount of time spent on grading. He then learned to use presentation software. A need by his students for greater access to science project research materials motivated him to learn web site authoring. Over time a synergistic relationship developed between his desire to improve instruction, students' needs, and his need for greater skills with instructional technology.

Teaching Enhanced, continued

Discussion

The use of technology by this instructor has had many benefits to both the teacher and the students. The teacher now has tools to deliver engaging content more efficiently. Integration of presentation software with lecture and laboratory exercises streamlines the content delivery and maximizes instructional time. Using the class web site, students can access reading lists, previous class notes, and tests. These materials convey a sense of organization on the part of the teacher and have the added advantage of allowing students to have greater responsibility for their learning. Students are exposed to high quality, current content information presented in a manner that increases their engagement. The class web site also allows parents to get up-to-date information about class assignments and instructional practices.

The typical advanced placement or honors science teacher is a person well versed in the content and in general has some educational technology experience. Students in these classes experience success to a greater degree than do students in lower-level academic classes. The conflict occurs when these teachers are asked to modify proven teaching methodology in an effort to integrate educational technology into their teaching repertoire. Using the steps outlined by TET, teachers can transition to instruction using a variety of educational technologies without totally restructuring their curricula.

Article Resource Links

Class website: http://chaucer.chesterfield.k12.va.us/~rtemplet/index.html

Science video clips: http://www.unitedstreaming.com

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The Reflective Teacher: An Action Research Primer

by Diane DeMott Painter

Editor's Note: This article is actually a combination of four articles written by Dr. Painter for the VSTE Journal between Spring 1998 and Winter 1999. Formerly the Research editor of the VSTE Journal (and later its managing editor), Painter wrote the articles for a special series she originally called "The Reflective Teacher."

This article covers a number of important issues regarding teacher-researcher, also known as action research. What it does not address is presumed: teachers who are interested in conducting research in their classrooms or in their schools will be readily familiar with policies that protect the rights of human subjects. There may even be research review committees in place to ensure students and their parents are protected. Teacher-researchers are strongly encouraged to check into these policies before beginning any quantitative or qualitative measurement, no matter how innocuous it may seem.

We are happy to offer our readers the material again with the hope that they will become actively involved in teacher-research. Other articles published by teacher-researchers in this issue exemplify the principles that Painter discusses here.

Teacher-research: What is it? (Part I)

In the late 1980s, I was awarded a grant to obtain an Apple computer for my special education classroom. When the computer arrived, I was truly amazed at how my students enjoyed using it to write. It seemed to me that they wrote more, revised more often, and were better able to edit their text because they could use a spellchecker than when writing using paper and pencil. One afternoon, my superintendent came into my classroom and watched a student typing a story at the computer. He asked me, "Can you prove that 'thing' is helping her write?" I chewed on that question for a moment or two before replying, "I do not believe a computer can teach her to write, but I do believe it is enabling her to write." He looked directly at me and asked, "How?" I did not have a definitive response and that really bothered me. It was then that I realized I needed to investigate what was happening in my classroom. I needed to observe, document what I was seeing and reflect upon what I documented. But I felt

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terribly alone and at a loss as to how to get started. I felt the need to talk with other educators who had the same interest in finding out and talking about what was happening in their classrooms.

Fortunately I discovered the Northern Virginia Writing Project and enrolled in a teacher-research course at George Mason University. I learned that teacher-research is a practical and action-based type of research that enables educators to follow their interests and their needs as they investigate what they and their students do. Teachers who practice teacher-research find that it expands and enriches their teaching skills and puts them in collaborative contact with their peers. Some people call it "action research" and by definition it is, "done by and for the people taking the actions and relates to the actions they are taking. Its purpose can be improving the practice of an individual researcher or it can be collaborative and focus on school goals" (Sagor, 1992, p. 3).

What is Teacher-Research?

Since the time that I took the teacher-researcher course, I have been actively involved in a teacher-researcher group at my last two schools. I have learned that teacher-researchers do a number of things with their colleagues. They:

- Develop research questions based on their own curiosity about teaching and learning in their classrooms.
- Systematically collect data and research methodology.
- Analyze and interpret the data and the research methodology.
- Write about their own research.
- Share findings with students, colleagues, and members of the educational community.
- Discuss with colleagues relationships among practice, theory, and their own research.
- Examine their underlying assumptions about teaching and learning.
- Assume responsibility for their own professional growth.

What are some of the effects of teacher-researcher projects?

- Increased sharing and collaboration with other teachers.
- Increased dialogue about instructional issues and student learning with enhanced communication between teachers and students.
- Revision of practice based on new knowledge about teaching and learning.
- Development of priorities for school-wide planning and assessment efforts.
- Contributions to the profession's body of knowledge about teaching and learning.

Reflective Teacher, continued

Creating Teacher-research Teams (Part II)

Introducing the Idea to Colleagues

You may want to introduce your idea at the beginning of the school year to allow for maximum time to develop research ideas, collect data, review literature, and write up your results. When you present the concept – perhaps at a faculty meeting – you may want to briefly share with other instructors what teacher-research is all about. Distribute a simple handout that outlines what teacher-researchers do with colleagues on a research team (see "What is teacher-researcher" above for points to include).

Hopefully you will find others willing to share the experience of being a teacher-researcher with you. Once you have found one or more colleagues interested in forming a Teacher-research Team (TRT), set an agenda for monthly meetings. A supportive administrator or a district office willing to provide start-up funds for administrative leave may enable you to meet once a month for half days. If funding to provide leave during the school day can not be provided, your TRT may need to meet after school. I would suggest that you cap each meeting with dinner at a local restaurant!

Getting Started With Your Own Teacher Research Team

Begin your first meeting with a discussion of the importance of maintaining a journal. Some teachers may tell you that they do not like to write. Emphasize that no one will see the journals, but it is important in the process of reflective-research that each teacher maintains one. Start with a free-write activity based on asking these questions:

- What do I want to figure out?
- What do I want to know about my teaching?
- What do I want to know about student learning?
- What classroom situation do I want to analyze?

After sharing highlights from the free-write session, brainstorm with your colleagues your interests, curiosities and questions. Marian Mohr, a teacher-researcher consultant, talks about the evolution of a research question. She suggests that TRT members recast their questions in several ways. Write your question first as a why statement: "Why do my students do…" or "Why do I do…". Next, recast your question: "What happens when...?"; "How does…?"; "What is happening when...?"

Settle on a question that you feel comfortable addressing and then brainstorm ways that you can collect data that may address the question you have chosen. As you begin collecting data, Mohr warns that you may discover that it will be necessary to revise your research question to fit the data.

You may find yourself asking, "Is there something else more interesting emerging

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from my data?" She encourages TRT's to conduct a midyear review of the research question by asking, What data do I have? What does the data tell me about my question? What other questions does my data tell me about? Is my question more complicated than I had previously thought?

Do not worry if you need to revise or even change your question. Remember, the research that you are doing is helping you become more aware of what is happening in your classroom.

Collecting Data

After a few weeks you may decide that you need to expand or change the ways that you collect data. There are a number of terrific books available to teacher-researchers about collecting data. Most of the ideas presented in these books teachers already do in the normal course of teaching. I suggest Brenda Miller Power's (1996) book, *Taking Note: Improving Your Observational Notetaking .*

Power stresses that the first step in taking good observational notes is to gather your supplies. Experiment with materials to find what works best as you observe and write about what is happening in your classroom.

My favorite suggestion is using "sticky notes." I keep a sticky-notepad on my desk to grab quickly when I need to make a few notations. Then I stick the notes inside my journal, which will serve as a reminder to me to write about what I observed. I do this "free-write reflection" later in the day during a quiet time to myself.

Power stresses that notes keep you focused on the parts of your job that really matter which are your students and their learning. She suggests that you:

- Keep thoughtful records of student learning;
- Build confidence in what you are doing;
- Get into a cycle of reflection and change;
- Write narratives about your students without making too many sacrifices in other areas of your life. (In other words, do not let Teacher-research consume everything you do!)
- Give yourself permission to write freely.

What you might write about may seem trivial and should not be polished thoughts. Free-writes are raw data and thoughts that will provide insights and are "raw nuggets of truth that will shape the rest of your note-taking agenda."

Power's article provides many other useful note-taking strategies such as video-

Reflective Teacher, continued

taking, audio recordings, and creating record-keeping forms (such as checklists for recording tally marks on frequency of behaviors).

She stresses that it is important to get into the habit of taking daily notes. She acknowledges that a teacher's time is short and the needs of students are great, but even with those constraints, teachers can still systematically analyze and improve their observational skills with daily note-taking practice.

Remind your TRT members to periodically review their notes and consider these points:

- Why do you think you thought these notes were important enough to write down?
- How do these notes connect with earlier entries?
- Based on what you are seeing, what actions do you think you should take in collecting data in different ways, or change the way you are teaching?

Understanding What We Know: Data Analysis (Part III)

This section focuses on the types of data collection classroom teachers might want to consider and ways to begin data analysis.

Types of Data Collection

When engaging in teacher-research in your classroom, you want to be able to collect data in ways that are conducive to your teaching environment and teaching style. Some of the types of data collections you might want to consider are:

- Teacher observations with log reflections (case studies or group analysis)
- Teacher observation checklists
- Comparisons of progress marks from each interim and marking period
- Assessment results (running records, student work samples, portfolio analysis, chapter tests, quizzes and standardized test scores, comparisons of pretest and post-test assessments...)
- Comparisons of writing drafts
- Observation notes from an outside observer(s) such as a teacher-research partner, university intern, administrator
- Audiotape and/or videotape recordings of student-centered or teacher-centered activities
- Opinion surveys and attitude questionnaires

After looking over preliminary data, consider what appears to be emerging.

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Important considerations when analyzing data:

- Curriculum/assessment matches- do the assessment methods fit into the curriculum or ways that match your teaching style?
- The context of the data- will it be possible to collect the type of data you have in mind considering your schedule and your classroom environment?
- Degree of change over period of time- do you think you will have enough time during the year to see a difference?
- The number of students and variables in your study
- The questions which the data is supposed to reflect- are your questions too broad? Or too focused for the data that can be collected?

Ways to Analyze Data

Triangulate. Look at the same question based on your topic from at least three separate pieces of data and three points of view. For example, those three might be your observations in your research log, recorded comments by a student (tape recorded comments or quotes you have noted in your log) and examples of student work.

Compare constantly. As you look through your data, keep comparing what you are looking at with what you saw earlier. Use different bases for comparison. For example, if you have compared what the students did in October with what they did in January, try comparing their written work with their oral work.

Categorize. Set up charts, columns, outlines, counts. Make up your own categories or borrow those of another researcher. Watch for ways your data develops into categories different from other researchers. Explore those differences.

Order. Decide on an order and try it out on your data- chronologically, by importance and by frequency (how often it occurs).

Contrast. Look for what doesn't fit your assumptions or theories, what sticks out, goes against the grain. Look for what doesn't fit the theories of other researchers.

Speculate. Try out different hunches about what your data means. Make an educated guess and then see if it is supported by the data. Do not stick rigidly to an assumption or hypothesis you may have had. Imagine the world anew.

Renew. Rewrite your question many times, changing it when necessary to fit what's

Reflective Teacher, continued

interesting in your data. What is it you really want to figure out? Sometimes you will make the question more global, sometimes more tightly focused.

Visualize. Map out your data and draw it all on one page. Sketch the metaphors that come to your mind when you think of your data and what it means. Use colors and shapes to separate ideas.

Abstract and distill. State the essence of your findings as if you had to explain them in 50 words or less. What matters most in this data? Write as if you had been invited to speak at a conference and had to send an abstract of your work for the conference program.

Talk and validate. Explain your data interpretations to others and see if they can see what you see. Consider their different interpretations and use them to clarify, broaden and otherwise validate your findings.

The Influence of Teacher-research (Part IV)

This section illustrates several examples of how teacher-researcher projects often influence initiatives related to curriculum and instruction, planning and evaluation, and staff development.

Reporting the Findings

Susan and William Stainback (1988) provide some very useful tips about how to write a qualitative study that can be helpful when writing teacher-researcher reports. In their book, *Understanding and Conducting Qualitative Research*, they state that the purpose, characteristics and collected data (findings) need to be considered when deciding on the form and content of the report. Teacher-researchers most often write a report that is a storytelling involving "drawing a portrait with words" to provide a "personalized, emphatic understanding of their research setting" (i.e. the educational environment). They suggest that teacher-researchers begin their reports with a clear statement of the focus or purpose of the study. This gives the reader a better understanding of the theoretical framework that is guiding the study. Background information can be presented by briefly reviewing the professional literature or summarizing the current theories, concern(s), or debate(s) related to the focus of the investigation. Next, the research question needs to be stated along with an overview on how the research report is organized. This will provide the reader with an understanding of what is to follow. A clear description of the methods used in the study is important for the reader to understand the findings. The site(s), setting(s) and participant(s) should also be described (pp. 62-63)

Erickson (1986) states three types of information that should be reported: particular description, general description, and interpretative commentary. Particular description involves reporting polished versions of what is in the field notes and other

Reflective Teacher, continued

documents or materials. Actions of the participants, their comments during observations, and setting conditions are examples of particular description.

General description involves providing the reader with a summary of what occurred. The researcher should also link a key event to others like it, or an event unlike it, so that the reader can understand the relationship of the various events to each other. Summary tables or charts are useful for this purpose.

Interpretative commentary involves meaning as perceived by the researcher. The purpose of interpretative commentary is to provide the reader with the researcher's analyses and interpretations of the data and provide a discussion about practical significance of the findings and how they may relate to the theoretical framework that guided the study.

Finally, the report's conclusion section often refocuses on the purpose of the study and summary of the findings. Limitations of the study and implications for further investigations are commonly included in this section.

Publishing

When writing the paper, teacher-researchers need to keep in mind that they are first writing to better understand what the research implications mean to them. The implications are therefore important because the study was meant for them to better understand their students, their teaching methods and their particular teaching environment. To other people reading the research it will be important if they can relate to the study in some way. That may mean that the paper might be read by a fellow teacher, parent or administrator who wants to know more about the research topic and what was found. In some cases, a wider audience may read the paper such as readers of educational journals or magazines. Therefore, teacher-researchers need to think of the audience and the publishing criteria when writing the report. Publishing criteria for educational magazines and journals can usually be found inside the front or back covers of the publications. Most teacher-researchers who work in teacher-research teams first publish their reports in a team collection. This collection of TRT articles can be run off and bound or placed in a notebook and distributed to fellow staff members at their school or placed in the school library. At my school we also send a copy of our TRT articles to our school district's area superintendent and to the school system's staff development office. There are also Intranet and Internet publishing opportunities. Reports can be summarized as short articles and placed on a school's Intranet website in a section devoted to teacher-research.

Another way to disseminate findings is to present a project as a short report during an informal sharing/discussion session at school, or as a conference paper at educational conferences, such as the VSTE Conference (held in the Spring), regional

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conferences, or other conferences such as those sponsored by ISTE, AECT, AACE, or subject-specific consortiums.

Finding Resources to Support Teacher-Research

Finding the time to meet and talk about findings and determine their implications can be difficult. It is often helpful to find staff development funds to provide for substitutes so teachers can meet as a team. Reproducing reports and going to conferences to report findings can also be expensive. Fortunately there are a number of organizations that recognize and support teacher-research initiatives. Other associations that support teacher-research initiatives are:

- Virginia Reading Association
- International Reading Association
- The Spencer Foundation
- National Council of Teachers of English Research Foundation

The U.S. Department of Education's Office of Educational Research and Improvement published a guide for educators with little or no formal training in research or evaluation. It has some wonderful teacher technology surveys and rubrics to determine technology competency and staff development needs. It is entitled, *An Educator's Guide to Evaluating the Use of Technology in Schools and Classrooms*. The URL for the guide can be found at the end of this article.

How Teacher-Research Projects Often Influence Whole School Initiatives

Although the primary purpose of teacher-research is for teachers to learn more about themselves as teachers and how they teach their students, discover how to address student needs, and improve the instructional program, many schools see the work teacher-researchers do complimenting the goals and objectives set forth in school plans. Quite often school plan initiatives have the same focus as teacher-researchers when it comes to looking at the instructional program and how to improve it. Betsy Sanford at Lemon Road Elementary School addressed the Fairfax County School Board in February, 1997 and said,

In this, the third year of our Lemon Road teacher research group—a time during which teachers have pursued such varied topics as how students develop spelling strategies, the inclusion of LD students in the regular education program, and how we develop a school-wide vision of technology use. The program at Lemon Road is beginning to benefit from the hard look we've taken, singly but in a collaborative setting, at instructional issues. Not one of us has all the answers, but together we have a way to search for answers.

Reflective Teacher, continued

In another example, a team of four to six grade teachers at Mosby Woods Elementary School developed and tested a rubric to assess students' strengths and needs in report writing. A comparison between the data collected in Fall 1996 and Spring1998 indicated improvement for all three grades in planning for and in writing the final report. Several implications emerged from this instructional inquiry study. Chief among them was the development of a scope and sequence for research and report-writing skills that provides a common vocabulary for planning and developing lessons and procedures. (Impact II Star, Winter 1998).

At Deer Park Elementary School a group of teacher-researchers investigated "What Happens When Students Work in a Student Learning Team Environment to Complete Multimedia Research Presentations?" Their findings led the team to make several recommendations to the staff in the way technology initiatives are implemented throughout the school:

1) Encourage teachers to make careful considerations when grouping students to create project teams, keeping in mind strengths, weaknesses, temperament, and independent working skills;
2) Emphasize keyboarding skills and completion of keyboarding lessons during the first half of the school year in grades three and four so that students are more proficient with keying in text when they begin projects in the second semester;
3) Develop and provide guided lessons in reading information and note-taking skills along with making use of a structured note-taking form when conducting research projects;
4) Allot more independent work time at computer stations in the classroom which would enable students to be more creative with their projects; and
5) Develop and use rubrics to assess the quality of the presentations as well as independent work skills. Part of the school plan that addresses independent learning came from teacher-researcher findings and recommendations.

As school systems investigate instructional programs and strive to find ways to improve student achievement, they often look at "what is happening" using traditional educational research methods such as standardized testing, surveys and other quantitative methodologies. The work teacher-researchers often do helps to explain the "why" of what is happening because teacher-research provides interpretive research through its qualitative approach to research. Teacher-research is concerned with the questions that arise from the lived experiences of teachers and everyday life of teaching expressed in a language that emanates from practice. Teachers are concerned about the consequences of their actions, and teacher-research is often prompted by teachers' desires to know more about the dynamic interplay of classroom events. Hence, teacher-research is well positioned to produce precisely the kind of knowledge currently needed in the field. (Cochran-Smith & Lytle, 1993, p. 5-22).

Reflective Teacher, continued

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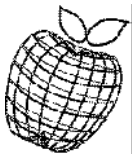

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What do students think about computer ethics?

by Gail Chmura

Editor's Note: This article first appeared in the Fall 2000 VSTE Journal. We are republishing it for two reasons. First, this work helps emphasize VSTE's commitment to keeping our readers aware of ethical uses of technology. Second, it is a good example of a teacher-research project, something we encourage all of our educators to participate in and write about.

Overview

Chmura's teacher research project conducted at Oakton High School (VA) raises serious questions about how and when educators should address issues related to ethical uses of computers and copyright laws. Chmura's computer science students were required to review articles related to moral and ethical attitudes of computer use. From the project papers the students had to write, Chmura discovered a variety of interesting reactions and opinions held by her high school students that led her to conclude that children should be made aware of computer ethics and etiquette at a very early age. In addition, the unspoken acceptance of unethical computer practices at home and at school may contribute to a wide variety of copyright and plagiarism issues that educators face in schools today.

Introduction

From a very young age, children enthusiastically use computers with both positive and negative support and role modeling from their parents and their teachers. Many parents often suggest borrowing software from each other, much like loaning a video among friends. Unlike video swapping, though, most people who borrow computer games or other software copy them onto their own systems for continued use.

When they return the borrowed disks, there's now a duplicate on their computer and two households are using a product that was legally purchased for use in only one household. The children know the software was not purchased by their parents. After all, there's no box or instruction booklet, etc. Parents may not say to their children-"It's OK. Joe's dad let us

Computer Ethics, continued

have a copy of his new game. Don't worry about it. No one will ever know that we are using an illegal copy." It's an unspoken acceptance of an unethical practice and an unethical lesson that is presented to the child as being OK to do. It's a lesson that it is OK to do wrong things if no one can catch you.

When children use computers at school, they are constantly leaning over into each other's space, sharing ideas, seeing how someone else does something and often times intruding to the point of even typing on the other person's keyboard. This enthusiasm for sharing and helping is encouraged by the teacher, without any restrictions or qualifiers put on the activity. Yet teachers do not understand why older students see nothing wrong with continuing this behavior. Teachers now try to discourage it but cannot understand why students are so quick to copy from each other without any remorse or sense of wrongdoing.

Ideas and computer work were OK to share, but not actual written answers. When these same students were younger, they were reprimanded for leaning over a friend's desk and looking at his paper to get the answer to a problem. With paper and pencil, the teacher's rules were different.

Students were taught to stay in their own space at their desks. But wait a minute! Do teachers really expect students to understand the difference between sharing and copying from the computer versus from a handwritten paper product or from an Internet source or from a textbook? What happened to "It's OK. Help each other. Information is public property. Use it!"

As children get older, the borrowing definitely broadens further than among a couple of households. Students become independent and use computers without adult supervision. After all, weren't the adults only watching to make sure the younger children did not "break" the computer?

Were parents really ever a concerned with what the child was "doing" or "seeing" on the computer? In this unsupervised environment, do adults think the "copying" mindset will suddenly vanish? Will the earlier, unspoken misconception that "It's OK to do something wrong if you can't get caught" change because the students are older? Why should students "know better" now if no one has ever discussed ethical issues with them?

"Hey, did you finish the report for history yet? I'm having a terrible time finding enough information."

"Yeah. I finished it. I copied things I found on the Internet. It's so easy to write reports now. Mr. Jones will never know I didn't write it myself."

"Well, I have Mrs. Smith. She'd figure it out!"

Computer Ethics, continued

"No way! Say, why not take a copy of my report and turn it in. You'll have to change the heading a little, but it's OK. No one will ever know."

"Gee, thanks! That will help my stress level a lot. I have so much to do, and we have a long soccer practice today."

Because of conversations I have overheard like this one, I added a section to the ethics project I assign to my high school computer science classes (see Lesson Plan, attached at the end of the article) I wanted the students to express their own beliefs of right and wrong and to weigh their behavior against their beliefs and standards.

The project required students to self examine their behavior and their attitudes toward the rights of others, including software authors, teachers, Internet sources and classmates' work; and to suggest ways to address these ethical issues. I was very specific about the grading procedures in order to let students know the importance of each assignment (see Grading Rubric attached at the end of the article).

Ethics Paper Follow-up Evaluation

After you read the paper(s) given to you today, please answer the following:

1. What was the message/opinion stated in this paper?
2. Do you agree with the writer's opinion and explain your reasons?
3. Do you think the writer referenced outside sources to write the paper? Why?
4. Did the writer give credit to the references used in writing the paper?
5. Do you think it is OK to copy information from sources written by others without giving them credit in your work? Why?
6. Rate this paper from 1 to 10, based on clarity of the opinion stated and strength of argument. Defend your opinion. (1 is the lowest score)

Rating: _____

In addition, the project required the students to review a classmate's paper to express whether they agreed or disagreed with the opinions expressed. This exercise also focused the students' attention on the need to adequately cite references. Students used the guide to the right:

Then to complete the project, students wrote a follow-up reaction which called for them to read an article regarding moral and ethical uses of computers and to make a final summary statement reflecting each student's opinions on the subject (see Follow-Up Sheet, attached at the end of the article).

I do not use software that is not legally licensed for classroom use, and I have always emphasized legal issues involved with copying software, not allowing students to make illegal copies of software so they could work at home. Some of my students cannot believe the rules and responsibilities I expect them to follow.

Computer Ethics, continued

When our classrooms gained access to the Internet this year, a new dimension of ethical issues and rights and responsibilities of students surfaced. Issues came up such as viewing inappropriate information-profanity, pornography, criminal activities, viewing other people's email, downloading software or Internet information from school computers for private use, and posting inappropriate information on web pages.

How was I supposed to control and monitor what thirty students were doing at any given moment? I already knew the students would do whatever they could get away with, but how could I instill a sense of morality regarding computer use and etiquette in each individual?

Some of the responses I got from my students were very insightful. I hesitate to share their statements because I am not sure if they are their own or if they are taken from information they borrowed without giving proper credit. (Yes, students plagiarize even on a paper about ethics!) In any case, I do have permission from my students to use the statements they made in the various stages of their ethics projects.

Regarding the illegal practices of copying software programs:

1. If parents copy games and other programs when kids are young, the child will grow up thinking it is OK to do it, too.
2. If so many people don't think it's wrong to simply copy a program, why shouldn't the law reflect this?
3. Copyright laws have to change since the majority of people don't follow them or agree with them.
4. People who copy programs raise the prices for those who do not.
5. The easier a law is to break, the more often it will be ignored.
6. The only way to counter software piracy is to raise children with high ethical standards. It is something that CAN be taught.
7. Many people think of sharing software in the same way they think of sharing tools or household items. They do not see the fact that at any given time, there is only one rake or lawnmower being used by one person. When you copy software, it has reproduced, and is now two pieces of software, each usable by different people at the same time.

Regarding Plagiarism:

1. The fact that computers can reproduce information makes people believe that copying other people's work is not a crime. Just as it is wrong to blame someone for something they did not do, it is wrong for people to expect credit for something they did not do.
2. The facelessness of information is what makes people believe they can rightfully claim it as their own. If Internet users keep in mind that there is a person's face behind the information they are using, they would be more likely to cite it properly.

Computer Ethics, continued

3. Good students are pushed to cheat (i.e. plagiarize) when teachers give them too much work and not enough time. Teachers need to be more willing to listen to complaints of students and to change due dates and adjust the workload when necessary.

Regarding teaching young children computer ethics:

1. Ethics awareness must begin early in the schools and at home. Children must be taught that copying from a friend's computer disk or monitor is wrong. They must also be punished as if they were caught cheating on a test or copying homework. The question of cheating must be expanded to include copying information from a computer.
2. Parents must monitor and teach children from an early age where to go and where not to go on a computer.
3. When a person is a child, he or she should be taught right from wrong and have it stressed that doing wrong things is really bad, and if they do anything bad, they should be punished.
4. Children in today's world have been brought up to believe that information is free. For example, they think nothing of photocopying a magazine article or copying their friend's computer program or game. Parents need to teach their children to have an ethical code of behavior for what is right or wrong.

Regarding Industries' Responsibilities

1. Computer engineers work, make and discover new things and don't even think of what society will do with them. The ethical issues we face with the Internet should have been considered before the product was released to the public.
2. If software companies really feel so strongly about people copying and sharing software, why don't they put more copyright safe guards on their products?
3. Copying for educational purposes should be made legal.

Regarding the Older Generation's Attitudes

1. The concepts of right and wrong are not clear to most computer users today. Therefore, even the most moral person could easily think differently than the law and commit a computer crime unknowingly.
2. The previous generation has felt comfortable violating copyright laws. They have passed that on to the current generation by their bad example. In order to build a strong moral code, the last generation must first be convinced that breaking copyright laws is wrong.
3. Persons involved in computer crimes usually acquire their attitudes at an early age.

Computer Ethics, continued

Regarding the need to teach computer ethics:

1. Moral laws can be extremely effective because if someone believes that what they are doing is wrong, they will probably not do it.
2. Newcomers to the computer world are often unaware of these laws and infringe upon them unknowingly. One primary job of groups attempting to enforce software copyright laws should be to make these laws well known to the general public.
3. Just because you can figure out how to break into someone's files or email does not mean you have a right to do that. Just because someone's front door is not locked does not mean you can walk in and browse around or use something because it is available and no one is watching. Just because the neighbors are not home does not mean you can look through their US mail in their mailbox, read their magazines, and put them back before they get home.
4. What is necessary is an ethical theory, valid for all humans – globally – a fundamental consensus on binding values, unconditional standards and personal attitudes.

After reviewing the students' ethics project papers and the conversations that I have had with them in class, I found the strongest messages from my students to be:

- From an early age, children should be made aware of computer ethics and etiquette.
- Teachers and parents must be better role models.
- Although information is impersonal, factual or unemotional, society must realize that it can belong to someone by law.
- Just because you have access to something doesn't mean you can claim it as your own.
- Philosophically, social change should occur to reflect the attitudes of the majority of society.
- A change is necessary in either the attitudes of people or in current laws regarding access to information.

Information is offered to us for the purpose of being read and internalized. It is intended to be merged with our previous knowledge and attitudes. What is not intended is the copying and reiterating of the information as if it were our own creation. Students need to have early practice in acknowledging what others say and do. Then they can concentrate on expanding this information or using it to justify their own ideas. This is how progress, growth and understanding occur without impinging on the rights of others.

Although most of my students expressed their agreement and understanding of the laws protecting software piracy, the issues related to 'cheating', copyright issues, etc., they still talk about the illegal things they continue to do. The bottom line unfortunately seems to be that as long as they aren't hurting themselves or others and as long as they can't get caught, they will do what they want, regardless of the law. While the current status of computer ethics is not acceptable, students should be engaged regularly in

Computer Ethics, continued

discussions about software, Internet and copyright laws. We may not see an immediate change in the amount of unethical computer use, but perhaps by setting a climate of intolerance for unethical and illegal activities in our schools, one day our students will educate their own children from a very young age to be responsible users of technology.

Computer Science: Ethics Paper Follow-up

1. Snooping in someone's computer files, email, program code, etc. Do you think it is OK to do the above and why?

2. Do you think it is OK to walk down the street, try the front door of every house, and upon finding one unlocked, walk in and browse around as long as nothing is disturbed? Why?

3. What is the difference to you between #1 and #2 above?

4. Do you think it is OK to copy software purchased by a friend since you really need this software and don't want to spend your own money to get a copy of it? Why?

5. Is it OK to also make a copy of the instructions that came with the software? Why?

6. Do you think it is OK for your friend to let 15 or 20 people make copies of this software and the instructions? Why?

If you answered YES to #4, 5, or 6, then also answer #7.

7. If your job were to write programs and create software, either in the design or programming stages, and your income was based on the sales of this software, would you still think it's OK to copy software from a friend for your use?

8. After you read the article given to you today, please answer the following:

- What was the message of this article?
- Do you agree with the writer's opinion and explain your reasons?
- Do you think the writer used outside sources to write the article? Why?
- Did the writer give credit to the sources used in writing the article?

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Computer Ethics, continued

Computer Science : Ethics in Computer Use

Sample Lesson Plan

Goal/Objective: Students will research current materials on ethical issues of computer use. They will state and justify their opinions of several of these issues.

Subject: Moral and ethical responsibilities of using computers.

Audience: Any audience that is able to use, read and understand material found on the Internet (elementary through high school).

Objective: Raise student awareness of the social and ethical implications of computers in society.

Timeline: 6-8 weeks:

Initial Class: Complete worksheet on ethics attitudes. In class, read 6 articles provided by teacher, taking notes and recording bibliography information.

Week 1: Locate, print out (with bibliography information) and read two online sources regarding computer ethics.

Week 2: Turn in an alphabetized bibliography of eight sources and the notes taken from articles read in class.

Week 4: Turn in a first draft of opinion paper with hard copies of 2 online sources.

Week 6: (or one week after first drafts were returned to students)Turn in final paper with title page, bibliography, first draft and on-line printouts. Make a brief oral statement of opinions on ethical issues.

Week 6-8: (after teacher has returned papers) Read a classmate's paper and rate it for quality of opinions and arguments. Complete a post-ethics attitude worksheet.

Follow-up: (not included as part of project grade) Share constructive opinions and attitudes about ethical use of computers with younger students via email as arranged by teacher.

Materials/Equipment Needed:

1. Teacher / Librarian provides 8-10 articles on computer ethics/cheating/piracy issues. They can be from journals, magazines, Internet sources, etc.

2. Access to email and the Internet is necessary, with capability to print.

Student Preparation: Students should be familiar with research procedures, use of Netscape and the Internet. However they can be guided through procedures by the teacher or1ibrarian as needed.

Teacher Preparation:

1. For younger grade levels, find Internet sites which have information on computer ethics issues. Older students should be able to find their own sites with guidance if necessary. Arrange for computer lab/ library use of Netscape as needed.

2. Find other teachers who are willing to use email to share information and opinions between students. Decide if students will be allowed to contact each other directly or only via teachers.

3. Allow yourself time to read and comment on the first drafts, returning them soon enough for the final papers to be completed per timeline.

4. Allow time to grade projects, returning them as soon as possible for peer evaluations.

Computer Ethics, continued

Computer Science: Project Grading Guidelines

Objective: This project is designed to raise your awareness of moral and ethical attitudes regarding computer use. You will be asked to form an opinion on this topic after reading eight sources. You will defend and justify your opinions using both written and oral communication with regard to the sources of information that you review.

Day 1: In class you will select and read six articles from the sources provided by the teacher. Notes will be taken on the reading and bibliography information will be noted. After completing this assignment, you will complete and turn in a worksheet about ethics attitudes. (3 points)

Week 1: You will locate, print out and read two online sources regarding computer ethics issues. These must have been published within the past two years. These sources should be referenced in your opinion paper along with the bibliography.

Week 2: (10 points) You will turn in an alphabetized bibliography of the eight sources and the notes taken from the classroom readings.

Week 4: (30 points) You will turn in your first draft of your opinion paper and hard copies of the two online sources. The paper should address issues such as copying and using software that you aren't licensed to use, turning in programs you copied from someone else, copying and using software manuals you aren't licensed to copy, and using an online source without giving credit to the source. The first draft should be four to five handwritten pages or two to three typed pages.

Week 6: (50 points) Turn in final paper including:

- a title page (basic info on title page)
- final paper (2-3 pages)
- your student ID number at the top of page 1
- final bibliography
- first draft should be turned in again
- online printouts (if you are willing to let me keep them)

Do not have your name on any of the pages of the final ethics paper except the title page. The final paper should be typed, double-spaced, font 12 or 14. Turn in the final paper with the grading sheet stapled on top of the title page. The final paper and bibliography should be stapled separately. The online printouts, if you are willing to let me keep them, and the handwritten first draft should also be stapled separately.

Week 6: (2 points) Be prepared to make a few oral statements in class about your opinion. (5 points) You will read a classmate's paper, evaluate it and give it a rating of 1 to 10, 1 being lowest, based on the clarity of the opinions stated in the ethics paper, defense/arguments in support of the opinion, and use of appropriate references to sources used.

Weeks 6-8: Interact with younger students regarding ethics issues via email-as arranged by teacher.

Computer Ethics, continued

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The Technology Game:

Perspectives and Reflections on School-based Technology Training Specialist Support (Part II)

by Sally Bryan

Editor's Note: This article is the second part of an article that appeared in the Spring 2003 edition of the VSTE Journal.

The process by which technology is integrated into classroom curriculum throughout Fairfax County Public Schools is being played in a manner similar to a board game. Each day teachers encounter circumstances that either encourage or discourage the integration of technology into lesson plans and curriculum objectives. When teachers draw favorable circumstances, their integrated plans are implemented, their students find appropriate on-line resources, or create new knowledge and communicate in unique ways. Teachers are encouraged to use technology in future lessons. When those same teachers draw unfavorable circumstances, they might not be aware of appropriate software available to them, might feel too insecure to implement new programs, their schedules might be interrupted, or their computers might freeze. Their momentum is stopped, their projects are delayed or destroyed, and their desire to play *The Technology Game* dissolves.

While *The Technology Game* is being played, the future of our students hangs in the balance. To successfully complete this game, teachers must recognize the importance of technology integration and appreciate new teaching strategies that support the changing literacy needs of students. The final goal of the technology game is to create a learning environment in which student achievement is accelerated through the integration of technology in classroom curriculum. This learning environment must provide the tools of knowledge acquisition and communication for the 21st century and must develop the skills required to utilize these tools.

Technology Game, continued

Attending team planning meetings and analyzing the results of my teacher survey gave me important insights upon which to base future collaboration and activities. By February, teachers were signing up to use the computer lab based upon pre-arranged lessons. I used a lesson plan form that indicated the responsibility of each teacher. I knew what I was responsible for and I knew that students would arrive with needed background information. I became so busy modeling with collaborating teachers that I didn't have time to worry about the teachers who were not available.

Attendance at team meetings by the school-based technology training specialist (hereafter, SBTS) was a critical activity for fostering technology integration. I had fewer interruptions and fewer requests for instant information or resources. It allowed me to plan "just-in-time" modeling. Teachers were happy to accept my help. Now we were playing the game together. Hindsight is always clear, but I should have seen that it was my responsibility to present myself to teams, to more aggressively offer suggestions, support and encouragement to increase effective technology integration.

Primary Players

During the first half of the year, I visited primary classrooms to model use of computers and introduce CDs to be used in centers. In January the four kindergarten/ first grade multiage classes began coming to the Lab on a weekly schedule. Teachers tell me the topic of study and I support them with related CD programs. Students sit in front of the Smartboard for instruction before working in pairs on the computers. The "Veterans" (first graders) help the "Rookies" (kindergartners) learn to manipulate the mouse or drag objects on the screen. Realizing that teachers need timely introductions to appropriate CD programs, I frequently introduce a new software program and then invite student exploration. I try to create a one page "resource sheet" for teachers to take to their classroom with the CDs. Thus students have been introduced to the CDs and know what behavior is expected at computer centers. Teachers know what concept developments are available on each CD and observe activities to be continued in the classroom. During these lessons I see good cooperation between partners and excitement about hands-on learning experiences. In this manner we have enjoyed the newly purchased *Learn About Science* programs and the *Wanderoos*.

Workshops: Creating Our Own Game Plan

As part of my Technology Training Plan I requested a day of training workshops in March. Our Principal allowed me to hire three substitutes to cover classes. Assistants could cover classes for additional teachers who wished to attend the workshops. Specialists were invited to any workshops. At the team planning meetings, I suggested the plan and asked teachers what topics they would like covered. The 4/5/6 team said they wanted *Inspiration* training and spreadsheet applications. The 2/3 team wanted *Kidspiration* and math resources. The Primary Team wanted primary websites and resources and *Kidspiration* applications. Each workshop was scheduled for two hours.

Technology Game, continued

Teachers would have instruction and time for hands-on activities in their requested topics. Thus, the 4/5/6 teachers left with spreadsheet schedules and seating charts, spreadsheets with formulas for recording test results and *Inspiration* templates. The 2/3 team reviewed our collection of math software and looked at math websites. They experimented with *Kidspiration* and saw the value of turning webs into story-writing outlines. The primary team searched the web for appropriate websites to collect in a special primary Intranet page, and each made a *Kidspiration* template to add to a Primary templates folder on the server. I consider the workshops a great success.

What is the Score?

April walked into the Lab today saying, "I can't wait to see what I will learn today!" You would never guess that she was arriving for the after-school math club, our remedial Standards of Learning math program.

My involvement in the after-school math club has been a remarkable journey. Because I thought Betty, our math resource teacher, had math resources well established, I had not ventured into this curriculum area. When I volunteered to help with the after-school math club, a whole new world opened to each of us. I had focused on computers as a vast resource of information waiting to be tapped. I had not explored computers as a tool to zero in on precisely the concept development that a particular child might need. When Betsy and I began to plan our after-school lessons, I began to see this valuable use for computers. Betsy planned deliberately to instruct students in precisely those concepts which they would need for standards testing. She wanted to reinforce what they knew and introduce that which they had not yet grasped. Thus, she was very particular about what software I should use with students. Time was short and must be used to the students' best advantage. We collaborated closely with Betsy telling me what concepts were needed and with me searching our resources to support those needs. One night I gave Betsy a list of promising websites to investigate. I was surprised when she returned with a site to use in our next class. Betsy didn't have time to surf the net, but she was willing to look at the sites I had suggested. We achieved a new level of collaboration and student support. I think we were both surprised at how quickly students grasped the concepts and how excited they became. Alternating between Betsy's direct instruction and test taking skill practice and my interactive computer software with teacher intervention as needed, students worked for two hours after school each week. I believe that we have achieved a situation in which students are engaged and eager to learn. They are developing self-confidence as they gain mastery of math concepts. It is my hope that they will test far better than was previously expected because of our collaboration and ability to present students with appropriate resources.

Technology Game, continued

On February 6, Betsy sent this note to a friend:

First day of after-school math (new program) went well. Sally Bryan is working with me now, for the first time, and it's great being able to send the kids to the lab for math work. I simply haven't found a way to incorporate using technology in the math work I do. I know it can be done, but I never feel I have the time to explore it, and so it sits. Classroom teachers don't use technology support in math, either.

Sally, because she's a proactive kind of a person, had the vision to see that a way "in" with math/technology was to support the after-school math program, and it's just exactly right. It's the perfect setting for giving kids tech time in math, with two important benefits—they get to practice on math skills, plus it reduces the size of the group so that I can work with fewer kids at a time.

Our Math Club experience has taught me that when students are given math activities that are challenging, they are excited and energetic in their responses. They are encouraged when scores add up and validate their belief that they are "getting it." Students are highly motivated to learn using interactive CD activities. If the work is too hard, they want teacher intervention to show them what they have not understood. Once the concept is explained, the students are eager to proceed. When the activities become too easy, they lose interest and want to move on to other activities. Thus, it seems transparent when concepts are understood and when concepts need further explanation or practice. The ability to observe these attitudes only happens when the teacher is closely supervising activities and evaluating student behavior. Students should not be left independently in front of the computer. Rather, the teacher should observe at some distance so that she can intervene only as needed. The teacher needs to know when the student is constructively involved and when the student needs support. It is the interaction between the student, the teacher and the computer programs that creates a powerful learning environment.

I was surprised at 8:45am on Monday morning when Maureen brought her fourth grade math class to the computer lab "to do math." Could they please use the programs we had introduced in the after-school math club, they begged. I explained that they were welcome but that CDs would have to be installed. I gave a brief introduction to students who were not in the math club and explained how I expected partners to collaborate to solve the challenges. For the next half-hour students were happily engaged in "*Place Value and Grouping*" activities. The programs were so popular that Maureen now returns each week to support student learning with appropriate Math CDs. Suddenly there is the perception that the computer lab is a good place "to do math." And it is! Of course other classes have heard about the programs and have scheduled math computer times, too. Activities have expanded beyond the CDs as everyone realizes how easily computers support math.

Technology Game, continued

Jenny, a second grade teacher, wanted to create a money counting lesson. I imported coin pictures into KidPix and showed her how to copy and paste the coins to represent various amounts of money. She asked students to draw cards out of a bag showing different amounts of money and then to illustrate the amount of money in *KidPix*. The students loved her game. Sonia 's class took the game a step further and found a way to show change from a transaction. A recent note from Sonia states:

Hi Sally,

Last Friday's math was so great I'm going to try to make this a weekly thing. I signed up for Thursday this week. We're working on making change. It would be great if there were two levels of activities. Making change from amounts up to $5.00 and making changed from $1.00 or less. Do you have anything like that?

A Winning Teacher

Sandra, an LD Resource Teacher, came to me recently with a wonderful idea. She asked her third grade students to become "Renovation Reporters." They would carry clipboards and pencils while investigating the construction site. They would conduct interviews of people affected by our school renovation. Although these students were reluctant writers, they were excited by this project. She wanted to know if I would like to be part of this project and if I had any ideas. Yes, yes, yes I exclaimed! We could teach the students to take digital pictures and import pictures into their writing. They could use AlphaSmarts to chronicle the renovation progress. We could start a Timeline along the hallway and add pictures and interviews as work progressed. She asked me to join her class in the LD trailer and discuss the project with the students. They were full of questions and excited by their prospects. Could I take their picture in front of their favorite hole? Could they interview the foreman and find out the names of the heavy equipment being used? Where did I think the playground would be built? Could they collect questions to ask people? What a great project! Sonia will guide these students to use critical thinking skills, gain practice in their reading and writing skills, and will use available technology to support their learning.

Playing the Game Through Project-Based Learning

When Lemon Road celebrates Artist & Authors Day this June, the Computer Lab will be a busy part of the student display. Many classes have completed projects in which students were asked to research a topic, gather notes and select information to use in their final product. The students used Internet and CD resources as well as library books. They determined what they thought was pertinent information. They worked in collaborative teams to create *Hyperstudio* stacks, *Power Point* slideshows or *Publisher* newsletters. They used the tools of the 21st century to evaluate resources and to communicate their findings. Teachers acted as mentors supporting student efforts and individual skill development but allowed students to develop their own critical

Technology Game, continued

thinking skills. The SBTS became a guide helping everyone access new resources and using various media to express student learning. I believe that such a learning environment prepares students for their future in the Age of Information.

What If We Lose the Game?

There are many rewards for success and many consequences for failure. Teachers lose the game if they receive so many poor card draws that they give up and make no further attempt to integrate technology into the curriculum. Such teachers fall back on traditional methods of teaching, isolated by four walls and defined by knowledge outlined in textbooks and lectures. These teachers will not prepare students for their future in a world of electronic media. Failure is largely invisible in the present, but will become all too visible in the future. If we lose the game, our school will continue to prepare students as it always has. Students will listen to lectures, will absorb that body of knowledge that teachers deem important, will read the text and will be tested on a prescribed context. Students may perform well on Standards of Learning and standardized tests. After all, standardized tests do test that small body of knowledge which students have been told to study. But what of their future needs? Will they have the critical thinking skills needed to select relevant information from the overwhelming flood of information that threatens to drown them? Will they know how to evaluate or utilize information that is not spoon-fed to them? Is this when we realize that we have lost the game?

Winning the Game

Teachers win the game when they see technology as a tool to advance learning, a tool that provides alternative ways of learning and self-expression, a tool that offers greatly expanded resources for student investigation. They realize that they are no longer responsible for all student learning. Their job is no longer to lecture. Rather, they become guides supporting students as they interact with resources and learn to independently refine their knowledge. The teacher's role is more challenging because there is a greater opportunity to differentiate instruction. The teacher needs great skill to evaluate the progress of each student and to intervene in such a way as to guide the student toward appropriate skill development.

The student rewards are visible when the game has been won. Students become excited about their learning opportunities. They are given new ways to see and comprehend knowledge. They are energized by their ability to create their own learning. They take the technology and travel along paths to success that only they can determine.

Technology Game, continued

Drawing Discouraging Cards

There are some stumbling blocks that the SBTS can't easily overcome. Many SBTS support two schools and are only halftime at each. They can't overcome the fact that their presence is only halftime, their ability to intervene is halftime, and their attention to a school is only halftime. Many schools do not have the hardware and software systems that Lemon Road has acquired. Many SBTS do not have the leadership support that LRES enjoys. The SBTS who is dealing with too many discouraging circumstances is at a great disadvantage.

Findings: Discovering the rules of *The Technology Game*

Finding #1: Before teachers can use technology consistently in their lesson plans and curriculum objectives, they need assurance of prerequisite conditions. These conditions include:

- Leadership support and encouragement
- Adequate accessibility to hardware and software
- Timely troubleshooting help
- "Just-in-time" training
- Support for risk taking and lesson planning

Implication: The school system must provide teachers with these elements of support before they are likely to consistently incorporate technology into classroom curriculum.

Finding #2: Having technology available does not insure appropriate use. The power of school technology can only be realized when teachers are trained and motivated to use the available equipment. Teachers are motivated to use technology, even if it requires a change in teaching strategies, if they are aware of the importance of technology to their students. Modeling by SBTS offers opportunities for teachers to see these advantages.

- Student directed learning
- Teacher as guide
- Availability of increased resources
- Practice selecting, evaluating and utilizing information
- Small group collaboration
- Practice exercises for concept development
- Ability to differentiate services
- Accommodation of learning styles
- Multimedia ways to know
- Student interest and enthusiasm
- Fun

Technology Game, continued

Implication: Training in the use of technology must be accompanied by recognition of the importance of technology use to our students. The SBTS should model lessons in which teachers observe new strategies of teaching and observe student-centered learning activities.

Finding #3: Teachers are more willing to attend training if they anticipate immediate classroom use of applications. When workshops are planned around teacher requests and curriculum needs, they are well received and are more likely to be used by teachers in subsequent lessons.

Implication: The SBTS should plan "just in time" training that is based upon teacher requests and that has immediate classroom application for teachers.

Finding #4: The SBTS is in a unique position to help teachers integrate technology into their classroom curriculum. The SBTS can design activities that will be responsive to teacher requests. The SBTS can be proactive and initiate activities to train and motivate teachers as they struggle to integrate technology. The SBTS can encourage teachers to take risks in using technology. Collaboration between two experts, initiated by "SBTS," is a critical way that SBTS can support teachers.

Implication: The SBTS must initiate activities that support teachers. These activities might include:

- Attend team-planning meetings and discuss curriculum to be covered
- Suggest programs and activities that support curriculum
- Collaborate between experts to design lesson plans and projects
- Model use of programs so that teachers see new strategies of teaching and observe student interest in learning.
- Plan workshops during school hours
- Ask teachers to suggest topics and programs to explore
- Support risk taking
- Prepare software reviews to accompany classroom CDs
- Create a flexible, responsive schedule
- Make teachers aware of available resources

A Winning Strategy

The power of our technology can only be accessed through teacher training and desire to integrate. Computers are merely tools to be harnessed and used to create a powerful new learning environment. Nothing beneficial can be achieved until teachers are trained and motivated to use the equipment placed in their rooms. This is where the role of SBTS becomes critical. The SBTS is responsible for teacher training and support and must initiate and encourage collaboration. It is through collaboration that

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the SBTS can enhance the chances of winning *The Technology Game* in classroom curriculum.

Lemon Road has been slowly but surely winning *The Technology Game*. Because I expected to move too quickly and because I allowed discouraging situations to distract me, I didn't see how truly successful we have become. Teachers at Lemon Road want to support student learning by integrating technology. Teachers who are confident and comfortable with technology are taking risks and creating wonderful projects on their own. The teachers who need support know I am ready and willing to help. Collaboration and planning are the keys to winning this game. So, to answer the question: Are we winning *The Technology Game*? Yes! I believe that Lemon Road is winning *The Technology Game*! Is your school winning *The Technology Game* too?

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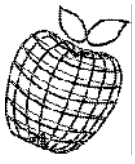

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