Technology in the Classroom

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Take a Ride on the Technology Express

Everywhere we turn, articles, dialogues, and presentations focus on technology in education. Schools may have something to learn from U.S. businesses forced into dramatic changes over the last 15 years by economic pressures and the revolution in technology. Though more gradual than predicted, information technology—led by an explosion in e-mail and World Wide Web use—is moving into the mainstream of schools. The state of Washington already has a reputation for and an orientation toward high-technology.

Is this movement a trendy hype, a passing fancy, or is it the greatest change in education since the printed book? facemeyer and Peterson posit in this issue that “once you get caught in the World Wide Web (making telecomputing a personal resource for work and learning) you will never leave.” They suggest that once you’ve learned to use the telephone you will never long for the telegraph, once you’ve learned to word process, you will never return to the IBM Selectric. They propose: you will start, you can’t quit and everyone will soon be online. The light at the end of the educational technology tunnel is the headlight of the telecomputing express and either we move fast enough to keep ahead of it or we may be overtaken by new institutions such as online charter schools.

Before everyone jumps aboard the telecomputing express, Cortlund and Eychaner question how access to and use of e-mail impacts the social capital of America’s schools. Social capital is described as the features of schools such as networks, collegiality, community, and social trust that facilitate cooperation for the mutual benefit of teaching and learning. While e-mail enthusiasts are effusive about its impact on communication efficiency, does it come at the cost of face-to-face interactions that build social capital in a school setting? While cautious about anything replacing face-to-face communication, the authors realistically attest that no relationship exists solely through e-mail, but believe it can enhance as already existing relationship by building rapport and connections that might not otherwise occur.

As you run to catch the technology express, be sure to consider where it is going, the track it is taking, the price of the ticket, the number of passengers you want to take along and the vintage and power of the locomotive. Michael Wyant provides eight beliefs and practices in support of technology in Omak schools and Whitman and Rayborn provide illustrative vignettes of Mukilteo School District’s implementation plan to assist teachers and students incorporate technology tools for teaching and learning. Finally, Rowley and New establish a system to assess whether Bellingham’s technology ride achieves the goals of their district’s technology plan.

The importance of selecting your route is illuminated by Teresa VanHaalen as she suggests that the way technology has been introduced into schools has not always coincided with what we know about effective instruction and optimal learning. She provides a conceptual framework for interactive technologies based on two types of learning environments: information seeking and information producing. Gary Brown astutely notes in his article that the questions we ask before the trip will be most productive if the particulars are framed in contexts of the journey (appropriate to instructional objectives and teaching and learning practices). The PIG he portrays (Presentation/Interaction/Generation) represents the range of or continuum of technology implantation strategies in education. Consider his conceptual model before you hop aboard any technology train.

As you travel through life and the journey to technology, reflect on Mahatma Gandhi’s wise imperatives that doom us to failure:

- Wealth without work
- Pleasure without conscience
- Knowledge without character
- Commerce without morality
- Science without humanity
- Worship without sacrifice
- Politics without principle
- Rights without responsibilities

And consider a few truisms of technology, teaching and learning which may also doom us to failure:

- Technology without direction
- Learning without community
- Teaching without passion

Enjoy your journey!

In the Spring Issue. Technology just doesn’t happen—it takes commitment and conviction from the educational decision makers. In contrast to our current issue, one corporate executive proclaims: “Most of the changes you’re going to see in the world will come from leadership and not technology.” The next issue will address an equally important topic: leadership in schools, from site councils to superintendents. If you would like to be a contributor to Curriculum in Context, please contact Walt Gmelch or Susan Poch at (509) 335-9117, FAX 509-335-7977 or e-mail gmelch@mail.wsu.edu or poch@mail.wsu.edu.
Building Beliefs to Support Technology

MICHAEL WYANT

Technology plays an important part in most school programs these days. Visit almost any school and you are likely to see computers and other sophisticated equipment in computer labs, classrooms and libraries. To have the technology is one thing. To do something productive with it is often quite another. Too often, expensive equipment and software languishes unused because some fundamental issues have not been dealt with in the school. Over several years we have been able to identify and nurture a number of beliefs and practices that have resulted in extensive use of the computers and other kinds of technology in our school. Our students are kindergartners, first graders and second graders but they use technology in sophisticated, meaningful ways that contribute to their learning as well as to their sense of the power to be in charge of their learning. The following beliefs and practices have helped us bring technology to our students.

KNOW WHAT YOU WANT TO ACCOMPLISH.

Early on we decided that we wanted students to use technology as a learning tool just as they use books, pencils and the other tools of school. Students use word processing and drawing programs in order to publish their work. Electronic encyclopedias, atlases and other reference materials are used for research. Students use our building’s electronic mail to practice written communication with other students and adults. Our message to students is that computers are tools to be exploited for learning rather than toys to be played with.

HAVE A BUILDING TECHNOLOGY PLAN IN PLACE.

A Catch 22 situation can develop with technology plans. Schools sometimes don’t want to write a plan because, they argue, there is no point if there is no money to implement it. On the other hand, those with the money (school boards, district offices, etc.) are quite reluctant to consider spending money for technology when there is no plan as to how it will be used. We developed a plan even though there did not appear to be money available. One only has to think back over the past few years to see that you never can tell when some money might appear. Twice in six years our legislature has made one-time grants available to all schools for acquiring technology. Even if the plan is basic, having it in place makes a school ready for the money that may come along.

MAKE TECHNOLOGY USE A BUILDING PRIORITY.

Schools that are making widespread and effective use of technology for student learning have done so in part by making technology a high priority. Our school has developed a building goal that identifies the importance of the effective use of technology to support student learning. Use of technology is often addressed in staff meetings and a portion some staff development money is designated to support training. Buildings that have some control over their budgets set aside money to support the acquisition of hardware and software, staff training and maintenance and repair of equipment. A committee whose purpose is to support the goal of effective use of technology for student learning provides important leadership for our school.

STICK WITH TECHNOLOGY FOR THE LONG RUN.

Avoid the temptation to jump from technology to some other focus too soon. Any change in a school takes time. Changes in the way the staff and students view and use technology may take more than the usual amount of time and patience. Technology can be threatening. It is an easy out for staff to argue that they don’t have time to learn to use the technology or they don’t have time to fit it into their already full teaching days. If that kind of thinking is going to be changed, it is going to require concerted effort over several years. Schools that are successful at making good use of educational technology are the ones that keep that as a focus over several years.

TRAIN THE STAFF FIRST.

Good staff development is crucial for effective technology use by students. Adults need some degree of comfort with the technology before they are willing to let students use it. Adults also need to have an opportunity to see what the benefits are to having students use technology.
Staff development does not to be especially sophisticated to be effective. Some of our very best training has been provided by our staff for our staff. This training has taken many forms, including small, personalized workshops, regular presentations at staff meetings, individual professional development plans, and mentorships. Teachers always seem willing to share what they know if they are invited to do so and if they are provided with some time to prepare. We found that as the staff’s level of comfort with technology increased, so did their willingness to put it in the hands of their students.

**SUPPORT THE TECHNOLOGY STARS.**

Every school has several technology stars. They are the teachers, librarians or paraeducators who seem to have that special combination of strength and interest in technology. They are the ones who are always after a little more money for technology. They constantly fidget, beg and borrow equipment to get it in the hands of their students. They are the visionaries who see the potential of technology to assist student learning and will do whatever it takes to make it available.

These folks have the excitement for technology and the understanding of its place in the classroom that will pull other staff along. Support for building technology leaders can take many forms. They can be encouraged to teach other staff, either in large or small groups, and be given incentives to do so. They can be sent to technology conferences or to visit other schools. They can be linked with people outside the school, such as Educational Service District specialists, who can offer support, advice and training. The technology stars can be supported with other incentives like the opportunity to try out the newest hardware and software in the building or the chance to keep those extra computers in their rooms.

These people are the staff who are going to bring the rest of the building along. Given the right support, they will coax the reluctant and excite those who are still a little uncomfortable with technology related to student learning. Give them tangible, steady support and they will move your school toward more effective uses of technology.

**INVOLVE PARENTS.**

Most parents believe that it is important for their children to learn to use technology. Parents are a powerful resource in a school that is moving toward better use of technology as a learning tool. Parent volunteers can give help to students using technology in classrooms. At the same time they are helping students, volunteers are often learning about technology and becoming excited about its potential. These parents become advocates in the community for the use of learning technology in classrooms. They also often support the budgeting of money for technology when they talk with district administration and school boards.

One of the best ways to involve parents is to offer them training and the opportunity to use the school’s technology. Training can be as simple as a quick one to one session with the teacher prior to class or it can be as sophisticated as formal classes in the evening or on weekends. Whatever the method, it is also important to keep in mind that parents are often intimidated by the technology their children use so naturally and comfortably. Patience and understanding are needed to help parents feel relaxed when they are learning to use hardware and software.

**SCHOOLS THAT ARE SUCCESSFUL AT MAKING GOOD USE OF EDUCATIONAL TECHNOLOGY ARE THE ONES THAT KEEP THAT AS A FOCUS OVER SEVERAL YEARS.**

**MAKE TECHNOLOGY PRACTICAL AND USEFUL.**

If technology is viewed by staff, students and parents as exotic, its acquisition and use will not be supported. If it is viewed as something used by only a select few in the school it will not be supported. If it is seen as something that is added on top of everything else that needs to be taught in school it will be viewed with skepticism at best and more likely with hostility. On the other hand, if the technology can be shown to be a practical tool that supports and enhances student learning then it will be embraced and its use will spread through the school. Schools where technology is widely used and solidly supported are the ones where technology is viewed as a learning tool.

**CONCLUSION**

In the ideal school, we would have all of the technology we need and want. Staff and students would use it regularly, eagerly and naturally. Parents, community members, school boards and district level administrators would support its use and find ways to provide it. Unfortunately, none of us works in the ideal school. But with some thoughtfulness and effort we can each help move our school closer to the goal of having today’s sophisticated technology as much a natural part of students’ learning as pencils and books have been in the past.

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Learning Turned Up a Notch

GREGORY WHITEMAN AND ROBERT RAYBORN

Significant time, energy and monetary expenditures are focused on just getting technology into schools. But to be successful, those efforts must be guided by the answers to two fundamental questions. Why should schools incorporate technology tools into the educational setting? And, how can technology tools effectively impact the teaching and learning process?

A considerable body of information exists to provide a response to the why question. Answers range from employer expectations, to improving efficiency for completing routine tasks at school. Technology profoundly impacts our everyday lives and cannot be left at the school house door. It shapes and defines organizational tasks, from the management of the Atlanta Olympics to checking out groceries at the neighborhood store. It provides immediate access to information. The ability to use technology is a performance requirement for success in the job market. Schools must equip students with technology skills to give them a fair chance to compete in the world they will inherit.

To answer the how question, we can look at what happens when technology tools are integrated into the learning environment.

**TECHNOLOGY TOOLS**

Don steps to the chalkboard and quickly writes out the complex equation, explaining each step to his students as he progresses. He calls on Andrea to come up and demonstrate the final step in reaching the solution.

The low-tech tool of the chalkboard has become a fixture in classrooms, supporting curriculum delivery almost without deliberate thought on the part of teachers and students. However, historical evidence shows that at one time this new innovation required specialized training to enable the effective use of the chalkboard in education. Just as grabbing a piece of chalk became a reflective response in the instructional process, the use of high-tech tools must become an automatic choice for educators and students before the promise of technology can effectively impact the teaching and learning process.

High-tech tools can impact teaching and learning by helping manipulate data to inform decision making, by supporting the creative presentation of content, by enabling immediate access to information, by involving learners through interactive simulation, and by providing channels for effective communication.

**DECISION MAKING**

After entering the final grade in the electronic grade book, Carol selects the “summarize” command to combine each student’s performance on the last three assigned tasks. Reviewing the results, she decides to spend more time tomorrow re-teaching the steps of preparing an outline.

Student progress information entered into a database allows a teacher to create new information for making teaching decisions. Patterns emerge while manipulating data that stimulate new ways of looking at the results. With a computer and effective grade book software, teaching decisions can be driven by student performance resulting in a manner unavailable with traditional paper-based grade books.

Chris types in his final response on the occupational interest survey, then clicks on the command that combines the results with the aptitude evaluation completed earlier. He uses the printout to select three vocations to explore on the career pathways database.

Tools for helping students identify elusive preferences and interests are widely used in career counseling programs. When students complete those instruments at a computer keyboard, the software program combines the results immediately to present a comprehensive profile for helping students select classes, choose a mentoring program, or research a career field in greater detail. Those results linked to the wealth of career pathway information available in commercial programs can better equip students as they prepare for the world of work.

**PRESENTATIONS**

To illustrate events leading to Kennedy’s nomination as the Democratic candidate for president, Steven clicks to the next frame of the presentation. An animated timeline plays on the monitor for the class to view.

A teaching computer attached to a group display device provides teachers with an electronic chalkboard that literally sings and dances beyond the capability of a standard chalkboard. The presentation of new information comes alive with multimedia. In addition, presentations tailor made by teachers to support specific
instruction can be viewed individually by students needing review or who were absent during the original lesson.

Sarah presses "stop" on the laser disc player and jets down the frame number. The section she just previewed perfectly illustrates the information she researched on the American labor movement in the 1920's. She will use this video clip in her multimedia presentation.

Presentation software provides a vehicle for students to demonstrate higher level thinking skills. Student research findings from a variety of sources can be combined to show teachers and classmates the results of independent learning activities. A collection of student work also becomes a resource for future students.

**INFORMATION ACCESS**

David enters a search on Ken Griffey at the library computer only to discover that the school's copy of the biography is already checked out. After typing two more key strokes, he locates six different books about Griffey at school libraries across the district. The librarian will have one delivered tomorrow.

Many valuable print materials go unused unless they can be quickly located. By combining library catalogs into a unified database, district resources are used more effectively. Establishing links to municipal, regional, or university libraries increases convenience for conducting searches and extends the range of material available to teachers and students.

When the social studies discussion turns to the troops in Bosnia, Ann sits down at the computer and brings up an encyclopedia article giving the history of the region. She then searches the magazine CD-ROM for current articles on how the American soldiers are impacting the situation.

Electronically stored and indexed information adds significant depth in the study of discrete topics. Information that does not change over time, such as historical events, is easily accessed from CD-ROMs. In addition, magazine and journal articles pressed onto a CD that is updated and distributed each month increase the number of resources that can quickly be searched for current information.

**INTERACTIVE SIMULATIONS**

Shawn groups the class into teams of four, then assigns a role to each team member. After viewing the software presentation on pollution problems at Alpine Lake, students join the team members to discuss priorities for attacking the problem. Each team rotates through the computer station to answer a series of questions and receive their next team task while Shawn facilitates the discussion process.

Simulation software makes effective use of one computer and cooperative learning strategies in guiding teams of students through higher level thinking activities. Software design that demands the active participation of all students requires each student to contribute to the process for teams to complete the assignments. The computer performs routine clerical record keeping tasks, freeing the teacher for interaction with students.

Each day the middle school social studies class logs onto the Internet site to check the progress of cyclists traveling through Mexico. The traveler’s message describes their options for the next day; turn right to visit a village market or turn left to explore some ancient ruins. After a discussion, the class e-mails their vote for a visit to the market.

On-line adventures become classroom simulations in real time as students follow explorers by way of the Internet. Producers of the event supply support materials that tie into the curriculum and help integrate disciplines. Routine skill development centers on the thematic adventure. Previously unconnected learning assumes new meaning as learned skills are practiced in the context of real events.

**COMMUNICATION**

The visiting electrical engineer sparks a debate among the fourth graders that continues throughout the day. After the students reach an impasse, Diane sends him an e-mail message with their questions. The reply she receives that afternoon prompts a re-run of the science experiment. The students discover that it works both ways.

Phone tag and mailed letters often cause unnecessary delays. Sending electronic messages by e-mail or voice mail enhances communication by allowing messages to be received and answered when time permits. The resulting communications flow creates better understanding and positively impacts student learning.

Ryan looks over the morning announcements while Andrea checks the focus on the video camera. In five minutes they will broadcast the student news onto all classroom televisions in the school.

The visual medium plays a significant role in all communications, greatly enhancing the impact of a message. Innovations in digital video are enabling new visual applications and making those applications accessible to everyone.

**MAKING IT HAPPEN**

All of the preceding vignettes are illustrative of Mukilteo School District’s technology implementation that aims at assisting teachers and students in incorporating technology tools for teaching and learning. The components of the complete system include adequate classroom-based equipment, broad licenses for basic software, a high-speed wide-area network, curriculum related on-line resources, a comprehensive staff development program, and provision for user support and hardware repair.

Add all the parts together and technology tools can effectively impact the teaching and learning process. Decision making processes are better informed. Content presentation becomes more engaging. Detailed information is available instantly. Students become more active participants in their learning. Communications are enhanced. The outcome is basic learning turned up a notch, enriched and enlivened through this use of technology.

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E-mail and School Climate: Building Social Capital?

JOAN CORTLUND AND CHUCK EYCHANER

Computer technology has provided us with a new means of communicating with one another. As more and more teachers gain access to electronic communications, and e-mail becomes a significant part of a professional educator’s day, what is the overall impact on the climate and routine of the school?

Robert Putnam’s idea of social capital, set forth in his article entitled “Bowling Alone,” has caught the attention of many social scientists. Briefly, Putnam contends that America’s social capital, “features of social organizations such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit,” has been diminishing over the past 40 years. He points to evidence gathered from weekly church attendance, and memberships in labor unions, P.T.A., and other civil and fraternal organizations. The title springs from the statistics surrounding bowling leagues: while overall bowling is up, participation in leagues has dropped. Putnam’s conclusion is that we, as a society, are “bowling alone,” without the benefits of social interaction at the local alley.

His thesis has not been unanimously accepted. In a recent Time magazine, Richard Stengel responded with data of his own that indicates “traditional forms of civic activism are flourishing.” He points to participation in Big Brothers and Big Sisters Organizations, as well as soccer leagues, health clubs, Promise Keepers and the Internet. He counters that electronic communication “is being alone together, which will increasingly be a form of togetherness.”

Throughout this past year, we have been intrigued by the idea of social capital, and the extension of this idea to schools and educational communities. The social capital of a school has often been referred to as school climate and collegiality: What are the qualities of professional and personal interaction among educators in a school organization? How does access to and use of e-mail change the frequency and characteristics of this interaction? (We won’t address the possibilities of Bulletin Board Services or Internet Newsgroups here.)

E-MAIL

First, what is e-mail? Electronic-mail is a network service that enables users to send and receive messages via computer over telephone lines. Some popular e-mail packages utilized by districts include Eudora, GroupWise, Pine, and CCMail. It is difficult to say exactly how many school employees actively use or have access to electronic mail. According to Dennis Small, O.S.P.L.’s Educational Telecommunications Supervisor, in Washington State it is estimated that over 60% of all school buildings are wired for some sort of access to a LAN (local area network) and at least some form of in-district e-mail. While only about 10% of classrooms have direct access to the Internet, many teachers have taken advantage of on-line services that provide e-mail, such as America Online or Compuserve. School districts vary greatly in the technology available to staff members. Some districts have e-mail packages loaded on computers at every teacher’s desk, while others have limited access through one or two computers in a workroom or library while still others have no access at all. This large discrepancy in technological availability also exists from school to school within districts.

How does e-mail work? An employee enters the network by logging on, either at school or by remote dial-up access. After entering a unique password, the user is presented with a list of options that usually includes reading new mail, replying to new or saved mail, and composing new messages. When sending mail, the user can address their message to a single recipient, or a group (for example, a grade level team or department members). E-mail messages may be saved for future use, deleted completely, or received mail can be forwarded to other recipients. In addition, users often have the option to leave the program running continuously and have an audio or visual prompt to indicate when new mail has been received. Once sent, an e-mail message usually arrives at its destination within moments.

IMPACT ON SOCIAL CAPITAL

Many who have access to electronic mail, are enthusiastic about its impact on communication effectiveness, school climate, and social capital. One elementary principal told us, “E-mail enables me to communicate with my staff. I can reply to ten of their ideas rather than have ten teachers hanging around the office after school trying to catch me. It also helps us to sustain conversations. We don’t have to do too much ‘catching up’ when we’ve exchanged e-mail messages, and we can get down to business much more quickly.”

In buildings that utilize e-mail, there is no longer a need to check a “mail box” in the office to retrieve a stack of papers and memos. With all communications in one place and in one format, messages are not lost or misplaced. Another principal told us that e-mail enhances the organizational efficiency of a school. “There is most definitely a savings on the cost of paper and duplication, not to mention the time savings in copying and distribution of printed information. It is a ‘foolproof’ system because you know everyone received the information and it is easily retrievable.”

To e-mail users, the convenience is undeniable. Users can read and reply to messages when their schedules allow and
from any desk top in the same system. This means you can read and write e-mail at any time, including planning periods and outside of school hours.

Does this organizational and communication efficiency come at a cost to the face-to-face interactions that build social capital in a school setting? Will the ability to communicate instantly interfere with Putnam’s “networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit”?

Context can be crucial in communications. Facial expression, inflection, and body language are often as valuable as the actual words when communicating ideas. E-mail lacks these. According to Putnam, “My hunch is that a meeting in an electronic forum is not equivalent of meeting in a bowling alley - or even a saloon ...” R. Thor Prichard agrees, “I once heard someone say that the greatest bandwidth is not found in e-mail but at the dinner table.”

**CONCLUSION**

While electronic communication certainly cannot replace face-to-face interactions, it can impact professional relationships. It is rare to find a relationship that exists solely through e-mail, but it can be a powerful enhancement where a relationship already exists. It can also be used to built rapport and connections that might not otherwise occur, as when teachers who would not have time to meet and work collaboratively are able to exchange ideas electronically.

There are caveats to keep in mind however. The informal nature of e-mail can be deceptive, and the issue of privacy is one that must be considered. E-mail is not as secure as telephone systems and should not be considered private. The common wisdom among e-mail users is to not send e-mail that you would not like to see as a headline in tomorrow’s newspaper. A superintendent advised us to never send e-mail when you’re angry. She related a story about an angry teacher who sent a message that was obviously filled with feelings of frustration, and the message was forwarded from one person to another, “and it never went away.” Another principal told of a teacher forwarding the complaining remarks of a colleague to the principal, without informing the original author. The results were some hurt feelings, and a definite setback in the building of social capital in that school. (For a summary of e-mail etiquette, see below.)

The full impact of e-mail (and other new communication tools) on social capital in educational settings is yet to be seen. This appears to be very little empirical evidence about the impact of electronic communication on school climate/social capital. Our conversations with principals and other e-mail users points to the need for additional research.

As with the telephone or television in past generations, after the initial controversy settles, society seems to make the necessary adjustments and then finds itself unable to function normally without the latest indispensable invention. Will educators make this same adjustment? Can this be the fate of e-mail?

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**E-MAIL: ETIQUETTE NETIQUETTE**

Employing, or at least being aware of these issues, will make your experience with e-mail much smoother.

**E-mail is an informal method of communication.** As a result, use it so. Consider it more of a memo than a rigidly-structured, formal business letter, even if you are sending to a person of authority.

**E-mail is cold and faceless.** Add faces. To be more specific, employ Smilies, or caricatures and small face-like designed, with the basic ASCII characters available to you. Since the recipient of your letter cannot see your facial expressions or hear your tone and intonation, Smilies can be employed to fill these gaps. The Unofficial Smiley Dictionary (HTML version) is the ultimate source.

**Do not type e-mail in caps!!!** Strangely enough, this is considered rather rude and reminiscent of shouting.

**Check for typographical errors.** Nothing is more embarrassing than sending a brief note to your boss which was supposed to say.

- Just wanted to say a quick HELLO to you.
- When it comes out on the screen as...
- Just wanted to say a quick HELL to you.

Keep in mind that if, by some strange act of fate or slip-up on your part, you address the letter to the wrong person, your message could be read by a stranger. Furthermore, the message you send to a generic address (companyX@x.com, for example) could be read by any number of people, not just the individual at that organization who usually answers the mail. Keep this in mind when you write.

Never assume that your E-mail can be read by no one except yourself; others may be able to read or access your mail. Never send or keep anything that you would not mind seeing on the evening news.

From The Net: User Guidelines and Netiquette,
By Arlene H. Ronaldr, at http://www.fau.edu/ronaldr/netiquette.html
Popular culture has created an artificial division between those who produce and those who consume. As we strive to become politically correct by recycling and downsizing, we are transitioning from a society that views members not so much by what they have, but by how little they take from the environment (meaning culture or surroundings). This distinction between consumers and producers becomes even more pronounced with the emergence of information technologies that shape and the environments of our homes, schools and businesses.

The purpose of this article is not to discount the creative minds and souls who fashion the technological wonders we all enjoy, but to take a breath and explore how we (and the folk we teach) use existing technologies to both learn and create. And to examine how these technologies transform our thinking and our lives. In a recent issue of Learning and Leading with Technology, Gary Griest points out that schools will parallel society because they are globally affected by the introduction of information technologies and the “second-order effects that transforms what happens in the classroom”.

**LEARNING AND TECHNOLOGY**

Researchers are attempting to understand the effect that media of all sorts have on the way we learn, the way we think and the way we behave. By building on cognitive research from decades past, specialists in interactive technologies are beginning to parse out the factors that contribute to learning. What we are finding indicates that indeed, interactive technologies can play a dramatic role in the way learning transpires with school-age youngsters. Unfortunately, the way in which technology has been introduced into school environments has not always coincided with what we know about effective instruction or optimal learning. Cognitive psychology may help us stay the course as we venture into new and relatively uncharted waters.

One helpful learning model describes three categories of interaction from a student perspective. These dynamics focus on: 1) interaction of the learner with the content to be learned, 2) interaction between the learner and the instructor, and 3) interaction between the learner and other learners (Moore, 1989). Hillman, Willis and Gunawardena have noted in addition, that the interaction of the learner with the medium of instruction, especially forms of information technologies (IT) are certain to add critical variables to the learning process. They argue that the comfort of the learner with the medium can positively or negatively impact motivation, and content retention among other factors.

These arguments seem valid in light of the notion that when learners struggle to adjust to an IT environment, content and motivation will probably suffer. Indeed, some research with young writers has found that the psychomotor development predicted to some extent the quality of the written work they produced. Important for us as educators however, is to also examine the types of tasks we are asking students to perform using new technologies, and how these tasks fit within a matrix of performance goals, learner needs and always, available technological resources.

Given the pioneering nature of many interactive technologies being used in classrooms today, the nature of what is considered “interactive” is now being called into question. Merely supplying learners with full motion video, lots of text or even virtual environments does not necessarily mean students are actively involved or acquiring knowledge. Similarly, we know that pairing two students to complete a project will not automatically insure “cooperative learning”.

To assist teachers in understanding the probable results of injecting IT into the instructional process, it is helpful to provide a conceptual framework for these technologies and the interactions that are most likely to occur when students access them. I have broadly grouped these interactive technologies into two types of learning environments: information seeking and information producing.

**INFORMATION SEEKING**

Information seeking technologies are those that the learner actively (or sometimes even passively, as in viewing a videotape) pursues to expand an existing knowledge base. These information technologies include some television, the much-maligned “skill drill” applications, and database searches over the Internet. It is safer to rely on a paradigm that evaluates how technology is to be used over how “sophisticated” it appears to be. For example, this excerpt from a report produced by the Office of Technology Assessment (1995), is not looking at the way information is organized for technological distribution so much as it is looking at the recency of the technology itself:
"The most common uses of technology today are the uses of video for presenting information, the use of computers for basic skills practice at the elementary and middle school levels, and the use of word processing and other generic programs for developing computer-specific skills in middle and high schools."

The report continues, and if you are following my argument, notice how several different types of technologies are clustered into one category:

"Other uses of technologies such as desktop publishing, developing mathematical and scientific reasoning with computer simulations, information gathering from databases on CD-ROM or networks, or communicating by electronic mail—are much rarer in the classroom. Technologies are not used widely in traditional academic subjects in secondary schools."

While the first paragraph relegated the use of skill development into the realm of "lower" application, databases on CD-ROM are given higher credence. I would argue, however, that students using simple game programs such as Math Munchers, sophisticated CD-ROM volumes such as the Time Almanac series, or researching wave generation on the Internet, are all seeking to increase their knowledge base within a subject or content area. And other than using a different application (and a closed vs. open environment) are all 'information seekers'. They have learned to navigate within defined parameters usually set by others. These parameters can be closely defined (such as the database of plants and plant care produced by Sunset's Western Garden CD), or loosely defined and free flowing (such as the best way to travel to Honduras) by searching a variety of sites on the Internet.

My point is that at certain junctures in every learner's quest for knowledge, even primitive technology resources have the potential for motivating students, improving self esteem, and providing opportunity for collaboration and communication with others.

Prepackaged game environments and simulations also can provide such opportunities. According to Brody (1993), "the secret to education is to motivate the student—give him or her a compelling reason to want to absorb the information." Certainly game environments can provide intrinsic motivation because they offer opportunities to complete successfully what we start, offer clear goals, immediate feedback and a sense of control (Hillman, 1996). Clearly, the elite notion that students must be involved in creating multimedia extravaganzas in order to fall within constructivist models of learning is inaccurate. (We know from observation that kids can be busy constructing all kinds of theories about life and learning watching daytime TV). It is our job as educators to attempt as best we can to match student interests, talents and cultural demands to the appropriate instructional experience.

**INFORMATION PRODUCING**

Technologies that allow us to produce, publish, create or report what we have learned have leapt to the fore in recent years. As a graduate student at the University of Houston not too many years ago, our "cutting edge" technology was Hyperstudio running on an Apple IIgs with a 2200 laser disc drive. Now, along with Hyperstudio (still a very good authoring tool) there is a cadre of sophisticated software including Macromedia Director, and Authorware, all pulling full motion or Quicktime video into the picture.

These tools, perhaps more than any others, can offer potential of collaboration, integration of content areas and creation of technologically literate students. A word of caution however. These applications in and of themselves do not guarantee instructional excellence or increased learning. I have seen hypermedia projects created by students (and perhaps orchestrated by teachers) that were no better than the worst "drill and kill" that ever hit an integrated learning lab. Publishing opportunities on the Internet are presenting interesting challenges for educators as well. Along with ethical considerations, publishing issues of quality, design and presentation emerge. The World Wide Web is full of sites inhabited by folks who merely want to tell the world they have a gray and white cat.

**CONCLUSIONS**

I hope I've not implied that the two learning environments are mutually exclu-

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**REFERENCES**


Digital Imagery in the Photography Classroom

Penny Niemi

My tools have always been an important part of my craft as an artist and an art teacher, and I have tried to instill in my students this respect and appreciation. When the computer was introduced by one of my technology-fluent peers about 10 years ago, I was the first one to immediately reject it as a tool for the artist. "Give me my pencils and my brushes. I will never be able to draw with this mouse!" I exclaimed. Today, I am one of those techno-proponents, adamantly underwriting computers as a necessary part of the artist’s toolbox. I still feel that computer technology will never replace traditional tools, but it is a resource that every artist should be more than acquainted with. This is especially true of today's young artists. The computer is an integral part of their future and the sooner that they become fluent on it, the more realistic their educational experience will be.

In photography, digital imaging is already an important component in the profession in magazines, newspapers, and television. Again, I don't think digital photography will replace traditional photographic methods, especially for the amateur photographer, but knowledge of it is currently a necessity for professional photographers. With skill in digital imaging, one has unlimited career opportunities.

In all my photography classes, from Beginning to Advanced Photo, I try to expose students to some form of digital imaging. Beginning students learn how to scan images with a flatbed scanner and incorporate them into graphics using Photoshop, the industry software for digital imaging. There are several other reasons for introducing computer imaging into photography, one being the increase in the cost of traditional photography. Students on limited budgets may be restricted from taking photography classes because of the expense of the materials. Computer graphics programs allow students to experiment with digital images much like the darkroom experience, but at a much lower cost.

Making decisions, integrating, and problem solving are some of the thinking skills used in creating digital images. These are some of the most important skills that can be transferred to other parts of the student's life. The more capable students become at computer skills, the better chance they will have to be successful in the future, a future that will be dependent on computers in every area.

This year, for the final project in Beginning Photography, I wanted to present an activity that was new, exciting, high-interest, and used computers and digital imaging. Since the end of the year is a time when the seniors are signing memory books and students are taking a last look at school life for the year, I thought, "Why not have them use the digital camera to record some of that student life?" They could then digitize those images into a project using Photoshop. This would be a very active project where the students would take pictures of their school community.

In this year-end assignment students first created a word using the Text tool in Photoshop, and then filled it with pictures that they took with the digital camera. I noticed that the students were excited about the project and seemed to enjoy getting out into the school with the digital camera and taking pictures of whatever they wanted. They used an Apple QuickTake camera to take their pictures, and downloaded them onto their disk.

Some students had trouble, either the pictures were blurry or not what they wanted, so they took additional pictures. Most were not satisfied with mediocre results. One student commented that he did above and beyond his "call of duty," and another was "very satisfied" with her finished product, even though she had to go out several times for more pictures. The ability to do quality work easily is one of the advantages of computer graphics. The capability of quickly making changes and modifications lets students experience drafting, revising, and fine-tuning.

Students learned more about Photoshop and a digital camera by doing quality work of which they were proud. They worked hard and developed higher level thinking skills which included making choices, problem-solving, and evaluation that they can transfer to other parts of their life. The computer and related tools are fun for students to use, keeping students actively involved in learning. Computer technology is most certainly an important tool for the artist, photographer, and all students.

The Instructions for this Assignment Follow:

Using a digital camera students take pictures around a theme: friends, kids at their school, girls, sports, architecture, cars. They download these onto disks.

They open Photoshop and open a new document that is Gray scale, 150 DPI, any size. This will keep memory small. In Photoshop, they type the words that they want; these words should relate to the pictures they have taken. They choose a font that is wide and bold. ("Boulder" is a good font for this project.) Then they
scale the words so that they are large and fill the page. Next they fill the letters with a shade of gray or black which will facilitate pasting the pictures into the words. In Photoshop the students use the Magic Wand tool to select one of the letters. (A marquee will form around the selected letter.) Now they are ready to open one of their digital images. They copy all or part of it, then close that file. Next they go to their word file and Paste Into the selected letter. They move and scale the pasted image as they want. Hold the shift key to constrain proportions of the image when scaling. Otherwise they will just stretch and distort the image. With the Magic Wand tool, they select another letter or part of a letter and Open another of their digital camera pictures and Copy, Paste Into. They repeat this process until all the letters are filled with pictures. If they find some of the pictures are blurry or inappropriate to the shape of the letters, they may have to take more pictures.

Remind students to save after each step. When they are finished, they print their document on a laser printer.

Equipment and Software used for this project:
- Apple QuickTake Camera and software
- Photoshop 2.5.1 or 3.0
- Laser Writer Printer
- Macintosh with 16 megs of Ram

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Assessing Student Learning in the Technology Rich Classroom

Stephen R. Rowley and Darlina New

The rapid infusion of technology into Washington state classrooms can create powerful learning opportunities for students. In a few short years, students in many of Washington's school districts have become linked to limitless sources of data and rich communications networks. This technological explosion gives students unprecedented ability to retrieve and exchange information. Using this wealth of technology and information to help us achieve "world class standards" challenges us to think deeply about the purposes, methods, and results of classroom instruction and assessment.

In the Bellingham School District we believe that acquiring essential competencies in the use of computer technology is a fundamental goal for all students and teachers. Effectively utilizing these skills in the context of problem solving, persuasive presentation, analysis, decision making, is a much greater and more complex goal.

Our District Technology Plan defines the essential technology competencies we believe are necessary for high performing students and staff. We also use a two-tiered assessment system to help students and staff evaluate their ability to effectively understand, demonstrate, and apply these essential technology skills. Our technology competencies for students and teachers, and our assessment system, is briefly described in the sections below.

**STUDENT COMPETENCIES**

Ten essential technology skills comprise our student competencies. A more precise definition of each skill area and its outcomes is built into the Mankato Survey, our initial assessment instrument for students. Our student competencies are:

- Basic computer use, including the ability to use more than one program at a time.
- File management.
- Word processing.
- Spreadsheet, including analysis of data.
- Data base, including the ability to generate a report or create a data base.
- Graphics, including the ability to invent or use graphics to illustrate learning.
- E-mail, including the ability to request and send information globally.
- Information searching from a variety of electronic sources.
- Multimedia, including the creation of multimedia presentations.
- Technology presentation, including the ability to use a variety of sources (e.g., Paintbrush, CDs) or combine technology (e.g., Quick Take, laser disk).

**TEACHER COMPETENCIES**

Not surprisingly, the technology skills needed by teachers (as well as administrators and other staff members) is highly similar to that of students. Although phrased and defined with more adult sophistication, many of our teacher competencies are the same as those for students. Listed below are our teacher competencies:

1. Basic computer use, including the ability to use several windows at the same time.
2. File management, including the ability to organize, locate, and back up multiple files.
3. Word processing.
4. Spreadsheet, including the ability to use spreadsheets for labels, formulas, cell references, and charts.
5. Data base, including the ability to create data bases and effectively display information.
6. Graphics, including the ability to edit and utilize clip art and create original graphics.
7. Netscape operation and Internet Research.
8. Telecommunications use, including active participation in professional listservers and communications with other professionals and students.
9. Ethical use, including behaviors consistent with Board policies, copyright laws, and high ethical standards.
10. Technology integration, including helping students employ new technologies for support communication, analysis, and problem solving.

**ASSESSING STUDENT AND STAFF PROFICIENCIES: THE MANKATO SURVEY**

The first tier of our assessment system is the Mankato Survey. The Mankato is a highly adaptable self-assessment instrument designed to show the levels of use or understanding by the student and teacher.
The goal is for students and teachers to achieve a level 3 or 4 in all of the ten basic competencies. Two examples of the levels of use or understanding for a specific competency are shown below. These examples also demonstrate how competencies are defined as outcomes.

**#2 File Management (Student Mankato)**
- Level 1 - I do not save any documents I create using the computer.
- Level 2 - I save documents to different drives.
- Level 3 - I create my own directories to keep files organized.
- Level 4 - I move files between directories and drives.

**#7 Netscape operation and Internet Research (Teacher Mankato)**
- Level 1 - I do not use Netscape, nor can I identify any uses or features it might have which would benefit the way I work.
- Level 2 - I can start up Netscape and use district World Wide Web menus to find basic information on the Internet, but I spend little time doing so.
- Level 3 - I am able to make profitable use of Web searching software as well as lists of Internet resources to explore educational resources.
- Level 4 - I can create my own HTML pages and hot-lists of resources. I have shown my students how to mine the great informational resources available on the Internet.

The Student Mankato takes approximately ten minutes to fill out. Students in grades 5, 8, and 11 are given the Mankato Survey in the fall and spring. The pre- and post-assessments are then used by the classroom teacher to adjust instruction for individual students and the entire classroom. Classroom results are combined to yield composite statewide scores to demonstrate progress for the year and needs for improvement the following year.

All teachers take the Teacher Mankato Survey in the fall and spring. The data from the Teacher Mankato is shared by the principal and library media specialist with the faculty and site council for analysis.

The identity of the individual teacher is protected, however, by giving each teacher an identification number rather than using a name. The Teacher Mankato provides rich data for personal reflection and peer discussion regarding the progress and issues of concern that flow from the Mankato Survey assessment data. As in the case with students, it provides quantifiable data that shows success for individual and total staff growth. The Teacher and Student Mankato results help the principal, faculty, and site council make informed choices for professional development and school improvement action plans for the future.

### ASSESSING THE APPLICATION OF COMPETENCIES: THE STUDENT PERFORMANCE ASSESSMENT

The second tier of our assessment system is the Student Performance Assessment. Unlike the Mankato Survey, which is based on self-report, the Student Performance Assessment requires the student to use his or her emergent technology skills to solve a "real life" problem by analyzing data, using collaborative work skills with other students, and making a plausible argument for justifiable decision or course of action.

A fall and spring Performance Assessment is given to a randomly selected group of 5th, 8th, and 11th grade students who are assigned randomly to a four-person student work group. Students are given a problem to resolve or respond to in a three hour period.

The Spring Performance Assessment is an example of the tasks that students are required to perform. Student groups are asked to name the most important invention of the last two hundred years. They are asked to assess the accomplishments of Edison, Bell, and Goodyear. Students must find and graphically format the following data from CD ROM sources:

- What important inventions were developed by each inventor?
- What resulted from the inventions of each inventor?
- How do each inventor’s discoveries affect your life today?

Students must then use spreadsheet and other data formatting skills to present their choice for the most important invention to a group of teachers and students. Student groups are assessed by three criteria:

1. Ability to work cooperatively and productively in a group.
2. Ability to select, organize, and analyze data.
3. Ability to present data and draw a valid conclusion or make a valid case for a choice of inventor.

The ability to work together as a group is assessed by a group of teachers who look for frequency of behaviors such as listening, questioning, sharing, and participating. The ability to select and analyze data and ability to make conclusions from data, are rated by teachers using a 12 level rubric. Although not every student at the 5th, 8th, and 11th grade is required to take the Performance Assessment, the data generated by a limited number of randomly selected groups gives teachers and students alike specific information about the progress students are making in using their technology skills to perform challenging and integrated learning tasks.

### CONCLUSION

We have presented a very brief and descriptive look at Bellingham’s technology assessment system. Due to the limits for this article, we are unable to provide the details of our assessment system, or other important elements of our technology support system such as professional development and school-based planning.

Suffice it to say that without the data generated from our assessment instruments, we would have no valid or reliable means of knowing if we were achieving the goals of our district’s Technology Plan. Similarly, without the component of student performance assessment, the use of technology would be detached from a meaningful contribution to powerful, integrated learning for students or teachers.

Stephen R. Rowley is the Assistant Superintendent for Administration and School Improvement. Darlina New is the Library Media Specialist for Silver Beach Elementary School in the Bellingham School District.
MEMO

TO: WSASCD 1997 Conference Attendees

FROM: WSASCD Executive Board and Conference Committee

RE: Forming Education
What’s Essential?

As the 1997 WSASCD Conference Committee discussed what would be a timely and appropriate theme for a conference, thought centered on the essentials of education. In a deliberate play on words, the Committee focused on the larger issue of school reform, in relationship to Washington State’s goals and essential learnings.

During the 1997 WSASCD Conference, we hope that presenters and participants alike will deliberate on those elements that are essential as we reform education in Washington State to prepare students for the next century. What is essential? How do educators, parents and community members decide what it will take to truly reform education to meet the needs of all children?

The responsibility of shaping an educational system that can fulfill the myriad charges it has been given is an incredible, an often, overwhelming challenge. Is there a way to simplify the task by identifying the essentials? A central purpose of the conference will be to provide us with time to reflect on this question together.

KEYNOTE SPEAKERS:
Joining us on February 6-8, 1997 at the Conference locations-the Meydenbauer Center and the Hyatt Hotel in Bellevue-will be keynote speakers who will inspire and guide us. Dr. Thomas Lickona, a developmental psychologist and professor of education at the State University of New York at Cortland, will be sharing insights from his work on moral development and character education. Coming from Harvard University Graduate School of Education is Professor Eleanor Duckworth. Having studied with Jean Piaget, and from her own research, Dr. Duckworth will provide us with information on how children construct knowledge.
Dr. Grace Pung Guthrie, Co-Director of the Center for Research, Evaluation, and Training in Education in Burlingame, California, will be addressing issues related to multilingual/multicultural education. The conference will close with a presentation by Dr. George "Pinky" Nelson from the University of Washington's Physics and Astronomy Department who was the first educator to do a space walk in the space shuttle program.

**ACTION LABS AND CRITICAL ISSUES:**

The action lab day will take on a little different format this year. Following a presentation by Dr. David Berliner, Professor at Arizona State University and author of *The Manufactured Crises*, brunch will be served. Then, all of the action lab presenters will participate in a panel discussion addressing the conference theme of what's essential in reforming education.

In the afternoon, conference participants can select from among the following action labs:

- Multiple Intelligences—*Linda Campbell*
- Integrated Learning—*Susan Kovalik*
- Tribes Training—*Judy Fenton*
- Charter Schools—*Dennis Mah* and *Emily Saur*
- Alternative Assessment—(Presenter TBA)
- Systemic Change/School Governance Issues—*Marilyn Simpson*
- Exemplary Reading Programs: Linking for Leverage—*Linda Lee, Pat Mainella, and Sue Ryan*

The Critical Issues Institute Committee has selected technology as its focus. Two exciting projects have been developed as a result of the Committee's work: a technology strand will be part of the conference sessions planned for all three days; and a WSASCD Home Page is being created for those seeking information about the organization.

The 1997 WSASCD annual conference planning committee has worked to create both an atmosphere and an array of offerings that will help us all focus on

**RE: Forming Education**

**What's Essential?**
DIGESTING THE PIG: IMPLEMENTING AND ASSESSING INSTRUCTIONAL TECHNOLOGIES

GARY BROWN

INTRODUCTION

The Internet has precipitated with virtual certainty what those who have been working with technology in education have been saying for more than a decade: for better or for worse, the infiltration of technology into education is irrepressible. The Luddites' lament now parodies itself, dashed off, more often than not, on word processors and then zipped across campus via e-mail.

The spread of word processing in composition curricula makes the implications of this infiltration acutely: Though Hawisher's (1988) meta-analysis examining the impact of word processing on improving student compositions was inconclusive, a careful inspection of the studies included in her research reveals that most of the student writers began composing with pen or pencil and later were introduced to word processing. Hawisher found no verification that word processing actually helped students improve their prose. Yet a few years later, studies in Research in The Teaching of English (Jorma et al., 1992; Oweston et al., 1992) began reporting with some consistency that word processing was in fact helping students improve their writing skills. Inspection of those studies reveals, however, that most of the subjects were already accustomed to word processing and, for the purposes of the particular studies, had been asked to revert to pencil and paper. The progression in the research findings separated by a few short years makes some implicit and yet critical points.

First, we must recognize that it is probably neither reasonable nor productive to respond to the persistent, nagging, but ultimately irrelevant question— "Does technology work?" Technology is an integral part of contemporary western culture. Since it is now clearly a disservice to our students not to provide them with the opportunities to learn to use and think with technologies that pervade the culture, our challenge as educators is to understand how technologies work in educational contexts and then to deploy them appropriately and effectively.

On the other hand, we also need to acknowledge that assessment of overly specific, isolated technologies is equally problematic, especially when we consider the multitude of migrating variables. Technologies are changing at a stunning rate; computers and software change almost daily. Writing with Bank Street Writer is hardly comparable to composing with Word 6.0. As a result, assessment of narrow interface variables will be rendered obsolete and moot before the results are disseminated.

The questions we ask, therefore, will be most productive for educational purposes if they sidestep the particulars of technologies and are framed, instead, in contexts most appropriate to our instructional objectives, contexts that reflect our teaching and learning practice. In order to
begin to isolate what matters most to learning—the implementation variables, the PIG Continuum may provide a useful reference.

**The PIG Continuum**

The Presentation/Interactive/Generative (PIG) represents the range or continuum of technology implementation strategies in education. Not coincidentally, the strategies themselves reflect traditional pedagogies found in educational practice.

The **PRESENTATIONAL** use of technologies ranges from methods as simple as enhancing lectures with slides to, now, with the development of computer technology, using multimedia or perhaps even the World Wide Web as lecture or research resource enhancement. Presentational uses of technology generally reflect pedagogies characterized by the lecture and the tradition of the research task as defined by the instructor. When a student asks an instructor who is using multimedia to enhance a lecture to repeat a point, the nature of the PIG as a continuum becomes clear: the question pushes the presentation across the PIG continuum toward interaction. The dynamic of this interaction in a lecture based classroom, however, tends to be limited. A recent study of twenty classes suggests that about 1/4 of the students in any given class interact on the average of about 2.3 minutes out of every forty minute period (Nunn, 1996).

**INTERACTIVE** technologies include multimedia programs developed commercially or by educators using authoring programs. Web-based interactive learning environments branch from site to site or within a site. The interactivity increases with the complexity of the branching, from text based and Skinnerian (right/wrong) interaction to more complicated multi-modal and adaptive (Crowderian) branching. Interactive pedagogies may also include asynchronous threaded discussions on the web or groupware that encourage increased human collaboration, and, as we move further across the PIG continuum, between groups of people sitting at a single computer terminal. At this point, most interactive uses of the web extend only marginally away from the presentational end of the continuum and are comprised primarily of text material presented with an interactive table of contents. Technologies other than the web are usually commercial packages introduced in campus computing labs targeting independent study.

The **GENERATIVE** use of technology describes methods that put multimedia and web tools into the hands of students. Most of these approaches at WSU require students to collaborate with each other and with faculty to create web pages or multimedia modules. Generative activities like collaborative writing or participating in threaded discussions bridge the interactive domain on the continuum to the extreme generative end of the spectrum where students actually design and make multimedia themselves—including animations, morphs, or full-featured hypermedia environments.

**Domain Learning Attributes**

The intervening variables along the PIG Continuum are numerous and complex and, as with technology variables, resist reduction. Nonetheless, there are general tendencies that further characterize each approach to instruction. The most obvious and the one most responsible for shaping technology implementation strategy is the control of content. As implementation moves from presentational to generative, the more instructors tend to divest themselves of their control of the specific information that students engage. When instructors lecture, they assume responsibility for the specific information students are expected to learn. (It is an ironic aside but frequently the case that those who most tenaciously embrace the lecture are the most vociferous in their condemnation of student passivity.)

The assumption of responsibility is increasingly confounded when we begin to acknowledge that students learn, as Steve Ehrmann (personal communication, February 21, 1996) argues, for diverse purposes in diverse ways. The consequences of that diversity of purpose and style are not surprising—what teachers teach is not necessarily what students learn.

It is also interesting that the use of presentational multimedia is often advocated in part because, unlike overheads and slides, multimedia presentations allow the instructor to respond more readily to individual student questions using images that illuminate the particular concept in question. The strategy assumes the generative imperative—that learning benefits stem from student interaction with the multimedia lecture. The more sophisticated questions, we further assume, are more than fact-based inquiries or requests to repeat a point, but are increasingly generative in nature—questions that extend or expand upon a point of discussion. However, the paucity of student generated discussion cited earlier tends to challenge the validity of such assertions.

On the other hand, it increasingly appears that learners who process information purposefully and actively, activities fostered by learning environments that move toward the generative end of the continuum, significantly improve student learning (Bickman, 1987; Meyers, 1993 & Jones). It also increasingly appears that at the most fundamental levels, learning is a by-product of student activity.

Nonetheless, it remains that interactive and generative activities are not without their drawbacks. Generally, as learning activities move toward the interactive and generative, the more instructors are required to give up more of their curricula, to give up control of what students learn.
Advocates of interactive and generative methodologies may counter that sacrificing what students learn for more influence on how students learn is more than a reasonable exchange. Further, advocacy of the generative use of technologies carries additional implications. Beyond the need to prepare students for active roles in careers that will in all likelihood themselves be interactive in nature, putting the technologies directly into the hands of students also implicitly embraces the heart of the tradition of the back-to-basics argument for emphasizing the three Rs. Most of us now recognize that it would be remiss to expect to teach reading without simultaneously teaching writing. It may now be equally remiss to suggest that we can develop and present new media without also fostering in the minds of students the generative context with which to manipulate that media. After all, as with the language of text, those who cannot manipulate the language are destined to be manipulated by it. For educational purposes, the increasing preponderance of visual media consumption suggests that we now reside in a culture where language must be redefined to include multiple modes, multiple media.

ASSESSMENT
To begin to verify these assertions, in the spring of 1996 Washington State University piloted, in collaboration with Annenberg/CPB, The Western Cooperative for Educational Telecommunications of the Western Interstate Commission for Higher Education (WCHE), and four other institutions, the Flashlight Project assessment instruments. The Flashlight instruments are designed to help institutions develop evaluation procedures to help determine how technologies are influencing educational strategies (1996). The instrument is an extensive survey item bank divided to provide questions for exploring the different deployment of technologies in a variety of educational contexts.

At Washington State University, the Flashlight instrument was piloted in several domains across the PIG continuum—the presentational implementation in two lecture courses, one with and one without multimedia, and in four interactive/generative Freshman Seminar pilot courses. In the multimedia lecture enhanced course, the instructor presented images, animations, and music to a class comprised of about 60 students, primarily freshmen. The control course of about 40 students covered the same material without the multimedia enhancements. Consistent with the attributes suggested by the PIG Continuum, the large lecture course covenant imposes considerable constraints upon the content the instructor must cover during the semester. As one course in a two semester sequence, the general education lecture courses are expected to complement each other by presenting the overview of material across time and geography.

The pilot Freshman Seminars included four linked courses of roughly 55 students who shared a common syllabus. The Seminars were conceptually framed in order to help students develop their learning skills within the context of the linked courses—which were actually the same courses (though different sections with different instructors) as the lecture courses. This happy accident tends to ground the comparison. Complicating that comparison, however, were the populations samples. Though enrollment in the large lecture courses is a general education requirement for all students at Washington State University, students in the spring pilot Seminar adjunct courses were required to enroll in the Seminar because of their previous poor academic performance.

Unlike students in the lecture courses, students in the Seminars interacted in groups of three around a single computer. They debated leveraged questions designed to foster speculation and reinforce general study strategies, but each question avoided, by design, specific content requirements. Though the four pilot Seminar courses included in the study shared a common syllabus, students in each group were encouraged to generate their own written responses to the leveraged questions. The World Wide Web interface was designed so that when each group was satisfied with their response, they could post it automatically onto the Web so that their collaborative response was accessible to other groups in the class, in other classes, and even in companion classes at other institutions and in other countries. In turn, each group in each class was required or encouraged to respond to the posted material. Through this ongoing process, the interactivity was integrated throughout the Seminar.

In addition to the interactive compositions, the Seminar required students to generate their own multimedia projects, including personal web pages, morphs (in which two or more images are fused or blended dynamically to make a visual statement), animations, and even, in several cases, full-featured interactive modules integrating some or all of the media mentioned. Both technical and conceptual support was provided by students with previous experiences who worked in computer labs as multimedia consultants (or Hypernauts). Again, the specific content of those multimedia productions was not tightly constrained. Students were free to choose their own subject matter from material presented in the linked general education course and express their own interpretation of a concept using the tools and techniques of their choosing.

RESULTS
End of the semester administration of the Flashlight surveys designed for each domain of technology implementation proved to be very valuable and insightful. The Flashlight findings between the two multimedia lecture courses revealed consistent enthusiasm for the instructors,
79.7% OF THE STUDENTS REPORTED THAT THE TECHNOLOGIES HELPED THEM TO EXERCISE THEIR CREATIVITY.

but very little difference emerged in the survey to distinguish outcomes between the multimedia and the control courses. Few students in either the multimedia lecture course or in the control reported communicating with the instructor about matters of content or their academic, professional, or personal goals. Few reported that the technology (<10%) motivated them to spend more time studying.

Alternately, the Flashlight findings in the interactive/generative pilot Seminar were dramatic:

- 50% of the students reported that the technologies used in the courses significantly helped them to understand and visualize the ideas and concepts taught in the course.
- 46.3% reported that the technologies helped them learn to manage large complex tasks.
- 79.7% reported that the technologies helped them to exercise their creativity.
- 53% reported that the technologies helped them prepare for tasks they will face as professionals.
- 70.4% reported that the implementation of the technologies helped them to ask for clarification and take responsibility for their learning.
- 42% reported that the use of technologies helped facilitate their ability to discuss their academic goals with their instructors.
- 45% reported that the use of interactive technologies in the seminars helped them to be much more or somewhat more likely to get to know students who are different from them in their physical abilities and/or their cultural and socio-economic background.
- 26% of the FS students reported that they are much more or somewhat more likely to obtain help understanding course material from students/peers who are not attending this institution.
- 23% reported that they are much more or somewhat more likely to communicate with content experts outside Washington State University.
- 30% reported that they are much more or somewhat more likely communicate with people from around the world.
- 40% reported that they are much more or somewhat more likely to communicate their complaints and/or suggestions about the course to their instructors.

CONCLUSION

Although the Flashlight approach to assessment did not directly assess student learning, the findings in a formative sense may in fact be more valuable for guiding the future implementation of technologies. For instance, the 23% who found their way to content experts outside Washington State University, like the 30% who have begun to communicate with people from around the world, suggests that more can and should be done to structure such activities. As a result, next semesters’ Seminars will coordinate with the Bureau of Land Management to systematically bring outside expertise into the Seminar Virtual classrooms. More partnerships with programs across the country and around the world will be included to bring more diverse viewpoints into the Seminar Virtual Communities.

These efforts also suggest, however, an additional down-side to the generative pedagogy introduced in the Seminar in that progression toward the interactive and generative tends to correspond to pedagogical complexity and an increasingly abrupt break with tradition—subsequently, the more generative the pedagogy, the more stress it puts upon an institution.

Finally, though perhaps the most valuable gain from the interactive and generative implementations of technologies is institutional stress that makes a necessity of change in our approach to curriculum assessment as well as instructional practice. It may be a confluence that has arrived none too soon.

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Technology Implementation

KEN WILSON

Technology ends up in our schools, it is not developed for them. Most often our technology comes from the government, medical schools, or industry. It then moves to home use, and finally is implemented in our schools.

To observe the reality of this point one needs to look no further than the development and use of the Internet in our society. It follows these points quite closely; created for government and industry, the Internet has slowly become important in homes and schools. The issue this premise raises for the educator is the method by which technology is infused into our education system.

EVALUATION

When education is the last participant in the chain, students may not be developing skills that are commensurate with real-world technological use. If viewed as a hierarchy with government at the top and education at the bottom, one can assess technology in terms of value to the student. Either they participate in raising the level of technological use or merely facilitate bottom-level experiences. Technology in education, therefore, can be evaluated in these simple terms:

• Is this a hand-me-down technology? If the answer is yes, then educators need to consider whether instructions (applied uses) have come from low-end consumers or from higher levels in the hierarchy.

• Are we educating or mirroring end user levels of development? This involves seriously examining the purpose of why we are implementing a technology. Are students developing new uses for technology, or are we offering them a knowledge which trains them only to be consumers?

• Do the educators, researchers in education, and the community at large, grasp the consequences of delivering end-user technology? End-user levels show up as products which copy current use and eliminate thinking skills. Higher levels of use involve the ability to alter the product to develop skills which promote new ideas.

• Does ongoing training for educators occur at a level that promotes timely implementation? Sound education involves equitable opportunities for all teachers and all students to learn technology that is current.

• Do equipment purchases follow a path of constant upgrading and provision for all students to participate in “current technological use”? Constant upgrading must become a part of any educational plan. As new equipment becomes available, is it an end-user product or a tool which allows participation in developing new technological uses?

By changing our views and focusing on developing technology use we can prepare our students to become comfortable with developing applications and uses for technology that are not handed down through the system. These products have a direct impact on the curriculum and allow students to experience the process of application rather than replication.

APPLICATION

My first experience with technology came in 1988, when teaching a third grade class. I noticed a growing number of National Geographic magazines sitting unused on a back shelf of the classroom. I prepared a simple problem solving activity for the class and queried them to the point where they brainstormed the concept of a machine that could find any article in any of the magazines on our shelf. As this discussion and lesson progressed the students formulated the plan for a system which could search all of the magazines information which met certain criteria.

The following days I worked with the class to create a data base system which could hold the information the students had developed. Within a week all of our 30 magazines had been stacked in order and entered into our “National Geographic Data Base”. Within one month of this projects inception we were acquiring boxes of magazines each day. We met as a class and decided to write letters to bookstores and place an ad in our local paper asking for donations of old National Geographic magazines. One bookstore donated all of their copies to our project and we found our collection now had volumes dating back to 1908.

The students were always monitoring this system and relying on their information system for research rather than using the encyclopedia and the school library. We were also collecting multiple volumes for group use and discussion. These students were very quick to realize that when they needed to find information they needed to come prepared with reference queries (keywords) which contained at least 12 to 15 items. Students became excited about each new project because they had the information at their finger tips, knew how it worked and were able to go find the information in our room. They had followed worked through Bloom’s Taxonomy. The students were able to brainstorm new projects for each new topic brought up by the curriculum, and design a new process for communicating their knowledge.

We were using shared data bases and research criteria for real world use (the immediate curriculum), when most teach-
ers were just becoming familiar with word processing, simple spreadsheets, and image acquisition. This project models the type of use which is cost effective and can provide opportunities for all students to participate in meaningful technology use.

HIGH LEVEL TECHNOLOGY USE

Essential Learnings are currently developed for state-wide implementation. They are sincere in their intent to develop better methods of educating our population. We have overlooked the fact that education leaves out the process of developing skills which foster new ideas and produce full metacognition as an outcome.

High end technology use is formed by the process of using thinking skills on a day to day basis. Students not actively developing their own outcomes and participating in the communication of their thought processes are not raising the level of their education. The demand of this system of process-teaching requires the student to become an active learner/partner in day to day learning activities. There should be a format in place which promotes high levels of skill acquisition and culminates in student application of knowledge/skill acquisition to produce individually derived outcomes. When technology is used to facilitate this process it rises above the consumer level and the predetermined presentation of knowledge. A high level outcome demonstrates a full knowledge of the information and an application of that knowledge in a fresh, student developed product.

The assessment of these products is viewed through examination of a matrix of thinking skills which guides the student to achieve higher levels of application. These assessments are possible through the use of technology. Throughout the past ten years I have been implementing programs which collect full assessment practices and produce more than grade evaluations for students. Students track their growth, show their work and development of skills, and show the dialogue which occurs throughout a learning experience. These assessments of development are held in electronic portfolios which are used day to day throughout the school.

CREATE A CLIMATE FOR TECHNOLOGY USE IS ESSENTIAL IN ORDER TO IMPLEMENT A PLAN.

IMPLEMENTATION

Creating a climate for technology use is essential in order to implement a plan. Several processes must occur simultaneously in order to infuse technology into the curriculum. First there must be support from the building administration to the extent that the administration is participating in learning new applications and participating in creating uses which improve daily operations through the use of technology (teacher observations, attendance, assessment, budget, logging of daily activities, and e-mail).

Secondly, the staff must develop areas of passion and use that passion to implement technology into the curriculum and their daily operations. Staff must have the opportunity to develop applications which promote the growth and development of educational use throughout the building. Some staff must serve as facilitators to maintain a goal of infusion throughout the building.

Third, all students must have access to all technology. They must be allowed to develop a passion for its use and have the means to access high-end use. This does not require all staff to be able to direct the process in the beginning, but does require that all students are able to get to the medium needed and receive support for developing solutions through the use of technology.

CONCLUSION

Innovation is the key to building valuable programs in our schools. Clearly, innovation and modeling of these criteria allow all of our education systems to offer quality programs. Innovation replaces cost, and the benefit of relying on innovation is that our system operates at a higher level than ever before.

Ken Wilson, works in the Issaquah School District and is currently completing a system for an Alternative High School.
Assessment: How Do We Know What They Know?

Washington State ASCD’s Critical Issues Institute publication for 1992, much research has been done including articles, commentaries, and case studies. Topics addressed include: alternative assessment pros and cons, what the alternatives are, standardized tests, assessment through the multiple intelligences, assessment through a writing program, assessing learning experiences, portfolio assessment, exhibitions, and mastery learning.

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Once You Are Caught in the Web You Can’t Get Out
The Internet Pandora’s Box is Open

KEVIN C. FACEMYER AND NILS S. PETERSON

INTRODUCTION

This article poses three propositions about the impact of Internet and telecomputing (computers linked to networks) on our society. From these propositions it makes three projections about future educational systems. It offers a glimpse of a future where a one room school house is connected to the Louvre and Princeton’s Fusion reactor as well as hundreds of thousands of other interesting and educational sites; and a glimpse of an educational future where a teacher’s first responsibility is to assist students in self-guided inquiry, rather than engage students in didactic, 1-talk-you-remember exercises. We do not address the merits of these changes (though we think they are generally good). We assert that telecomputing is the most important educational technology for schools to address in their planning and operations; and the need to start planning is urgent.

This article is not about whether a teacher can be better with the Internet or without. It is about the more subtle ways that society will be transformed by the presence of these new forces of communication and computing technologies. This article is not about what people say on the phone but an analysis of the impact telephony has had on society. Nor is it about the programming on television, but about the ways that the institution of television has impacted society’s needs, desires, and attention span. This article is about the inevitable impacts of telecomputing, which will overshadow all previous educational technologies.

Proposition One: Once you get caught in the World Wide Web (make telecomputing a personal resource for work and learning) you will never leave.

WE ASSERT THAT TELECOMPUTING IS THE MOST IMPORTANT EDUCATIONAL TECHNOLOGY FOR SCHOOLS TO ADDRESS IN THEIR PLANNING AND OPERATIONS.

The Web and Internet, and your uses of them, may change or mature, but once you start, you will never quit using them as a personal information and learning resource. Your access may go down, but you’ll wait for it to come up; you may even stop working until it does. Consider these analogies in support of the proposition:

- Reading. Once you have learned the technology of reading, you will never stop reading. You may choose different reading materials: comic books, lawn mower assembly manuals, Flaubert; but you will never willingly stop reading. Once a reader, always a reader.
- Telephony. Once you have learned to use the telephone you will never long for a return to telegraph. You may be irritated by the phone, or try to avoid it, but when it is available as a means of meeting your communication or information needs, you will never spurn it.
- Word processing. Once you have learned to word process, you will never cash in your computer for an IBM Selectric and onion skin. You may pen notes in the margin of a book, but you will never willfully decrease the percentage of your writing done by word processing in favor of manual forms of composition.

Once you are able to instantly call up an infrared satellite weather image on your Interneted computer, will you instead try to find a radio, try to tune it to a station, then wait for a weather report, including a verbal description of the temperature and the vague adjective: cloudy? Or, at your convenience, will you log onto the Internet and synthesize your own weather forecast, complete with animation, at the click of a mouse?

Once you are able to view the Dead Sea Scrolls at 8x magnification at your leisure, from your Interneted computer, would you instead choose to spend years waiting for a permit and travel to where they are kept, only to view them in the semi-dark and through glass? Or would you prefer to view them now, at your leisure, at increased magnification and in good lighting conditions, and to save representations of the Scrolls in your computer which can not even be photographed?

If that speculative description sounds farfetched, it may surprise you to find out that you can do all of these things now at: http://www.wni.com/yahoo (Weather) http://unixware.msc.c.huiji.ac.il/~orion/orion.html (Scrolls).

Once you have accessed these things and begun to incorporate these types of Internet interaction in to your daily life, perhaps into your lifestyle as a life-long learner, how often do you think you would prefer to revert to the pre-Net offline...
modes of: information gathering, recreational scholarship, or attention to news events? We don’t imply that you will never read a newspaper, listen to the radio, or watch television again, but you will never choose to use older modes of communication for things you expect to be done faster, more efficiently, and less expensively using the Internet.

Proposition Two. The developed world will achieve levels of Internet use approaching its level of literacy.

BY JANUARY, 1999 OVER HALF OF ALL AMERICAN HOUSEHOLDS WILL HAVE THE TELECOMPUTING TOOLS TO ACCESS THE INTERNET.

Literacy is essential to full participation in a modern post-industrial society. To use the resources of a literate person, you will use the Web. Key scholarly journals, such as Science, and government agencies like the U.S. Department of Education and are developing Web presences, as are information sources from the New York Times to CNN. These web presences are already a way that these organizations work with their constituencies. Many businesses, from L. L. Bean to our local bistro have a Web server. Major libraries have been working for decades to put their catalogs into electronically searchable forms. Now they are providing these databases with Web-browser interfaces (e.g., WSU Libraries). You may or may not choose to travel to a library to search its catalog, but when you search, you’ll do it via the Internet and the World Wide Web. Some publications exist only on the Web (e.g., Slate Magazine). The literate person in the developed world cannot help become ensnared in the Web.

Proposition Three. The rate of conversion to use of the Internet is growing exponentially.

Consider the analogy of the automobile. Think about the layout of towns. In the middle 1800s, grocers were located in town and shoppers visited on horse back or foot. Commerce was concentrated in the centers of small towns, and in walking distance in larger cities.

Now invent the automobile, they are common in the 40’s. Or better yet, string together several innovations: the automobile, the indoor mall and the air conditioner. It took 50 years for movable type to alter the relationship of the laity to books, it took half that long for shopping to shift from downtown to the malls.

An interesting source describing the online transformation is The PIPER Letter (1995), a set of collected public information documents discussing the implications of the Internet. In The PIPER Letter, Matrix Information and Directory Services (MIDS) (1995) mentions that in July of 1995 there were 13.4 million producers of interactive services of the Internet. They describe this as the core of the Internet. These are the users posting pages who have URLs and offer participants something to view and do. The consumers are estimated at 22.6 million. These are the users who are looking at things and asking for data to be transmitted to them. MIDS then estimates there are 35 million e-mail participants who use the Internet as a quick postal system. That sounds like a lot of participants, but viewed another way this is a small fraction of our society. The way you look at the numbers is not important in describing what will happen, (everyone on the Internet, always and expecting access everywhere) but when.

Viewed another way, according to Jupiter Communications (1995; as cited in The PIPER Letter, 1995) in about 27 months 63.6 million homes (62% of homes in America) will have PC in them, 51 million of them will have a modem in them. By January, 1999 over half of all American households will have the telecomputing tools to access the Internet. According to media and advertising theoreticians, mass market penetration is described as 30%, so sometime before the 1998-99 school year we will reach a point where the Internet will be mass media.
This is important in understanding what the vehicle will do the landscape of our society and in turn, to education.

When Gutenberg invented the movable type printing press there were about 30,000 books in Europe. Fifty years later that number had jumped to 9 million, a 300 fold increase (Gates, 1995). In February 1994, there were about 1580 World Wide Web servers (a unit of information, like a book). One year later there were over 76,000 (Network Wizards, 1996; and General Magic, Inc. 1996; as quoted in Butler, 1996). If you assume that there are 6 different types of information in these new servers, (this is probably a flagrant under-estimate) then there was about a 300 fold increase in titles and volumes available on the World Wide Web in one year. 100 years after Gutenberg, the first modern universities were being formed. Two years into the Web, the Western Governor's Virtual University is planning to open by 1997.

ANALYSIS

Our three propositions in a nutshell are: You can’t quit, you will start, and everybody will be online soon. What interesting projections can be made about online learning environments?

Projection One: Soon parents will assume the Web is an element of their student’s education. If current schools don’t meet that assumption, parents will begin looking elsewhere, perhaps even on the Web, to school their children.

As many as 15% of your neighbors may have already explored the Internet (MIDS, 1996), therefore, your peers’ and community’s expectations about school operation and education are about to change. In the Fall of 1995, WSU’s Virtual Professional Development School hosted the world’s first Virtual Science and Mathematics Fair. (The second of these children’s science meetings takes place this fall.) The attendance by public and private schools was about equal to the attendance by home schoolers. Most interestingly, there were a group of parents who decided their child’s school/teacher was not ready to participate, so they enrolled their child if they were home-schooled.

Where educators had to compete with the impacts of television, they will soon have to compete with, or else integrate, online resources, not just for data retrieval, but for pedagogic interaction and collaborative partnership. In fact, future teachers and educational systems may have to compete with parents as described in the previous paragraph. Television, and the cultural impact it had, changed many of the premises of our society.

If you teach art or AP physics, telecomputing changes how you can teach. You can take your students to the Louvre or watched the Tokamak reactor experiments at Princeton. Each may impact your teaching. More than just the opportunity to show art, or describe the theory of fusion, the opportunity to engage the art or science community and its products not just as an observer but as a participant suggests that rich educational experiences will be facilitated by telecomputing.

In this issue Brown describes a spectrum of multimedia interactivity and use, ranging from Presentation, through Interactive, to Generational. Presentation currently dominates Internet uses. This may thrust teachers into passive consumer roles for a short time. Presentation Internet is a library model: visit and check out information. But what happens when students are brought up on a diet of interactive and generative knowledge dissemination assisted by telecomputing technologies? In the same way that MTV children now have pop song-long attention spans (~3 minutes), will tomorrow’s Internet children (screenagers, to Douglas Rushkoff (1996)) and their youth culture make interactive and generative demands of our educational systems based on their online experiences? Further into the future it is easy to project teachers and administrators using more and more advanced telecomputing techniques, with these advances being driven by the inexorable advance of Internet penetration into our lives (Dede, 1995). [Dede speaking on the topic.] Using the initial premise, you never go back, it seems that educational environments will transmogrify into “Internet-assumed” learning opportunities.

In some ways these changes are not drastic. The Internet offers opportunities which differ little from the advantages of group instruction methodologies and peer coaching. These are proven effective strategies. Over time as we try these techniques and experience the power of their success we convert. Internet use may be the same in both its success and its methodology. More communication may mean more mental engagement with both the subject and
community generated to participate in this learning opportunity. The conjunction of students getting closer to knowledge and closer to each other results in distributed learning communities (DLCs). We have seen evidence of these DLCs forming spontaneously during preservice teacher classes, global science fairs (Facemyer, 1996; and Facemyer, Brown, & Peterson, In press), and cross campus planning and coordination of administrative enhancements. There are even theoretical speculations (Kauffman, 1995) that DLCs form spontaneously without regard to purpose or edict.

If that sounds abstract, it is important to remember that the core of these DLCs can be the classroom, and the focus will be learning and the attendant social interaction produced by the investigation of ideas and application of skills. Information technology (IT) is secondary to the experience. IT may be the vehicle for future educational travel, but the path and the journey's objective is still in the hands of the teacher. Few expect this to change drastically. However, few deny the coming transformation of how and what we teach students (Postman, 1995) and how we manage and lead our educational organizations (Means, 1995).

The future of high quality pedagogy may make use of scanners and personal productivity software, but in the same way that typing is not a skill of business management, word processing is not a skill of educational leadership. The key to good teaching and the effective training of teachers will be teachers who understand the principles of writing versus the mechanics of word processing. As governments and businesses abandon obsolete technologies, educators will be thrust into new directions. As broadcasting turns into narrowcasting (Negroponte, 1995), where the recipient makes choices about the delivery and configuration of the messages, the mechanics and expectations of society will change. Will students be able to participate in generation of knowledge from their schools?

This question is the key to understanding the point at which students will expect their educational systems to do what they want.

Projection Two: Of all the educational technologies, schools should give top priority to incorporating telecomputing into all aspects of their operations.

If telecomputing is becoming integral to our society, schools should go with the flow. A school home page should include a calendar for the school’s events, as well as the administrators’ and parent-teacher conference schedules. Initially the whole public won’t be able to access this information, but staff answering phones can get the information from the online source for them.

Web pages should also be used to provide parents a place to see (and critically examine) their child’s work, and the work of the child’s peers. [The Virtual Professional Development School has examples of what parents might see: Art/Writing, History, Science, Language Arts.] It should not be used for a special show-and-tell, but as a portfolio of a significant portion of the student’s work. During parent-teacher conferences, these online exhibits can be referenced by teachers, even if parents don’t yet have online access.

Children should use the Web to share their work and collaborate with peers working in DLCs. They should also access the catalog of the school and city library via the Web, as well as online information sources, from CNN to NASA. Children should understand online working/learning as being a continuum from: Presentation (by self or others), through Interaction (peer review and constructive critique of the work of themselves and others), to Generation, where new works are created as the synthetic response to
other information (research and publication) and participants.

School e-mail should not be confined to lunch counts and attendance. It should include sending agendas for meetings to participants, interested parents, and the local press. Parents should routinely communicate with teachers via e-mail, and teachers should communicate with other teachers and students working in DLCs via e-mail.

University preservice teachers should be involved in school DLCs as part of their practicum experiences to meet teachers and children before going to the building, and to learn the culture of the school’s online operations. University faculty should be involved in the school’s DLCs as part of their partnership and research activities.

Projection Three: Telecomputing must be funded as an operating supply (like library books and photocopy paper) and not as a capital item (like tables and chairs).

It may be acceptable to have a few CD-ROM computers, and a few scanners and one digital camera, but all school computers need to be on the Internet. Further, when telecomputing is central to the school’s operations, like photocopying, it needs to be budgeted as an operational supply. When students are accessing the library catalog (and contents) online,rather than paper, to create their work, telecomputing needs to be budgeted as an educational supply. Whether this means a school needs to increase its supplies budget, or reduce other supplies in favor of telecomputing will be an individual decision. When teachers and administrators use DLCs for professional development or other meetings, telecomputing needs to be budgeted as an alternative to travel.

CONCLUSIONS

In the way that telephones changed what society thinks of as minimal communication and basic connectivity, telecomputing, the union of computers and the Internet, may be the single most important force shaping our future educational settings. As telephones and television changed our perceptions of the size and accessibility of the world, so will the Internet and telecomputing.

That light you see is not the end of the educational technology tunnel; its the headlight of the telecomputing express. Will current schools move fast enough to keep ahead of it, or will they be overtaken by new institutions (online charter schools)? Web regulating policies won’t help avoid the force of change, any more than banning running on the playground will reduce the child after school. Being afraid of the headlight won’t stop the train. Jump aboard quick. This paper (Facemeyer & Peterson, 1996), with a forum for reader interaction, is located at http://www.vpds.wsu.edu/articles/ on the Web. See you on the ‘Net.

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Authors’ note: To maximize the experience of online learning mediated by this article, you are encouraged to spend time browsing and learning from the various linked resources. Some of the links will take you to places in the virtual school where you can (and should) spend time analyzing student work to see what you learn from it. We invite you to join the community by leaving your comments about this paper in a forum you will find at the end of the document.

An electronic version of this paper can be found at: http://www.vpds.wsu.edu/articles/cic.html The purpose of creating an online version is to help readers appreciate firsthand the impact of this media on schools and learning. You can visit the authors’ school on the World Wide Web (http://www.vpds.wsu.edu).

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At a time when books about technology, education, and the future are being written in scores, reviewing a book on these topics that has been out for 18 months seems odd. This is true especially when most books about technology and teaching are obsolete weeks after they are published. Why then should you be interested in reading *Being Digital*, or a review of it?

**Being Digital is for all of us.**

You should be interested in this book for several reasons. First, because it is current (and will be for years), and because this author gives a clear overview of a very plausible technical future. Secondly, you should be interested in this book if you work with information. *Being Digital* covers the gamut from entering cook times on your microwave to asking for an intelligent agent to browse the Web and produce a personalized overview.

*Being Digital* is current. It will be current and timely for years. Rather than focus on the mechanical impacts and changes in our computing environments, this work attends the historical developments of computer technology, and our interaction with it, and extrapolates far enough in the future to be useful as a guide. It is not a manual for technology use but it provides important perspectives into what digitized data movement means for the future of our society. This is an important perspective to examine. As an administrator or a teacher we all want to prepare our children, teachers or administrators as best we can, and often this preparation takes the form of training, coaching or leading people into the future with vision and a plan. Read this book if you think you might want to review and prepare for the future as either a leader or a follower.

*Being Digital* is not about computers, or about educational technology; it rarely discusses hardware. This book is important to educators and administrators, not because it describes how to use computers in your classroom or office, but because it describes how technology may revolutionize our basic ideals and beliefs. In three parts, Bits are Bits, Interface, and Digital Life, Negroponte describes how our conceptions of learning, media, broadcasting, interface, and display may be impacted by advances in technology. He elaborates on the ways these ideas and our uses of them may change in the coming years. As a teacher this is important because the meaning and founding assumptions of knowledge, and information and learning may be shifting. How we prepare students and what we prepare them for may be shaped by this book and its perspectives.

Finally, anyone planning on teaching or administering in the near future, should be interested in the environments in which he or she will work. *Being Digital* may help one prepare. Anyone planning to interact with children who understand and conceptualize a digital world might benefit from understanding how the GUI, (the Graphic User Interface; Negroponte does a good job of describing all of the jargon that has percolated into our language and lives) will change and what forces will drive it. While it is not a book about human psychology or perception, this book starts from a very human perspective and advances evidence for not just the current state of computing but evidence supporting the conjectures based on these human dimensions of perception and information processing.

In this bland-looking book (it is in black and white and has no figures), Nicholas Negroponte describes in entertaining detail what to expect of the coming information technologies. Often he begins his narrative with stories about his formative years. His experiences form the backdrop for histories of multimedia, virtual reality and street wise youngsters and their ability to gather and work with large amounts of data and analyze it quickly and efficiently. These stories blend into a projection of what information technology and its advances will lead to in our immediate future: wearable computers; smart web browsers; a global information network connecting all interested citizens. Each of these sounds far fetched but in context Negroponte generates support for each of these suppositions.

Perhaps more importantly, Negroponte describes how the culture affects creations and the reciprocal effect that the creations have on the culture. For instance he describes how the fax is a Japanese invention, not because they were good with technology as one might imagine, but because their language is pictograph and amenable to facsimile reproduction and transmission. He then illustrates how this, seemingly beneficial fax technology, has hampered the use of intelligent computer based indexing, sorting, searching and cataloging functions. Culture affects creation, and creations affect culture.

Much of this material appeared in *Wired*, the magazine of digital lifestyles, as a series of columns, therefore it is in a familiar and accessible style. This feature makes it amenable to digestion in small chunks, bits, if you will. Yet this collection (and it reads like a collection) has a message. Don’t plan too carefully anything that you might want to do with technology for the next few years. From wiring your kitchen to your alarm clock for coordinated coffee and toast making to...
television choice, your decisions might be influenced by understanding the ubiquity of microprocessors and their expected modes of communications in the very near future.

**BEING DIGITAL IS FOR EDUCATORS.**

But how does this analysis of bits, bandwidth, and broadcasting inform educators about the futures of teaching and administration? Very simply, the foundations of what it means to teach may change in a digital world.

As a teacher, think about the current sources of information in your classes — who are the authorities in your class? Yourself, your school's library, your community? What happens when the sources of information are global? What happens when the sources of instruction are global? Your students can now go to the United States' National Library of Medicine or the Library of Congress or the Smithsonian through the Internet. As these resources and ones like it around the world begin to be more sophisticated in their instructional characteristics, future students will have a world of quality curriculum to choose from. There is clearly a decrease in the distance between students and knowledge (and the communities that generate it) and between students themselves.

The concept of administration will certainly change in a digital world. Negroponte never prognosticates or makes dire predictions about the onset of these new conceptions of familiar ideas, but he leads the reader through a series of stories surrounding his observations which speak indirectly to administrators about their jobs and the future environments in which they will work. While Negroponte does little to prescribe actions or rigidly define what the characteristics of this networked world will mean to teachers and administrators, he makes it clear that some of us ought to be thinking clearly about the future of instructional technologies and their impact on our organizations.

**CONCLUSION**

I recommend this book as a start toward the future, either as a instructional tool or a good conversation device. If there is one message I took away from the book it was:

New methods of information management will change the ways the future will be experienced.

What you take a way might be different, but reading this book will put computers and networks into a new light. Perhaps friend, perhaps foe. Hopefully you will see that, in a future such as Negroponte describes, the jobs of educators who embrace technology and global networks will be rich and rewarding.

Kevin C. Facemyer is a researcher for Washington State University Virtual Professional Development School.