By Betsy Price

Principals often feel like referees in a World Wrestling Federation match: While mayhem takes place in the ring, they are off to the side discussing inappropriate behavior with a manager or suggesting that everyone in the audience take their seats and remain silent. In many cases, the matches are just the latest in an unending series of bouts: parents versus teachers, department heads versus teachers, students versus teachers, sports coaches versus teachers. The list of matches a principal referees seems endless, and winning one match doesn’t influence the outcome of the next one.

But in recent years, principals have had to act as referees for a new type of match between teachers and technology staff members, affectionately known as the “techies.” This time the match is for the control of the technology-integrated classroom. From 1999–2002, I participated as a program evaluator on a National Science Foundation formative evaluation grant. The project we were evaluating is a three-part high school biology program that integrates a textbook, a Web site, and a hands-on lab program. After three years of observing classrooms and interviewing principals, teachers, and technology coordinators, I stand in awe of the power that both the teachers and the techies bring to this match. The stakes are significant, and the principal will need to enforce the rules carefully and consistently.

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Match One: Technology in Computer Labs
On my way to observe a classroom, I walked past an impressive array of computer labs. Huge computers were neatly lined up, row after row, in the middle and down one side of the library. The setup was impressive, but my initial excitement waned when I followed a teacher and 30 students to the lab for their daily computer activity. Two science teachers agreed to split the computer room reservation time in half. The first 45 minutes was to be spent working on physics and the next, biology. Once they were in the spacious and well-equipped lab, the students began to log onto the computers and tried to access the Internet. They waited—some quietly played games, some did homework, and some discussed weekend plans—and they waited some more. The muted dreariness of waiting was periodically broken by either a jubilant “Yeah!” as one computer at a time connected to the Internet or by a depressed stream of “aws” as the computers failed to connect to the Internet. This was a match between high-powered computers versus bottlenecked Internet access. The school had provided funds for the finest equipment, but the district burdened the computers with filters and password hoops. In addition, the size of the school’s Internet connection did not equal the demand on it, and the computers could not handle all the content delivery software that the language, science, math, art, and social studies teachers wanted to put on them. Therefore, the teachers had to load the software onto the computers as they came into the labs. If they didn’t have more than one disk, this operation could take 20 minutes or longer. This combination of factors slowed the lab computers and resulted in students spending more time waiting to use the computers than actually using them.

The Next Decade
Those two matches illustrate the fight that is occurring daily as education attempts to respond to technology. Emerging textbook and curricular materials deliver electronic content for regular or daily classroom use. Although a great deal of software has been developed to enhance textbooks, it has been supplementary, sporadic, and of inconsistent quality. As a result, there has not been a wide adoption of electronic content that has brought about a systemic transformation of what happens in the classroom. This is poised to change as soon as more electronic curricula, like the one we were evaluating, appear. Change will also happen as principals coordinate the efforts of techies and teachers. Tough decisions lie ahead for they could easily and cost effectively be connected to power and the network. Therefore the tight, neat rows of computers were on the wall close to the central system leads. But the teacher immediately moved the computers from the wall and placed them on the lab benches. The neat row had made five computers available to five students at a time, but with the computers on individual lab tables, one computer could serve five or six students who were working together at that table. This made sense to the teacher because the directions to the labs and the data collection software were on the computers. Had the computers remained in their original place, chaos may have been created by chemical-toting students running back and forth to check directions and load data. The teacher managed to convince the principal that the computers needed to be where the learning was happening, and the computers remained on the lab benches. The techies moved the connections to the benches, but the ganglion of exposed wires were a reminder that the techies would be back.

Match Two: Computers in the Classroom
It became apparent to me that the match between teachers and techies was changing locations when I walked into a newly remodeled, doublewide biology classroom. A traditional classroom was in the front of the room, and a science lab was in the back. Up against the classroom wall was a long bench festooned with electrical outlets and network hookups, obviously designed to house an equally long row of computers. But there were no computers. Meanwhile, on each lab bench in the back of the room there was a desktop computer with a tangle of computer wires and connectors. This was the debris created by a match between economics and usability. The techies had installed the computers where
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principals because the guidelines and best practices for teachers to integrate technology and the requirements for techies to bring in and maintain equipment are often in direct conflict.

In the past, schools acquired technology with the blind faith that it would improve teaching and learning but without quite knowing that it would happen. After 10 years of creating an infrastructure of technology and networks, schools are now in a position to follow the business model for acquiring computers—let software create the demand for hardware. And just as business practices changed with electronic resources, teaching practices will change. As this happens, there will be a need to rethink old ideas from the 1990s about who controls technology and how it is used. Here are some general trends the next decade will bring.

Large computer labs for general use will slowly disappear. Frequently, the decision to put multiple labs in one area was economic. It was less expensive to wire one side of the building or a new addition than to string miles of wires to individual classrooms. This arrangement was also satisfactory when teaching students the mechanics of how to use the computer—how to use the keyboard, surf the Internet, and learn word processing. Those mechanics are now frequently mastered before a student comes to school, so this arrangement isn’t as necessary; even worse, it is not effective for doing activities that teach concepts and build academic skills. This practice may dominate present practices, but it shouldn’t.

For computers to be effective teaching tools, teachers must thread computer use into group projects, whole-class demos, individual tutoring, classroom management, and alternative assessment and testing along with the traditional teaching methods of lecturing, reading, and hands-on activities and experiments. To learn, students must use computers to store and organize information, enter and interpret data, do calculations, make graphs and charts, visualize difficult concepts, navigate interactive activities, receive immediate feedback, expand resources, update content, develop presentations, build publications, create artistic works, and so on.

This new paradigm requires students to use computers at varying times during the period and for different-length intervals. Interjecting computer use into daily classroom learning will be guided by the teaching strategy and not by the time the computer lab is free. It follows that computers need to be in classrooms or in facilities that are shared with teachers in the same content areas.

Technology will change the role for the principal. Over the next decade, the principal must increasingly foster a community spirit by which teachers and the techies work together to create an affordable and functional learning environment. Teachers need the flexibility to place computers in configurations that complement their teaching strategies. This could mean that computers are strung throughout the classroom or placed in active work areas where students have enough room to use companion textbooks, data-collection resources, and science and art equipment. The placement of the computers may cause conflicts between teachers and technology staff members, especially when each content area requires a unique configuration to match the activities with the learning. This will not be seen as cost effective or serviceable by the techies. Principals will have to mediate, moderate, and make decisions about how to resolve these conflicts.

Software will increasingly determine a school’s computer needs. The biggest computer is not always the best computer, and it is not realistic to believe that powerful, shared computers are capable of handling all the programs required for different content areas. In the past, because schools purchased computers before content-delivery software, it was wise for techies to purchase big systems for multipurpose labs until the needed computing power was clarified.

This will change because content-specific software that is used in the classroom will release schools from needing to purchase high-end or new computers. An English program may require only that students have computers with basic word processing with light graphic capabilities. This means that mid-sized computers, PDAs, and used computers are adequate. A math program may require basic drill activities and graphing capabilities as well as word problems and solutions,
tests and quizzes, and math manipulatives. These programs require higher-end computers because of the visuals and manipulatives, but they are still not as high end as the ones that some schools are purchasing now. The software should govern the computer purchase.

There will be an increased emphasis on how technology will be used. Although the software will guide the computer purchase, principals, backed by accountants, must consider the “how it will be used” factor when making choices about new, used, or alternative technology. Techies want all the equipment to be state-of-the-art; they want the computers to be new and have warranties that cover costs when a computer goes bad. Techies also want the computers to be made by the same manufacturer because that makes repairs and maintenance more streamlined. Teachers want lots of computers with adequate power and are happy to own used, donated, or refurbished computers. Principals, teachers, and techies need to discuss these issues as a group, which will require skillful mediation by the principal.

Not every computer has to be networked. Techies like everything to be networked. New software gives them the ability to upgrade and install software on all computers simultaneously from a central system. From their office, they can do diagnostic tests and make minor repairs on computers anywhere in the school and the district. This is a good thing for standardized software that every computer requires—such as operating system upgrades, filtering software, word-processing software, plug-ins, and browsers. The stumbling block is that customized computers in every content area will foil the ability to push upgrades to all computers.

Teachers primarily use the network to access the Internet for such content resources as current events, interactive activities, and visuals that supplement their teaching materials. This is a necessity because old, worn textbooks and printed materials are not acceptable for today’s students who are conditioned to the high visual appeal and interactive quality of Internet materials. Unfortunately, the Internet is not always a reliable source of supplementary teaching material. A Web site could be up one day and gone the next. Internet material is rarely grade specific and the reading and interest levels don’t always match those of the students. Teachers can waste countless hours searching for appropriate sites, and Web sites change plug-ins unpredictably, causing massive confusion as students (if filters allow it) download new plug-ins. Simply stated, using the Internet for supplementary material is not easy.

These negative factors will push teachers to purchase electronic content-delivery programs as quickly as they appear on the market. Teachers will abandon the Internet for electronic content materials that are written at the appropriate reading, interest, and visual levels for students. What teachers want is stability, validity, and reliability. Principals will have to mediate which computers are networked and which are not. As teachers’ dependence on the Internet decreases, the need for student computers to be connected will disappear or at least lighten. If the electronic curriculum is delivered over the Internet, it will control the computer power, speed, and plug-ins. Alternatives to network classroom computers are now available by beaming, Wi-Fi, and turning the teacher’s computer into a server. This will create more work for techies who will not have central control and will walk many extra miles to service computers.

The school library will continue to play an important role. Information technology belongs in the library. When the Internet appeared, soothsayers predicted the end of the library. However, the opposite has happened. The Internet is the major source for finding information by using search engines, Internet resources, government and industry databases, and online libraries. These resources, once reserved for major research universities, can now be accessed at any high school, and high school libraries have never been more popular.

Gaining access to information is a vital component to using inquiry- and problem-based learning. This makes the Internet a necessary tool, but there is a price to pay. Librarians are still in demand because Internet resources are overwhelmingly plentiful and complicated. Anyone who has put a topic in a search engine knows the frustration of trying to filter through unwanted items to get the needed information. Teachers cannot be resource experts for the broad-based activities that their teaching strategies require. They must rely on librarians to teach students how to wisely search, access, and evaluate Internet and other electronic resources.

Principals should work with teachers and librarians as a team to design strategies for students that enable them to identify problems, access information, devise solutions, and
produce a product. Principals will then have to meet with techies to plan how technology will be organized to accomplish these strategies.

**Technology decisions will require more cost analysis.** Even for small schools and especially for large ones, technology decisions will require complicated cost analysis as license fees, electronic content-delivery programs, recruitment and retention of highly trained staff members, and multiple types of computers and alternative technologies are factored into decisions. But cost will not be the only deciding factor. Increased student learning, decreased teacher planning time, increased energy for teaching, retention of staff members, and better resource acquisition are priceless. Better teaching is an economic gain.

**More highly trained techies and librarians will be needed.** The technology decisions will be tougher and more complicated; therefore, techies and librarians will require more specialized knowledge and professional training. Any savings in other areas may go toward hiring more professionally prepared support staff members.

**Technology will raise fundamental questions about instruction.** Students can direct the pace and level of their learning by using electronic resources and content-delivery systems. Teachers can facilitate more students and class sizes could increase. This could lower the cost and increase the quality of instruction.

### Classifying Technology Usage

Early on, technology in schools was faith-driven and it came as one lump package. Where computers were placed in schools was guided by the location of electrical outlets. When computers were used was dictated by schedules. How computers were used was limited by what teachers had time to find. Recruiting techies was done by prayer.

We now have information to manage technology more scientifically. There is now a three-tiered classification of who will use technology and how it will be used in schools. Each of these classifications requires a different type of computing power, networking, and professional development.

**Teaching.** Teachers need computers in the classroom to increase student learning, specifically for those students who have not been successful with the dominant textbook, lecture, or lab formula. Computers are used to supplement traditional instruction through electronic content that is up-to-date or more in-depth than textbooks. Computers are used to help students conceptualize difficult concepts through visualization, animations, and interactive activities. Students use computers in inquiry activities for data collection, calculations, and presentation. Students with special needs use computers for remedial and advanced work and self-paced instruction. Computers are used for basic skill building and memorization, and they also play an important part as a medium for alternative assessment.

### Classroom management

Teachers use computers to manage their classroom and to coordinate with school, district, and federal reporting policies. Electronic grade books increase student learning with sophisticated software that allows students to check their progress as quickly as they complete an assessment activity. These programs automatically grade papers, which saves the teacher’s time and provides students with more opportunities for feedback and guidance. Teachers also use computers to create assessment tools, teaching aids, and supplemental activities as well as to communicate to students, parents, peers, and administrators.

**Information technology.** Librarians need computers for information access. Activities include instructing students about Internet and database searches, procedures for identifying resources for research papers, and accessing electronic books and other materials. Librarians need to plan these activities with teachers to determine when the instruction will occur and which resources and level of instruction will be needed.

### Future Challenges

A picture of future challenges became clear when I visited a school right after an operating system upgrade was pushed to the computers from the central system—a techie’s dream. This upgrade was necessary for the computers to be compatible with a major and expensive new software purchase. A few teachers, however, found themselves out in the cold because the software they used in their classrooms was not compatible with the new system—a teacher’s nightmare. What happens now besides the principal protecting the techies from the teachers’ wrath? Should the incompatible software be retired? Should the teachers’ computers have the old operating system reinstalled? Should the new software purchase be stopped? Can you put two operating systems on the computers? Is it time to move to Linux?

Principals cannot be technology experts, but they must hire staff members and teachers who will work together as a team to make decisions about technology issues. This will require principals to hone their negotiation, debate, and facilitation skills. Just being a referee for matches between teachers and techies will not be sufficient for the next stage of integrating technology into the regular classroom routine. **PL**