



Illustrations by David Julian

# Syncing Up With The iKid

Educators must work to understand and motivate a new kind of digital learner. By Josh McHugh

**N**athaniel Hawthorne's novels are pretty daunting fodder for the average English class, no matter how they're approached. But Diane Hamstra, a teacher at Park Tudor School, in Indianapolis, found a way to get her tenth-grade students to dive enthusiastically into the nineteenth-century moralist's dark thick-

et of language.

Hamstra used a software application called DyKnow Vision to let her students analyze various passages from the books on computer screens at their desk. She then posted their work on a large-screen monitor at the front of the classroom (the computer lab, in this case), and the students discussed the displayed examples. Hamstra has also had students analyze similar passages using pen and paper.

The difference is startling. Using the software, the students' responses "were deeper than with pen and ink," Hamstra says. "The focus was really sharp. There's something about changing over to an electronic medium, something about that screen. It's psychological. It's a generational thing."

No kidding. Teachers in every strata of education are increasingly dealing with a student population that is not only more wired than they are but also grew up in a techno-drenched atmosphere that has trained them to absorb and process information in fundamentally different ways. This generation of students is more likely to be armed with cell phones, laptops, and iPods than with spiral notebooks and #2 pencils.

Teachers who once struggled for students' attention mainly against daydreams, passed notes, class clowns, and cross-aisle

flirting now also face a formidable array of gadgets and digitized content. Smart schools—and smart educators—are scrambling to figure out how to use these same tools and information-distribution techniques to reach and excite young minds. "You have to work with the kind of brains we've got now," says Susan Blackmore, who holds a PhD in psychology from Oxford and frequently writes and lectures on new technology's effects on consciousness.

According to Blackmore, today's brains are shaped by various information streams—sometimes referred to as memes—constantly popping and sparking and competing for attention. This new generation of digital learners—call them the MEdia Generation—take in the world via the filter of computing devices: the cellular phones, handheld gaming devices, PDAs, and laptops they take everywhere, plus the computers, TVs, and game consoles at home. A survey by the Henry J. Kaiser Family Foundation found that young people (ages eight to eighteen) mainline electronic media for more than six hours a day, on average. Interestingly, many are multitasking: listening to music while surfing the Web or instant-messaging friends while playing a video game.

Educators must figure out how to compete with this frenetic memestorm coming at them from marketers and other students. Many are. The last few years have seen a rapid class- and districtwide use of collaborative course-management systems such as DyKnow as well as so-called social technologies—blogs, wikis, and media-syndication systems based on the Really Simple Syndication (RSS) protocol—that allow anyone to shift from consuming media to being a media creator. (Blogs, from

weblogs, are simplified personal Web sites, and wikis are Web sites, either password-protected or public, that anyone can easily edit.) Giving students powerful media-authoring tools means relinquishing a degree of control, but doing so also makes it possible to help them learn in more effective ways (and tighter time frames) than ever before.

One way of competing with electronic distractions is to optimize lessons for the MEdia Generation's rapid-fire meme-hopping tendencies. Leapfrog Enterprises, maker of the LeapPad Learning System, the talking-book device that topped the list of best-selling toys in the United States for several years, imposes a seven-second rule on the writers and designers of its teaching toys: Stories and lessons must progress in increments of seven seconds or less, at the end of which the book prompts the child to interact with it. A concession to a fragmented attention span, perhaps, but one that recognizes reality.

Collaborative learning, too, has taken a tech-driven leap forward. In Michigan's Cranbrook school district, for instance, students use Moodle, an open-source course-management system designed to create online communities. With it, users discuss class content with teachers and other students, take quizzes and tests, and get help after school.

## Class Action

**A**lthough tech awareness in the schools has increased, in many instances it does not focus on the classroom. A recent survey by CDW Corporation shows that teachers are more likely to use technology to ease the administrative requirements of K-12 education than to utilize it in instructional applications. More than 85 percent of respondents in CDW's Teachers Talk Tech survey say that while they are adequately trained on Internet, word processing, and email software, 27 percent have little or no training with integrating computers into lessons. Nonetheless, the survey indicates that more than 70 percent of teachers at all grade levels believe computers are an important driver of student learning.

Christopher Moersch, an independent Internet-technology consultant who helps schools incorporate tech into the class, says most teachers he encounters are eager to engage their students with classroom technology, but federal testing requirements consistently get priority over technology initiatives. Consequently, teachers spend most of the day in drill-and-practice mode, preparing for standardized tests.

"The typical kid's reaction is, 'I'm bored to tears,'" says Moersch. "There's a total disconnect between my life and what's going on in the classroom." But if that changes, the effect

on learning could be immediate and widespread. More than half the students in a nationwide survey by the National Governors' Association said their classwork is easy, and two-thirds reported they would work harder if their coursework were more interesting or challenging.

To some degree, our gizmo-intensive state of affairs is Alan Kay's fault. Kay earned the sobriquet "father of the personal computer" for his work at Xerox PARC (Palo Alto Research Center) in the 1970s, where he came up with the concepts of the personal computer and the graphical user interface. But originally, Kay wasn't trying to create a better tool for business. He was thinking more along the lines of a teaching machine. In 1968, Kay, a computer science graduate student at the University of Utah, heard that MIT artificial intelligence researcher Seymour Papert was doing interesting work with computers and kids, and he visited Papert in Cambridge to check it out.

Papert, working with pioneering educational psychologist Jean Piaget, came up with a programming language called Logo, simple enough for kids to use to do math, generate poems, and even trans-

late sentences into Pig Latin. The theory behind Logo was that by actually creating their own learning environment, children would retain far more knowledge than they would from ordinary teaching methods. Kay came away from his visit with Papert with several new ideas, one of which led to object-oriented computing, and another that prompted a device called KiddieKomp, later renamed the Dynabook.

In a 1971 memo, Kay described his vision for the device, originally intended specifically for children to use as a learning machine: "In the 1990s, there will be millions of personal computers. They will be the size of notebooks today, have high-resolution, flat-screen displays, weigh less than ten pounds. . . . Let's call them Dynabooks."

And so it came to pass, almost exactly as Kay predicted/invented it. Except for one thing: The problem, Kay told me in a recent email, is largely with "the difficulty of adults to adjust to new ideas. I don't mean really new ideas like computing, but ideas new to the human race, like science and how it uses mathematics, or even slightly older ideas like reading and writing. Teaching the latter is still a struggle, despite its relative antiquity (and despite the fact that we know very well how to do it best). And real mathematics and real science are not yet taught in elementary and even most high schools."

## Turning of the Tide

**T**he slack tide of educational innovation Kay laments is beginning to turn, as teachers deploy the latest wave of teaching tech-

## Young people live media-saturated lives . . .

Percentage of eight- to eighteen-year-olds who live in homes with:

TV.....	99
CD/tape player.....	98
Radio.....	97
VCR/DVD player.....	97
Computer.....	86
Cable/satellite TV.....	82
Internet access.....	74
Digital video recorder.....	34
High-speed Internet access.....	31

## . . . often absorbing several info streams concurrently . . .

Percentage of eight- to eighteen-year-olds who say they use other media (TV, computers, print, or music) "most" of the time while:

Listening to music.....	33
Using computers.....	33
Reading.....	28
Watching TV.....	24

## . . . and on a daily basis.

In a typical day, percentage of eight- to eighteen-year-olds who:

Watch TV.....	81
Listen to the radio.....	74
Listen to a CD/tape/MP3.....	68
Use a computer.....	54
Go online.....	47
Read a book.....	46

nology. The kind of Dynabook Kay envisioned is still in the wish-list stage, but the means to deliver the deeply educational Dynabook experience Kay had hoped for are all around us: laptops, handheld computers, powerful cell phones, the same inescapable computing devices frequently bemoaned as weapons of mass distraction.

Together, blogs, wikis, and other social technologies are seen as a new entity that goes by many titles—the semantic Web, Web 2.0, the read-write Web—but whatever you call it, this swirl of media may well end up doing Kay's vision one better.

Pamela, a student at North Whiteville Academy, an alternative school in North Whiteville, North Carolina, writes on her page of teacher John Blake's class wiki, "Students are learning how to micromanage an array of elements while simultaneously balancing short- and long-term goals." Pamela's observation, incidentally, is at the heart of the defense of video games advanced recently in Steven Johnson's controversial book *Everything Bad Is Good For You*.

**"Students are learning how to micromanage an array of elements while simultaneously balancing short- and long-term goals."**

"Kids are bombarded by media," says Blake. "They're completely high tech, and they don't know a different way. When you hand them a book, they're going to say, 'Is this all there is?'"

Looking for more structure and access control than the wiki system gave him, Blake switched over to Moodle software this fall to manage class-related conversations, homework assignments, and quizzes. He also encourages students to keep blogs using BlogMeister, a student/teacher system created by the Landmark Project. To tie it all together, Blake's classes use Bloglines, a Web-based tool that aggregates RSS feeds generated by Moodle and BlogMeister, so all the school-related activity and conversation can be viewed in one place.

"This is a mix-and-match generation," Blake says. "I'm looking at these things as a way to hook into what they're doing outside the classroom. When they see that I know how to use the technology, they think, 'This is going to be cool.'"

At Martin Luther King Elementary School, in Atlantic City, New Jersey, fifth- and sixth-grade classes make short documentaries about local history, architecture, and celebrities and post them to the school's video blog, Atlantic City Rough Cuts. "We're using video blogging to put students in contact with real professionals," says Art Wolinsky, the consultant and retired teacher who helped set up the Atlantic City project. "They're creating products that are going to have an impact on them, on their friends, and on the community."

Older kids, even those getting ready for college, benefit from new applications of technology. High schoolers can tap into Boston Test Prep's BTP to Go, an audible SAT test-preparation course downloadable onto digital audio players such as iPods, as well as PDAs, smart

phones, and other listening devices. The audio format allows students the freedom to prepare for the SAT at their own pace and within their crazy schedules. Such personalized instruction can also alleviate much of the stress caused by an SAT prep course held in a traditional classroom setting.

#### HOT LINKS

- <http://moodle.whiteville.k12.nc.us>
- <http://sat.bostonestprep.com>
- [www.edutopia.org/ikid](http://www.edutopia.org/ikid)
- [www.starw.org/acrc/](http://www.starw.org/acrc/)

## Shifting Power Centers

Of course, there's a price educators pay when they open their classes up to the world: Power tends to move from the center outward, an exact duplication of the effect of the Internet on many institutions. In March, the principal of Proctor High School, in Rutland, Vermont, banned access from school computers to MySpace, a blogging site popular with students, saying blogging isn't an "educational use of computers" and citing concerns about Internet predators.

Just as in corporate America, where companies such as Delta Airlines, Microsoft, and even Google have fired employees over blog posts, schools are working on policies designed to protect themselves while trying not to stifle personal expression. For educators accustomed to making and enforcing absolute rules, letting the inmates take part in running the asylum (an inexact metaphor, of course) is going to take some getting used to. But in the end, the best way for students to learn about the world they live in is to have a hand in creating it.

"The key to teaching is keeping kids involved," says Ryan Ritz, the computer science teacher who first brought the DyKnow system to the Park Tudor School. "They like everything being electronic—it's speaking their language." Ritz cites near-instant feedback during class as the most important feature of the system, allowing him to know which points the students have observed and which ones need to be revisited. "You know immediately where they stand," he says. "This is a better way to learn."

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## Recreational computer use remains popular . . .

Average amount of time eight- to eighteen-year-olds spend using a computer per day to:

Play games.....	<b>19 minutes</b>
Instant message.....	<b>17 minutes</b>
Visit Web sites.....	<b>14 minutes</b>
Email.....	<b>5 minutes</b>
Chat.....	<b>4 minutes</b>
Use graphic programs.....	<b>4 minutes</b>

**TOTAL recreational computer use: 1 hour 2 minutes**

## . . . although kids use the PC for many types of activities.

Percentage of eight- to eighteen-year-olds who have ever:

Used instant messaging.....	<b>66</b>
Downloaded music.....	<b>64</b>
Looked for health information online.....	<b>50</b>
Listened to the radio through the Internet.....	<b>48</b>
Bought something online.....	<b>38</b>
Created a personal Web site or Web page.....	<b>32</b>

Source: Henry J. Kaiser Family Foundation study, March 2005





## Reality Bytes

Digital learners have their own tech tales to tell.

In a fresh new program that combines writing, art, and technology in a handful of lively San Francisco Bay Area classrooms, digi-savvy twelve-year-olds work with seasoned filmmakers to produce brief but poignant stories drawn from their lives. Tech Tales, run by Streetside Stories, a nonprofit arts-education organization devoted to cultivating the voices of young students, catches the momentum of the growing digital-storytelling movement and puts it to work in education.

More than 300 seventh graders at five middle schools have been involved in the storytelling project. "And they don't even need a camera to make a movie," says program facilitator Pepe Urquijo, an award-winning filmmaker who helps young people learn visual techniques. With the aid of teachers, administrators, and volunteers, each student constructs a one-minute digital narrative—after just four weeks of work. At the outset, admits Urquijo, "I didn't think what we did was even possible. I said, 'Fifteen minutes a day, thirty students, and sixteen computers? You're crazy!'"

"But I'm crazier," he continues with a grin, "because we did it."

In a process typical of the program, students in the fall of 2004 spent two weeks writing, storyboarding, and illustrating personal vignettes about a notable event in their lives. The following spring, they took another two weeks to learn how to navigate iMovie, using technology to turn their tales from creative introspection into personal art. The result: a series of touching, amusing, and digitally impressive mini-films featuring the students' drawings, voice recordings, photographs, and audio and visual effects (a baby's cry, for instance, or a lighting bolt sizzling across the screen).

The project offered students a chance to hone computer skills and artistic sensibilities. The young filmmakers even got professional-level exposure for their digital debuts: a screening of their compilation DVD at the Yerba Buena Center for the Arts, in downtown San Francisco. Tech Tales fits into the classroom agenda by allowing students to practice language and writing skills, adopt ways to reflect on the components of a multimedia story, and, most importantly, articulate the lessons of their lives. —Sara Bernard

### HOT LINK

• [www.streetside.org](http://www.streetside.org)

# Tech Savvy at seventeen

High school senior proves the power of gadgets in the classroom.

Alex Bick, an amiable senior from Millburn High School, in Millburn, New Jersey, is a pioneer of digital learning. He not only readily adapted to technological gizmos growing up, he also quickly understood their power as teaching tools. By the time he was a teenager, Bick had begun to imagine new ways of incorporating computers into the lives of students, and, as a very motivated guy, he went even further to find ways to test his ideas.



With the help of mentors at Harvard and MIT, and thanks to the loan of hardware from Microsoft, Bick conducted a study called "The Impact of Personal Digital Assistants on Academic Achievement," in



which he investigated the correlation between the use of Microsoft Pocket PCs and the academic performance of Millburn freshmen and sophomores over the course of five months. Five trials later, Bick found that his hunch—that access to the devices would raise the students' grade-point averages—was correct.

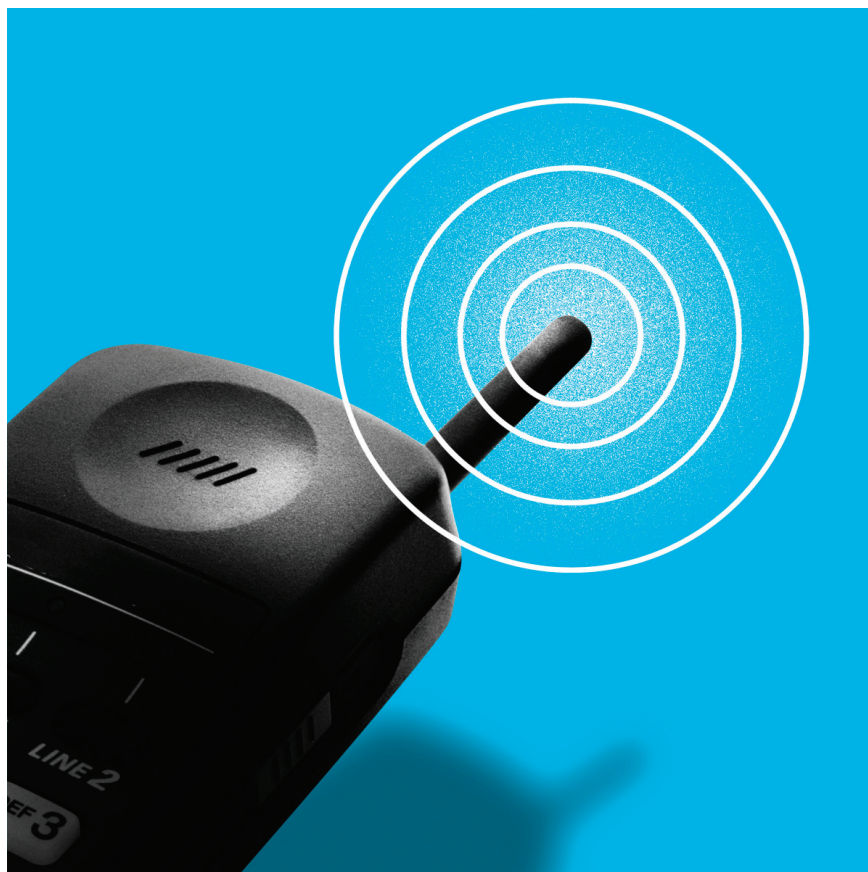
Even with no training on the personal digital assistant (PDA), study participants caught on naturally to the gadget's features—Pocket Calendar, Tasks, and Class Pro features were the most useful—and experienced grade-point-average boosts of about 14 percent compared to the control group, which started with similar grades. "They were reluctant to hand them back at the end of the semester," says Bick, who wrote two software applications that collect and record data on the applications the students used.

The seventeen-year-old also manages to teach a multimedia class to third graders at Temple B'nai Jeshurun, in his hometown of Short Hills, New Jersey. "We connect to an old subject in a new way," he says. Bick guides the kids on virtual trips to Israel, for instance, on Web sites such as the Israel Ministry of Tourism's site.

This fall, Bick is testing an intelligent tutoring-software program he wrote, which he hopes will teach students on the go. Under catchy titles such as "Algebra at the Mall" or "Addition at the Movies," the program presents problems and offers hints to guide students to correct answers, right on their pocket PCs. The interface is cheaper and more mobile than that of computers, plus the kids love it. "Kids are more tech savvy, because they have a lot of time to experiment and are not afraid of breaking the technology," says Bick. "It reflects their attitude to life." —Cheri Lucas

### HOT LINK

• [www.millburn.org/science/pda](http://www.millburn.org/science/pda)



# Extracurricular Learning

Technology use outside of class results in self-tutoring and shared results.

**M**izuko Ito, a research scientist at the University of Southern California, is coeditor of *Personal, Portable, Pedestrian: Mobile Phones in Japanese Life* (MIT Press), a new book that looks at the use of portable electronics by Japanese students. She also was one of several researchers to receive a \$3.3 million grant from the MacArthur Foundation to study children's use of digital media and its implications for education here in the United States. We spoke to Ito about her work and its implications for American classrooms.



**What makes your work different from traditional educational research?**

I focus on learning and technology use outside of schools. I look at settings like game play or online discussions, where kids are doing things on their own terms, not being held accountable to explicit educational goals, and see what they're learning.

**What's a good example of kids learning on their own?**

My research team is doing a case study on English-language fandoms of anime series such as *Yu-Gi-Oh!* or *Naruto*. In the United States, youth fan groups will capture the broadcast in Japanese, edit it, subtitle it, and release it here, often within hours. To do this, they

have to learn how to use fairly sophisticated video editing and subtitling software. They learn some Japanese. They also produce their own videos, art, and fiction by playing off the original material, and then share it with other fans. Part of this is also about getting validation from a much broader community of fellow fans. Large online sites provide spaces to not only share fan-generated content but also to rate other people's work, provide feedback, and develop visibility and reputation. Nobody has taught them explicitly how to do any of this. It's all self-organized.

**How are American youth similar to Japanese kids in their use of digital technology?**

For teens in both the United States and Japan, spaces for social contact are highly regulated. So when they're given the means to communicate over the Internet or cell phones or whatever channels adults don't have surveillance over, they use them a lot. Here, it tends to be instant messaging (IM); in Japan, it's text messaging.

**How have Japanese schools dealt with the widespread use of mobile technology by students?**

There's a lot of regulation of use. Things like trading cards and Gameboys are generally not allowed at school. Mobile phones are not supposed to be ringing in class, but by high school, most teens are text messaging in class. Still, that's part of the normal attention wandering you get in classrooms, no matter what. The technology may be exacerbating it somewhat, but it's probably not changing the fundamental dynamic of the class.

**In another era, you'd be passing notes. Right?**

Or doodling, or daydreaming. In the traditional classroom setting, where one teacher is lecturing to a large group of students, it's not surprising there are attention problems. What's potentially interesting—and a lot of educators have resistance to this—is creating a shared backchannel for the class, like an Internet Relay Chat channel. I have colleagues in higher education who have tried it and found that, while a lot of the discussion is off topic, it's also an opportunity for kids to clarify things and ask questions about the material as well.

**What other techniques from kids' digital learning environments might be brought into the classroom?**

One increasingly common idea is to bring popular culture into the educational context. The structure of experience is the same, but kids are allowed to bring their interest and expertise from popular culture into the curriculum. The more challenging approach is to make changes to the fundamental social dynamics of learning. One of my main research questions is whether adults and educators can support the kind of learning dynamics that I'm observing when kids are engaging in peer-based knowledge exchange, such as that found on online fan sites. This should work for academic content as well as popular culture. —Jenn Shreve

**S**can the classrooms, labs, and libraries of Empire High School and you'll find laptop computers, digital projectors, and wireless connections, but nowhere in the specially designed facility just outside Tucson, Arizona, will you find a textbook. No 30-pound backpacks, no armloads of classics, no future lumbar cases for chiropractors serving the neighborhood surrounding this outpost of the Vail Unified School District, in Vail, Arizona.

Beginning this year, 350 students will attend Empire, the state's first completely wireless, all-laptop school. (If the plan works, the school hopes to grow—eventually to a student body of 750.) This

doesn't mean they won't have access to texts: Through their Apple iBooks, students will be able to read any number of electronic texts, including traditional classroom tomes, but teachers will also assign them to read up-to-the-minute news articles and other e-media to support their studies.

As revolutionary as it sounds, Empire is clearly not the first school to outfit its students with computers. Many classrooms and, in some cases, entire counties have supplied laptops to support curricula, and reports from such projects—in Illinois, Maine, New Hampshire, and Virginia—have cited dramatic improvements in student engagement, reduced absenteeism, and fewer discipline problems. What distinguishes Empire is that the facility was designed from the ground up specifically for this program. Says school district superintendent Calvin Baker, "It's not a retrofit."

It isn't cheap, but once you do the long-term math, it makes sense. At about \$850, a laptop costs much more than all the textbooks required for a student's course schedule (high school books average about \$50 each). But the information accessible online is always up-to-date, unlike that found in older schoolbooks. Empire administrators acquired the schools' computers from Apple on a lease-to-own basis, using money from state and local taxes, builder contributions, and profit from a land swap—in other words, the kind of scraped-together funding not every school district can manage.

Once they had the hardware, Empire's planners needed teachers with an interest in the new approach—and the tech skills to facili-



## No More Books

PCs replace textbooks at one forward-thinking school.

tate it. So far, Baker says, the plan is working well for teachers and administrators. He quotes one teacher who described the school's array of new opportunities as "the difference between swimming in a pool and swimming in an ocean."

"They've embraced the whole enchilada—the vision of the digital school," says Scott Morris, program manager in education marketing at Apple, who helped Empire design its program once the school purchased the laptops. "[Empire is] out in front of where we see schools being in a few years."

Being in the vanguard also has its drawbacks, like dealing with a healthy dose of skepti-

cism. "We've had to answer the obvious questions: 'What do you do if a computer gets broken or stolen?' 'What about pornography and iChatting?'" says Baker. "We've had to deal with those issues, but they just haven't been big enough to deter us." (For the record, parents pay \$54 in insurance against broken or stolen computers, and the devices have been set up without iChat capability, and with pornography sites and most game sites blocked.)

If anything keeps other schools from following suit, it is likely to be funding, not logistical issues, says Stephen Driesler, executive director for the school division of the Association of American Publishers. Though more and more laptops are making their way into students' hands, he says, financial realities will keep this trend from becoming commonplace anytime soon. "All the major [textbook] publishers have the capacity to deliver the content electronically. The only reason the majority of schools still use printed textbooks is because that's what the demand is," said Driesler. "Do I think it's going to become a major trend over the next few years? No, I don't."

Nevertheless, Baker sees too much virtue in Empire's program for it not to spread. "If you talk to teachers, they tend to talk about the continual confinement of

their profession because of No Child Left Behind and continual testing—it's like a straitjacket," he says. "Well, allowing [teachers] to use digital media instead of a prescribed textbook is opening up all kinds of creativity for them, and empowering them to do all kinds of instruction." —Chris Colin

### HOT LINK

• [www.vail.k12.az.us/](http://www.vail.k12.az.us/)



# Tech Made Easy

It's not all about gadgets and gear. By Todd Oppenheimer



**W**hen renowned educational-software maker Tom Snyder used to address educational-technology conferences, he'd often hook the audience this way: "If you guys had all been really committed to technology in schools back in 1984—really committed, well funded and everything—your schools would all be permanently wired for Commodore 64s." The comment always prompted a big laugh, because his tech-savvy audiences knew the computer's manufacturer had gone out of business long ago, at which point its institutional customers were left with closets full of computers no one would maintain or upgrade—what the industry derisively calls orphans.

Wry observations like this made Snyder an early crusader for a radical idea: the one-computer classroom. Not one for each student, but a single machine for everyone in the room to share. In Snyder's view, the job of technology is not to break up the traditional classroom's group endeavors but, rather, to stimulate them. "Schools may be the last place where the government is funding us to gather together into public forums to have conversations," Snyder has said. "We have got to protect that." Perhaps even more important, a classroom with only one computer greatly simplifies a teacher's life. Call it education's KISS—an acronym for "Keep It Simple, Stupid," a slogan popular in the U.S. Army, another institution that must manage large numbers of people of varying abilities, often in very difficult circumstances.

Schools can apply simplicity to technology for an optimum classroom experience in a variety of ways. Some examples follow.

## Complexity—in the Right Place

Snyder's scheme was to put teachers and students in hypothetical dilemmas, which would be both fun and instructive. For a social studies lesson, for example, software would set up an international political standoff. Students role-played various officials—the U.S. president, the American secretary of state, the foreign minister of Israel or Iraq. All took various positions, each posing different but potentially catastrophic consequences. To fuel this game, Snyder included all sorts of information, context, and analysis, plus various solutions, complicated obstacles, and so forth. (Although Snyder has sold his company, his software is still available. See, for example, the "Decisions, Decisions" package at [www.tomsnyder.com](http://www.tomsnyder.com).)

The choices that simulations like these might present can be subtle and sophisticated. But in a classroom with only one computer, usually run by the teacher, the class manages and utilizes the technical and intellectual complications as a group, collaborating on solutions.

## Real Computer Science

One of the strangest ironies in the educational-technology story is that most high-tech schools don't teach true computer science. They do introduce the latest software programs, but by the time today's students reach the workforce, most of this technology will be long gone, significantly changed, or made so elementary that the time spent learning it is almost entirely wasted. It makes far more sense for schools to present computer skills the way they do every other subject: by concentrating on the subject's history and fundamental principles.

To do this, schools should take a "shop-class" approach to outdated or broken computers. Students could take them apart, learn how to rebuild circuit boards, and create their own software programs, thereby learning how computers and other digital gear actually work. A practical dividend: usable, fully refurbished computers. In Beverly, Ohio, the Fort Frye Local School District saved \$30,000 this way.

## Ten-Dollar Technology

In 1929, English philosopher and mathematician Alfred North Whitehead wrote that "the best education is to be found in gaining the utmost information from the simplest apparatus." Though this argument may sound quaint, many veterans of education technology endorse it. One is Bob Albrecht, the godfather of scholastic approaches to BASIC, the first programming language ever built for personal computers. Albrecht, now in his mid-seventies, still volunteers in schools around Sonoma and other communities north of San Francisco. He generally arrives with a knapsack full of manuals, both high- and low-tech gadgets, and computer disks full of hypertext links so students can, as he puts it, "just click and go, click and go."

Yet when it comes to teaching the law of probabilities, Albrecht will pull out a Tupperware container full of dice. Some are standard cubes, but others are dodecahedral (twelve faced) and icosahedral (twenty faced). Waving his dice box in the air, he once said to me, "This



is educational technology.” Cost? About ten dollars. Another favorite tool is base ten blocks, used to teach basic math functions and place value to young children. “I do a lot more with these sort of things than I do with computers, because they are powerful and cheap. And teachers can learn to use them.”

Even when Albrecht is teaching advanced college mathematics, all he carries is the simple stuff—in this case, protractors, calipers, and sundry other measuring devices. “That one will just about take you out to Mars,” he told me, pointing to his favorite gizmo, a folding metric measuring stick. When he visits schools, he says, “every single kid wants to use it, because it folds out.”

Albrecht’s point is that youngsters are fascinated by tools—any tools—especially when they’re used for real-world projects. And, often, the simple, older tools offer a more physical experience, which child development specialists generally consider the most instructive. One retired teacher told me her former school’s simple theory: “The more muscle, the more memory.”

This philosophy gets to the heart of the KISS approach: Schools will get the most out of digital technology with students in junior high school and above. In the younger grades, computers usually mean lots of mechanical hassle and wasted time, often spent teaching students to do things on a screen they can more easily accomplish with paper, pencil, and crayons. Letting young children be captivated by the allure of the screen can distract them from the tactile, imaginative activities.

## Critical Thinking

Judah Schwartz, professor emeritus of MIT and Harvard and the founder and former codirector of the latter’s Educational Technology Center, has long been a critic of the way calculators are used in math classes. “Using the calculator as a way of avoiding confrontation with how numbers work perpetrates a fraud on kids,” Schwartz says. The reason, he argues, is that the calculator’s tiny screen condenses, and thus distorts, the arithmetic process. Those limitations, he believes, afflict every tool, even multigigabyte computers. “All tools have their prices,” Schwartz says. “A useful strategy is to turn the price into a teaching occasion.” The goal, he says, is to ask, and figure, out, “What are the limits of this particular device?”

One of Schwartz’s answers to this question is an exercise he calls the Broken Calculator. He discovered that if he taped over all the keys on a class set of calculators except the 0, 1, and plus buttons, then challenged second graders to be first to tally up, say, 2,312, an interesting lesson would emerge. As students realize they don’t have to add one 2,312 times, but can, instead, reach the sum by adding combinations of 1, 10, 100, or 1,000, they discover, on their own, how numbers and place value actually work.

### HOT LINK

• [www.tomsnyder.com](http://www.tomsnyder.com)

## The Japanese Paradox

Curiously, Japan—the very symbol to many Americans of technological success, as well as lock-step thinking—has long practiced quite the opposite approach in its elementary schools. In science classes, for example, exercises typically begin with a simple question, followed by active exploration with basic materials: water, dirt, pendulums, and so forth. Rather than rushing from topic to topic, as most American schools do, Japanese students linger on individual problems, examining them from every angle, sometimes for weeks on end. Curiously, computers, Palm Pilots, and other fancy devices are rarely part of the picture. The emphasis, instead, is on the conversation—analysis, reflection, and aggressive argument, even with the teacher. Significantly, Japanese grade schoolers far outshine their American peers.

The issue here goes well beyond test scores. Consider Tom Snyder’s big fear: In time, he believes, employers will increasingly ask whether applicants have been computer trained or teacher trained. The machine-trained ones, he suspects, will be left out, because “they won’t be able to make sense of the world.” ☺

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