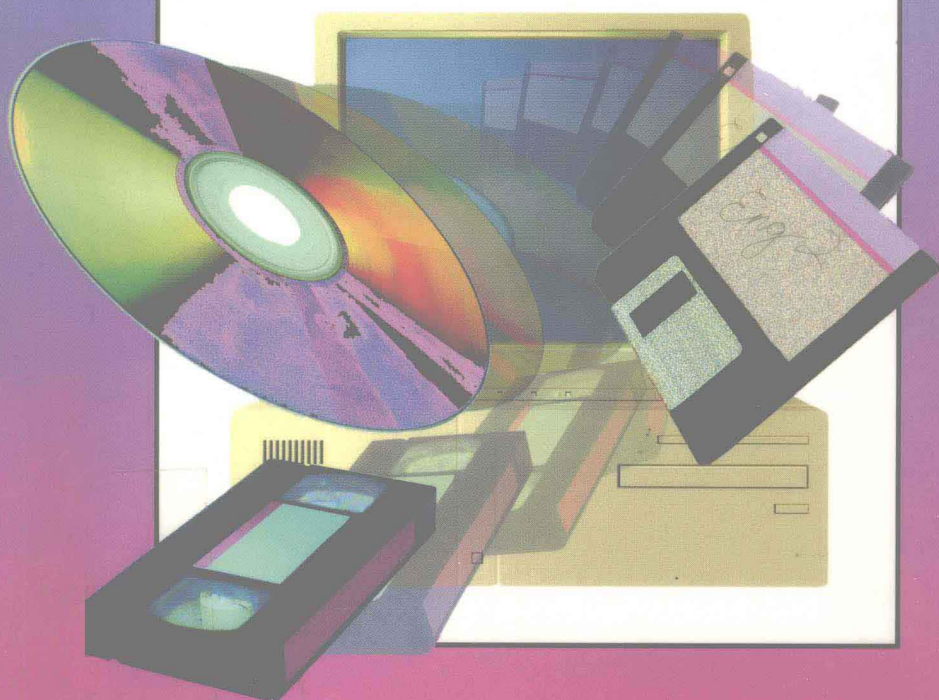# TECHNOLOGY
in the
CLASSROOM

A Collection
of Articles

EDITED BY TOM KING

Technology in the Classroom

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Technology in the Classroom: A Collection of Articles

To the thousands of teachers in America whose daily efforts to secure the learning excellence of each of their students is matched by their own commitment to continued learning and growth.

Introduction

Technology in the Classroom

I have spent more than twenty years in the exciting area of educational technology. During these years, I have found that while some believe education hasn't changed enough, many think technology is changing far too rapidly. We purchase the latest hardware (and, to some extent, even the newest software), only to find that by the time we get the system up and running, it is obsolete, doesn't do what we'd hoped, or is no longer relevant.

Educators need not only the tools, but also good ideas, sound applications, prudent use, and timely tips. These can be hard to find. This collection offers busy educators a brief compendium of recently published articles on educational technology that have permanence and value. Each article contains important information for teachers, administrators, educational technologists, and teacher trainers.

Among the dozens of publications and journals that deal with different aspects of technology in education, there are hundreds, perhaps thousands, of new articles each year. Educators are busier now than ever before and often don't have enough time to read and research in their areas of interest. With little time, it's hard to know what's worth reading, what might be useful, what new ideas can improve our teaching and our students' learning. Having talked and worked with thousands of educators in recent years, I have noticed recurring themes.

This collection is divided into those themes. Section 1, "The Difference Technology Makes," recognizes the growing research supporting the beliefs of many educators that technology in teaching and learning does make a difference—if used appropriately. Section 2, "Transforming Teaching with Technology," focuses on new ways of using technology in teaching. Finally, Section 3, "Making Technology Work," includes stories of schools that have successfully implemented technology in their classrooms.

There are obviously many fine articles not included in this collection, and it does not cover all of the many topics that well-versed educators need to know. Rather, these articles serve as a springboard for educators' search for information on technology in the classroom. I hope these writings will stimulate thought about these issues and encourage further reading. Most importantly, I hope that readers will discuss what they have learned with their colleagues, students, professors, community members, and other stakeholders in education.

I would be thrilled to hear thoughts about and reactions to these articles and others. My e-mail address is <dtking@stthomas.edu>. Thanks! Good educators always pass it on.

Contents

school infrastructure: computer upgrades, local and wide-area network wiring, servers, software, technical support, and training at all levels.

The new "cyberspace" consists of over sixty thousand interconnected networks from all around the world. This plethora of online data contributes to a new dynamic metaphor for learning and for rethinking traditional learning paradigms. The trick is finding what you need in the mass array of data floating in the electronic ether. Berenfeld suggests fascinating Web sites to visit, from Mt. Ruapehu volcano to the International Education and Resource Network (I*EARN). He also discusses tele-mentoring and tele-sharing, moving from online cooperation to "tele-collaboration."

Berenfeld's listing of new pedagogical goals for the millennium forces us to think about technology in new and powerful ways. We need to be ready. Our students are!

Hopkins' article, "Technology as Tools for Transforming Learning Environments," takes a very different look at the computer as a new tool for knowledge. Hopkins was a teacher at the Saturn School of Tomorrow with me back in 1991, when this article was written. We were trying to build a high-tech, high-teach, high-touch school. We succeeded in many ways, but we left many problems to work on for those who followed.

As the lead teacher at the school, Hopkins had the responsibility of leading a skilled team of teachers, parents, community, and, especially, the Saturn School students on this quest of reinventing the notion of school. In his work, Hopkins became increasingly aware of the many ways that students used computers as tools (we had nearly one computer for every two students). He cites the uses as *individualizing learning* (a very common use in many schools); *group interaction* (linking and sharing information with students and the teacher); *managing and coordinating student learning* (Saturn students have a key role in this important task since they manage their own personal learning plans); *expressing or sharing learning*; and *knowledge production* (making new knowledge out of old). Hopkins makes fine observations about the learning process in a new context.

Achieving Technological Equity and Equal Access to the Learning Tools of the 21st Century

by Curman L. Gaines, Willie Johnson, and D. Thomas King

I s there a problem of technology equity in our schools? Just ask the kids and teachers who use it. Even better, ask those who can't access it enough or at all. Technology's new tools are seen as empowering, productive and motivational. They make learning fun; more importantly, they let the user both access and create new realms of knowing and doing. But there simply aren't enough of these learning tools to go around, and many learners are being denied access.

School decision-makers are aware of the critical need for broader technology access. Parents, too, recognize the importance and, those who can, provide it at home. Employers tell us that nearly all workers entering the job market in this next century need to have an expanded set of technical skills in communication, problem-solving and product. Productivity and profit will both be linked to workers' effective uses of new technologies. Many high school graduates can't compete for entry-level technical jobs. Once hired, they're unable to progress to more responsible, remunerative levels of their chosen professions. Inequities of class, gender, ethnicity, and economic disparity correlate highly with denies or restricted access to the tools of technology. The have-nots have increasingly less.

When it comes to gaining greater access, many groups and classes are simply unable. The resources are just not there. Futurists tell us that tomorrow's workers who want to stay employed, or be re-employed, will need the skill of learning new skills. Technology will be the common link among most of tomorrow's jobs. Our growth as a national power has depended largely on the expertise of

our workers. If our schools fail to pass on these new skills, there may not be another opportunity. Inequity of access to today's new tools becomes tomorrow's enduring societal loss.

THE STATE OF TECHNOLOGY

Students don't have to share pencils. Most teachers even have their own overhead projectors, and certainly their own chalkboards. But when it comes to technology, there clearly isn't enough to go around. Yes, it does cost a lot more than paper and pencils: camcorders and computers are hundreds to thousands of dollars apiece. Most schools don't have the funds to address the issue of adequate access, let alone equity.

We need to remind ourselves, too, that there's more to technology tools than computers.

In Minnesota's Saint Paul Public Schools, there are 13 students to each computer.

That's not quite as attractive as the state average of about 10:1 and the national ratio of 11:1. Ratios vary considerably among the 16,000 school districts and, taken alone, don't tell us much about equity of usage, anyway. Many of our district's computers are older, less-powerful machines without high-resolution color, CD-ROMs or Internet access.

We need to remind ourselves, too, that there's more to technology tools than computers. Video tools are smaller and more powerful. New camcorders are hand-held and with editing features formerly found only on more expensive equipment. We find technology permeating new areas, enriching music, art and industrial/vocational education. But, it's not just the number of tools we make available, the number of new features makes a difference, too.

Newer technologies are functionally different from a decade ago. We see far more powerful tools, which let us move from thinking to doing, to modifying, to creating. Knowledge and information are made more accessible to both learners and teachers.

Special needs students are also major beneficiaries of these new tools. For the first time, technology makes learning accessible to many challenged students. While convenience for some learners, technology can be an absolute necessity for others. Instead of adapting our needs to technology, these new tools are better able to adapt to us and our unique learning needs.

EQUITY ISSUES

A recent search disclosed few current articles on the topic of equity and technology. However, Neuman's 1991 article[1] was helpful in clarifying who are the technology "have-nots." Not surprisingly, we find they are most often female, handicapped, minority, disadvantaged and urban. They are the less academically able, more kinesthetic learners, the often "at-risk" students.

Over 95% of homes in America have a VCR, but only 82% currently have a telephone.

Even when we find schools with adequate, up-to-date technology, it is often in the hands of more adept learners. The less able and special needs students are often consigned to less frequent access, to the older equipment, to the redundant, simple software applications.

An amazing statistic we have noted is that over 95% of homes in America have a VCR, but only 82% currently have a telephone. Why the disparity? Videotapes can be fun and entertaining; the phone may be a nuisance to a poor family. Entertainment often wins the battle for scarce discretionary dollars. Still, computers are entering the home at an amazing rate. Nearly one-third of American families are estimated to have computers, and many have CD-ROM-enriched software and modems for access to the Internet. While computer games may be fun, it costs a lot to play. Poor families cannot afford the thousand dollar plus price tags; VCRs and TVs still cost far less.

THE NEW "HIGHWAYS"

We have all heard government leaders declare the need for equal access to the new "Information Highways." When a new technology is first produced, it doesn't mean everyone wants to use it. When the teletype was first hooked up from Maine to California, Mark Twain was said to remark, "What makes you think anyone in Maine wants to talk with anyone in California?" It turned out, of course, that ultimately many did, but broad access still is often an issue of economics.

Governmental regulation or statements of encouragement haven't inspired equity of access. Most schools are funded primarily by local taxes. Urban and rural schools simply do not have the tax

base as their suburban counterparts. State and federal government must move to help address this growing inequity of funding for education.

THE NEW SKILLS

Learning *about* computers has changed to learning *with* computers. Programming and simple keyboard literacy have given way to desktop publishing and presentation, digital imaging and robotics, research and referencing, and to exciting new ways for students to demonstrate their learning accomplishments.

In *The Edison Project Report,* Hechinger and Hopkins have characterized this new paradigm of use, calling it "Technology as a Second Language." They describe it as a new process, affording an opportunity to learn many new tools of expression.[2] In their "Three C's" paradigm, just as with language, the user first needs a facility level to be able to *"communicate"* (to simply express one's ideas and needs). Next comes a *"comfort"* level with the newly learned languages of technology. The user now has a greater degree of comfort in being able to express ideas and understanding with facility and variety. Lastly, the learner may progress to the *"creative"* level, where the applications of technology become more unique and artistic, allowing for the freer expression of metaphor and representational symbolisms. Just as we become adept at spoken and written language according to age, need and ability, the same may be true for learning the new language of technology. Once again, it is essential that all students be provided equal opportunities to learn and use these new skills.

HOW TECHNOLOGY REALLY HELPS

There are many ways technology addresses different student needs. Former Saturn Lead Teacher Mike Hopkins has written about these different uses of technology for learning.[3] As staff developed the many new teaching and learning styles at Saturn, they found effective uses for technology in the following ways:

1. As a tool for *individual learning* (including skills building, referencing . . .),
2. As a tool for *group interaction* (e.g., a technology called Discourse enables the teacher or presenter to view learner responses to questions or problem situations),

3. As a tool for *managing and coordinating learning* (the student's personal growth plan, schedule building, portfolio construction, e-mail writing),

4. As a tool for *expression* (writing across the curriculum, video and multimedia, telecommunication networks),

5. As a tool for *knowledge production* (HyperCard, Hyperstudio and Lego/Logo projects for portfolios, MIDI music and new tools for art).

We are convinced that effective and equitable use of technology leverages school reform. Once students and staff decide to make meaningful uses of technology, learning is never the same again. Technology helps move the act of learning from hearing (and forgetting), from seeing (and remembering), to *doing* (and understanding). It helps bring about the active learning we educators all encourage, but find difficult to do.

Technology helps with different learning styles and provides new ways to learn. Equity requires that we address the learners' needs and learning styles. Thomas Armstrong lists a number of technology-based software systems that address multiple intelligences.[4] Among the intelligences and examples of concomitant software are:

Linguistic: word processing, desktop publishing

Logical-Mathematical: computer programming, Science Tool Kits

Spatial: animation, paint and clipart, Tetris

Kinesthetic: Lego-Logo, Flight Simulator

Musical: MIDI systems, Vocalizer

Interpersonal: Kidsnet, Discourse System

Intrapersonal: career software, decision-making systems

Technology can help address new learning standards that are more authentic, project-based and outcome-driven. Here in Minnesota we are moving to new "Graduation Standards" to replace "seat time standards" and Carnegie units. We are looking to portfolios and performance, in addition to report cards and GPAs. It is our belief that any activity as rich and complex as human performance must be addressed in a broader context than report cards. Numerical and letter grades are inadequate in describing what young learners know

and can do. Perpetuating this process cheats the learner and the community.

OTHER TECHNOLOGIES

Many teachers and students have discovered the power of video and the visual medium in the learning process. Students with a camcorder in hand and some rudimentary instruction can "show and tell" wonderful projects about what they've learned. Video, perhaps even more than the computer, is the new medium of expression with today's generation.

Video is the new medium of expression with today's generation.

We have seen many students construct marvelous video scenarios, creative stories and cooperative projects, showing remarkable production sophistication. The digital format makes it easier to marry the messages of these media together in very powerful presentational ways.

One day soon the Internet may provide a huge "electronic kiosk" of student performances (as do some Web pages already), and help learners improve what they know and can do. By exhibiting their work electronically, and by inviting comment and criticism from others, students can hone their knowledge.

LEVERAGING LEARNING REFORM

Our district chose early entry into the "school reform through technology" arena. We designed and introduced the innovative Saturn School of Tomorrow project back in the late 1980s and became one of the first school districts in the country to commit major resources and collaborative efforts to school reform.

Saturn's design called for equity of access to technology for all students in the school, as a part of the school's "high-touch, high-teach and high-tech" mission. We have since witnessed many successes in student accomplishment and learning. Once technology is integrated into the curriculum, and students are doing "real" learning activities, it's often impossible to return to simple lecture and listen as a means to "learning."

Teacher behaviors will change, too. Staff development is essential, not just for the new technology, but also for the new ways that teaching and learning will happen.

President Bush came to visit and recognize the Saturn School in 1991 in announcing his America 2000 (now Goals 2000) initiative. One thing our students taught him, and the thousands of other visitors over the years, is that powerful learning can happen with technology. Many are amazed at what these students do with desktop publishing, MIDI synthesizers, HyperCard, Lego/Logo, and video cameras.

But the staff have had to find ways to assure that other, more traditional learning is happening, too. Saturn students take the same national, standardized and district tests that others do and must show acceptable performance.

NEW PLACES AND SPACES FOR LEARNING

It should come as no surprise that better access to technology-transformed learning activities means redesigned learning environments.

Our District-Wide Technology Plan calls for moving more of our computers from labs into the classrooms. If we want our teachers to integrate technology into our teaching, it must be readily available. Further, they must know how to use it and what their students can do with it. Broader staff training has allowed us to change our old computer lab paradigm. New designs call for lab technology stations, with many kinds of technology tools for exploration, simulations, construction and testing. Often, there's more "noise" from students and their new tools, but there's also more real learning, too. The older lab computers are being moved to the classrooms for report writing and special learning and knowledge production uses. Networking, both local and wide area, is also an item of equity concern, as we look at many schools and a limited budget. We do not believe every classroom must be wired for communications. Cellular communications will obviate some of the needed writing, particularly when there is not continuing need for a network in a given space.

ADDRESSING INEQUITIES FOR LEARNING IN THE HOME

We are trying to find relatively inexpensive technologies that we can let students take home and use. Older Apple IIs, for example, can be assigned for home use, for special projects or for students with special needs. Some manufacturers are making special purpose, low cost, limited-function computers in the ($200–$400 range) that students can sign out without the worry of thousand dollar replacement costs. We await lower cost clones, particularly laptops that we can assign and reassign easily to students and staff.

We need manufacturers to "modularize" their computers so we can more simply replace certain components (CPU components, drives, CD-ROMs, monitors, etc.) without replacing everything. We think that technology must eventually be seen as a utility or service for which districts pay might pay an annual fee to assure appropriate access for all students. That service could include needed replacements and repair, even the training and retraining of staff and students.

A PLAN FOR CHANGE AND FOR SUCCESS

One of the most frequent questions we get from our schools is, "Where is our new technology?" Our response has been, "Where is your plan?" Fortunately we have a district-wide Technology Plan which serves as a basis for each school's site plan.[5] Each school develops a plan in accord with our board-adopted goals. All site planning ties back to the district's Strategic Plan, and that focuses everyone directly on increasing student achievement (which is a singularly important goal). Our Superintendent has stated our mission-building process in a terse and pithy five-step way: "Dreaming It; Planning It; Doing It; Changing It and Proving It!" That last accountability component is crucial, especially if we include "equity of access" among our requirements. If we can't show that improved student achievement is working, then our response is, "Why are we doing it?" We must find a way to make it work.

Another initiative that addresses the "tech-entity" issue for us is our "97 by '97 Project." As a part of our "High Five" strategic planning, we are focusing intensively on five key learning areas. The top two are: higher student achievement for all students, and a higher graduation rate for all students. That latter goal has been re-stated as "97 by '97." We are working to improve our graduate rate to 97%