Beyond Machines

BY
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In Steel City, schools are grappling with the human and technical nuances of the digital divide.

Pittsburgh

To appreciate how wide the digital divide can stretch, you need only wander into teacher Bob Vukela's computer-applications and business lab at Oliver High School here. You'll find a dozen students tapping the clunky keyboards connected to Tandy 1000s, computers that are older than most of the teenagers in the room. All the printers are broken, nothing but plastic and metal junk, because the parts to repair them are no longer manufactured. And the signature floppy disks students plug into the Tandy machines are like artifacts from an age of computing long since gone.

On this morning, Mark Abbott, a 15-year-old with a cap of bleached blond hair and an earring decorating his left eyebrow, is in the lab with other students, typing assignments into the obsolete machines. He raises his eyebrows and smiles sardonically when asked about the quality of the computers. "These things are garbage," he pronounces.

Vukela, a gray-bearded, bespectacled 57-year-old who plans to retire this June after 35 years of teaching, eyes the students working in the lab and concedes: "They're making the best of a bad situation."

Unfortunately, Vukela says, his is not the only computer lab in the Pittsburgh city schools sporting grossly obsolete machines. Other labs are also 15 or more years behind the times—footnotes to the so-called digital divide, a phrase popularized by the Clinton administration to express the wide disparities in access to current technologies, largely between rich and poor. Nowadays, though, some digital-learning advocates say the phrase is so overused it has almost become a cliché, blurring the underlying threat of what the digital divide really means for communities like Pittsburgh—namely, that the technology skills and knowledge of thousands of city children will fall way behind their peers in wealthier communities.

The good news in Steel City is that the Tandy 1000s are fading from the educational landscape. With help from the federal E-rate program, which offers discounts to needy schools to buy telecommunications technology, the Pittsburgh school district has invested $24 million in hardware and software upgrades over the past three years. Vukela's lab, for one, is scheduled for an upgrade in September. As it is, there are roughly 10,000 modern computers in the 39,000-student district—a computer-to-student ratio that is actually slightly better than the average national ratio of 1-to-5.

Just a few doors down from Vukela's lab, in fact, busi-
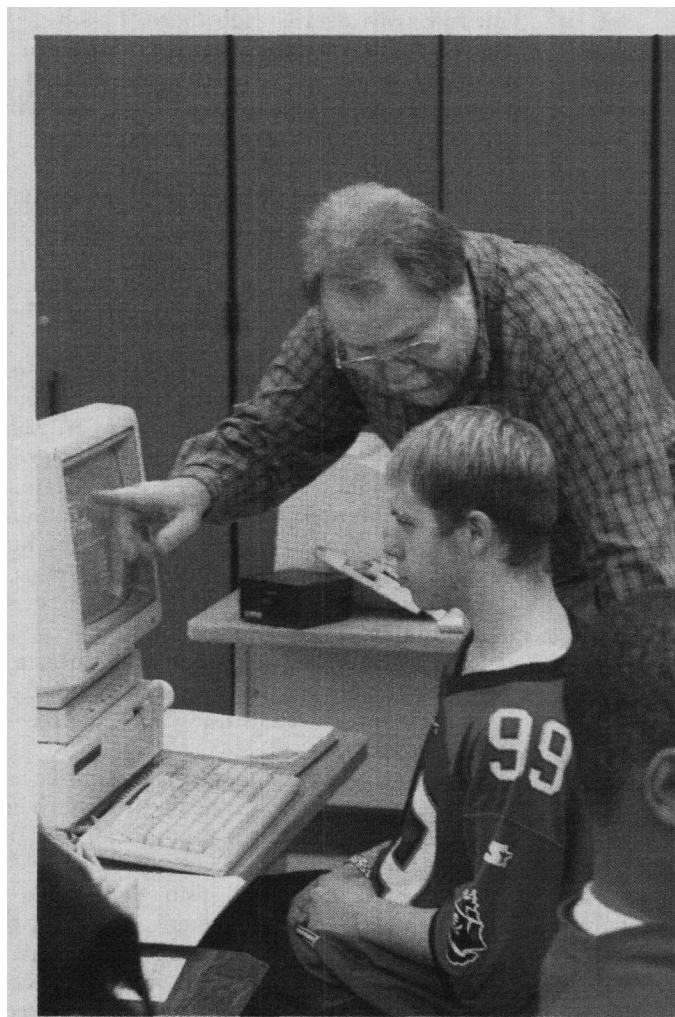
The computers in teacher Bob Vukela's classroom at Oliver High School in Pittsburgh are older than many of his students. In fact, they're so old that replacement parts for the machines are no longer manufactured. Here, Vukela helps student Mark Abbott.

John Heller

ness teacher Carolyn Flavin shows students in a computer-applications class, who are using state-of-the-art Dell computers, how to use Microsoft Word to create title and content pages for research papers. On any given day at Oliver High, you might also find some of the school's 1,250 students analyzing the credibility of Web pages—or working through algebra word problems using software that tailors questions to students' individual skill levels and provides immediate feedback on their answers.

The bad news, however, is that the Pittsburgh school system—like many other districts across the country—has largely ignored the human factors necessary to close the digital divide. So, you'll see "pockets of excellence" scattered around the district, but not widespread use of

technology in education, says Glenn Ponas, a former high school mathematics teacher who is now the district's acting coordinator of instructional technology.

He acknowledges that the district has invested little in technology training for teachers or in people to provide more technical support. Consequently, Ponas says, the schools are playing a game of catch-up. "Without focusing on human beings, we've lost some ground," he says.

Ponas points out that the wages the district offers technical-support employees are far behind the going rate in nearby suburban districts and the private sector. As a result, 16 of 59 technical-support positions went unfilled for the better part of this school year.

At the school building level, the lack of technical support frustrates teachers, often discouraging them from using technology. "Sometimes, I feel inadequate because I can't answer everyone's problem," says Rich Marasti, who splits his time between teaching business classes and providing technical support at the Perry Traditional Academy, a 1,036-student city high school that district officials say is considerably ahead of Oliver in its use of technology.

And, unlike in some other urban districts such as Milwaukee, where a third of the schools have opened computer labs for extended hours after the school day ends, no far-reaching efforts have been made to provide such services in Pittsburgh. That leaves some of Pittsburgh's poorest children—who don't have home phones, let alone computers—grasping for access wherever they can find it.

With the city schools facing a $37 million budget deficit last year that forced the school board to raise taxes and approve shutting down 11 schools over the next two years, closing the digital divide is going to be a tricky task. But Superintendent John W. Thompson warns that the consequences of failing to confront the divide here "could be devastating to our community."

That is especially so for a school like Oliver High.

On the Precipice of the Divide

As snow flurries fall on a patented cold, gray Pittsburgh day, students in thick winter coats and knit hats climb the steps leading to the front entrance of Oliver High, a drab block of concrete built in 1925. They pass through metal detectors on their way into a hallway, and blue-uniformed school security officers sporting walkie-talkies sift through the handbags and book bags of students who set off the metal detectors.

During the day, teachers are instructed to lock their classrooms whenever they leave them. Faculty restrooms are locked, too. And the school conducts frequent hallway sweeps, in which the main office orders teachers to lock their doors once the bell has rung denoting the start of a new class. All latecomers—and there are usually many—are rounded up and taken to the cafeteria.

Consider this as well: For three years, the school has struggled to get its attendance rate slightly above 65 percent, according to Principal Joseph Kmetz, who laments, "Our biggest problem is getting the kids here."

What's more, Pittsburgh school officials report that 60 percent of the students who attend Oliver are living in poverty (close to the district average of 64 percent) and nearly 70 percent are minorities—almost all of them African-American. Beyond that, roughly half of last year's 11th graders who took state exams in reading and math scored in the bottom quartile in both subjects, according to the Pennsylvania education department.

Somehow, then, it's not surprising that fewer than a third of the graduates of the class of 2000 went to four-year colleges. That statistic alone is a troubling reminder of the odds that many of the young people at Oliver High will end up on the wrong side of the digital divide.

A person with a college education is roughly 2½ times more likely to use the Internet than a person with only a high school education is, according to "Falling Through the Net: Toward Digital Inclusion," a report released last fall by the U.S. Department of Commerce. And a college graduate is almost six times more likely to use the Internet than a high school dropout.

Those realities set Oliver—and other schools like it in Pittsburgh, as well as around the country—on the precipice of the digital divide. If technology offers better ways to learn, these are the students who need that boost the most.

High-Tech Hopes and Classroom Realities

The reality, of course, is that some of these students will benefit from having teachers who know how to harness the powers of technology, but others will not.

One Oliver teacher who is infusing technology into lessons in a myriad of ways is social studies teacher Adjua Adama, a 26-year-old with a closely shaven head, a mustache, and a tuft of a beard.

On this day, Adama is wearing a white and maroon dashiki as he shows a visitor how he has transformed his classroom into an island of high technology. In the middle of his class, he has a laptop and a digital video disk, or DVD, player (which he purchased himself for use at home and school) and a school projector and VCR. "I find films that ... depict what I'm trying to convey. The DVD allows me to bookmark parts of the film and easily jump back and forth," he says.

Adama turns his attention to geography. "I have the entire Encarta series right here," he says, referring to encyclopedia software created by Microsoft. To showcase how he uses it to teach sophisticated geography skills—such as creating population and climate-zone maps—Adama clicks on a virtual map of the United States. On a large screen behind him, a map image appears, showing red dots concentrated around highly populated areas. The program zeros in on specific states and regions. It shows what a land mass looks like from satellite images taken during the day or night, and it closely outlines topography such as deserts and mountains.

He clicks again to show an image blanketed with red dots. He has landed on China, the most populous country in the world. "You should have heard the students when they saw that—it really conveys the aspect that they've got a lot of people over there," Adama says.

Showing his students the world would be nearly impossible using paper maps alone, he says, but technology puts thousands of maps at his fingertips.

Last year, Adama required his regular classes as well as his honors ones to do social studies projects using technology tools such as the Internet, Encarta, Microsoft Word, and Publisher. They created newsletters—based on academic research evaluated by Adama—about different countries.

This year, Adama plans to give a similar assignment to his honors classes, but he doesn't think he'll use as much technology with the regular classes. "It's motivation," he frets. "The mainstream classes I have this year are just not as motivated. It's a shame.

"You spend a lot of time going over basic technology stuff with the mainstream kids," he says, pointing out that teaching those remedial technology skills steals time away from covering the academic content he wants to complete. "I didn't have to worry about going over the basic technology stuff with honors kids—they already knew how to do it."

Adama is not the only teacher who has experienced that reality and adjusted his technology expectations accordingly.

Rose Haverlack, an English teacher at Perry academy, says "it's easier to use technology with the more motivated kids."

"They will try things on their own; ... they're interested in producing something. The average kids just want to be entertained. In order to get them to the lab and explain things to them," she says, "you wouldn't get anything done. They end up focusing on the technology instead of the content."

Still, some educational technology researchers are

cautioning that by forgoing the use of technology or using less with underachievers, teachers could be unknowingly contributing to a widening of the digital divide between high achievers and low achievers.

Henry J. Becker, a professor of education at the University of California, Irvine, points that out in "Who's Wired and Who's Not: Children's Access to and Use of Computer Technology," which was published this winter in *The Future of Children*.

Analyzing data from thousands of students and teachers and hundreds of schools, Becker concluded that "among teachers of the same subject, English teachers used word processing software much more often with high-achieving classes; computer and social studies teachers used presentation software more frequently with high-achieving classes; and social studies teachers used Web browsers more with high-achieving classes."

Others have found similar results.

Janet Ward Schofield, a professor of psychology at the Learning Research and Development Center at the University of Pittsburgh, conducted a study in the late 1990s on how Pittsburgh public school teachers were using technology in their classrooms. "Within schools, it was fairly common for kids in certain niches to have more access—those niches tended to be programs that served upper-level students," Schofield says of her research.

Even in mixed-ability classes with up to three computers in a room, Schofield found teachers made decisions that led to unequal access. For instance, some teachers gave access to the machines as a reward to students who were caught up on their work and behaving in class—in other words, usually academically stronger students.

And, she says some teachers also gave more computer access to students who were already skilled technology users. "Those kids," she recalls, "tended to be kids with home computers, from higher-income families, and higher-education homes."

Says Schofield: "In a sense, the technologically rich got richer."

A Different Take on Technology

Social studies teacher Tim Sullivan, who spent 26 years as a criminal-defense lawyer before returning to teaching about seven years ago, admits he's a latecomer to the digital revolution. A kindly, almost grandfatherly figure with a preference for casual clothes, he is affectionately called "Doc" by some students and teachers in honor of his law degree.

Sullivan, who was a teacher in his younger days before becoming a lawyer, says he chose to restart his teaching career at Oliver High over a wealthier, less troubled high school.

Although he is pondering ways he can infuse technology into future lessons, Sullivan has chosen not to use it regularly in his teaching so far.

That is due, in part, to limitations on access at school and a relative lack of time and good training available to teach him how to infuse technology into everyday learning. His classroom has only one computer—in Sullivan's tiny office, adjacent to the room. On that computer, he records grades and attendance and does other administrative tasks. But not much else—he can't use it for e-mail or Internet research because his classroom will not be wired until next year.

Whatever the benefits e-mail or the Web might offer teachers, Sullivan is still not sold on the idea that technology is really the answer to bridging the achievement gap between poor students and their better-off peers. "You've got to get the basics down before you even think of infusing technology into learning," he says. "I'm just getting these kids now to the point where they'll sit and listen to me for 15 minutes ... and they no longer skim-read."

Other Pittsburgh teachers express even greater skepticism about the role technology should play in teaching. When asked whether she planned to infuse more technology into her instruction, Perry academy math teacher Jan Trafican, a 30-year veteran, answers pointedly: "Never—absolutely never. I'm a back-to-basics person."

Such skepticism is worth noting, because some evidence suggests that technology can actually become a
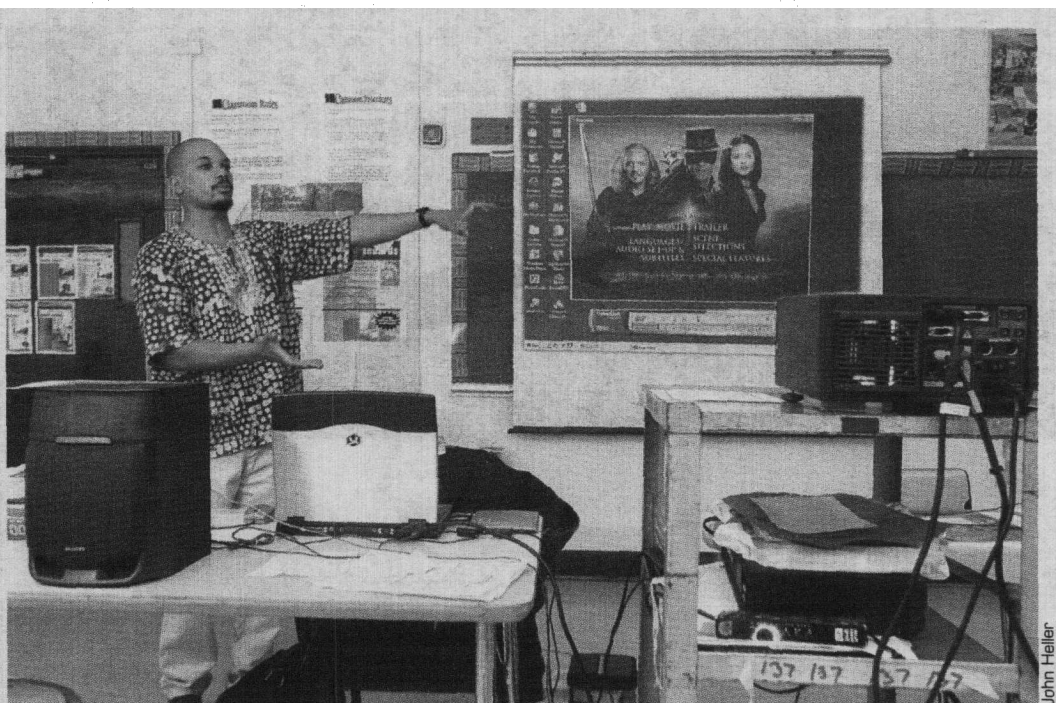
crutch that places students who use it too much at an academic disadvantage—a sort of digital divide in reverse.

In a report released last September by the Brookings Institution, a Washington think tank, researchers found that 4th graders who reported using calculators every day in school had the lowest scores on a National Assessment of Educational Progress math test, compared with children who never used calculators or used them sparingly. Beyond that, the study found, black students were nearly twice as likely to use calculators every day as white students. Hispanic students were about 1½ times more likely than white students to use calculators every day.

The report concludes: "Providing access to new technologies, only to learn later that they hinder learning, does not advance the cause of educational equity."

Educational technology advocates counter that it's how the technology is used—not simply access to it—that makes all the difference.

Tamara Harris, a 17-year-old junior at Oliver, is sitting in a chair in Sullivan's office tapping her feet nervously, talking about how she rarely uses computers for academic classes. Rather, she uses it mostly for business and career-related classes to learn how to enter data, format business letters, improve her typing speed, and hone other technical skills.

Occasionally, she might use Microsoft Word to type an English or social studies paper. And she used the Internet this year to do some cursory research for a short, one-page biography of a scientist for a science-timeline project. But that's it. "Oh no," Harris says, "we don't go to the computer lab for math—we learn from the book every day."

Her technology experiences are not unlike those of other students who attend poor urban and rural schools, says Mark Warschauer, an assistant professor of education at UC, Irvine.

A few years ago, when Warschauer was a professor at the University of Hawaii, he conducted a study of two high schools in the state—one a public school in an impoverished community in the state where the per capita income was less than $10,000; the other, an elite private school in Hawaii. His study, "Technology and

Social studies teacher Adjua Adama is one of the most technologically adept teachers at his Pittsburgh high school. Still, he frets that it's difficult to infuse technology into classes with unmotivated students.

School Reform: A View From Both Sides of the Tracks," sheds some light on how the digital divide manifests itself even when schools have relatively good access to multimedia computers and telecommunications.

Warschauer recalls that both schools were heavily integrating computers and the Internet into classrooms, but those machines were serving "very different functions."

At the private school, he says, teachers were using technology for mostly scholarly purposes. For example, students in physics classes analyzed computer-based simulations of motion experiments and followed that by conducting real experiments in laboratories using frictionless air tubes. In biology classes, students used palm-sized computing devices to gauge the temperature and acidity of plants around nearby ponds and downloaded that data to classroom computers to graph their findings.

At the public school in the poor community, meanwhile, technology was used largely to teach students narrow technical skills—such as Web-page design—or to produce other projects that required little, if any, academic rigor. For example, a newsletter the students produced using state-of-the-art publishing software for a marine-science project was generally devoid of "hard scientific information," Warschauer found. Instead, it focused more on the students' personal experiences learning about marine science.

"So much of digital-divide talk is focused on how many computers a school has and how many have Internet access," Warschauer says. "But it takes much more than putting in machines."

'Where We Fall Behind'

If there is such a thing as a technology evangelist, Glenn Ponas fits the profile. The former math teacher—who is as comfortable flinging around techie terms like "gigabytes" and "bandwidth" as he is chatting about quadratic equations and derivatives—talks with the speed and purpose of someone who is obsessed with catching up.

These days, in his role coordinating instructional technology, his primary obsession is creating a technology plan to bring Pittsburgh up to speed with other districts. To see how well the city's schools stacked up against other urban districts, Ponas visited the Austin and Houston school districts in Texas because they had taken aggressive steps to close the digital divide.

His conclusion: "We stack up very well as far as the stuff we have. ... [But] they're ahead of us in technical support, policy articulation, and staff development. That's where we fall behind. And compared to Houston, we are very far behind."

For example, in Pittsburgh, the instructional-technology staff is responsible for evaluating technology bids, and buying hardware and software and installing it—all duties tacked on to the technology employees' primary roles as teacher trainers, curriculum specialists, and technical troubleshooters. In Houston, Ponas found, the instructional-technology staff is responsible for none of those additional duties; its focus is primarily on instructional technology and training teachers.

What's more, every school in Houston has an educational technologist, a person with an education and technology background responsible for training teachers and fixing technical problems. Some schools in Pittsburgh have people filling similar roles comfortably; others don't, Ponas says.

In addition, he says, Pittsburgh's residency requirement—which means that school employees have to live in the city—makes it next to impossible to attract tech-savvy educators and other technology professionals who live in the suburbs. No such residency requirement exists in Austin or Houston.

Looking ahead to how the district might end its digital divide, Ponas proclaims: "The people are the common denominator."

Recently, Ponas says, much of the talk about the digital divide in Pittsburgh and elsewhere has turned to what students, parents, and teachers are doing with technology after school hours. Who has access to computers at home? Of those who do, is it regular, high-quality access? Or are there barriers that prevent them from using technology?

Jeston Robinson, 17, an Oliver High senior wearing a white T-shirt and a gold chain dangling around his neck, is hunched over a computer keyboard in one of Oliver's technology labs, working on an essay about the African-American writer Richard Wright for an advanced English class.

Robinson says he has a computer at home, but it's been broken for about two years. "I never bothered to get it fixed," he says, shrugging. "Now, it won't even boot up."

Did he call a computer help desk for assistance? Robinson shakes his head.

Could anyone else in his family fix it? He shakes his head again.

"If I need a computer to do my homework," he says, "I go to [a friend's house] or the library. If I can't get to his house or the library, I just don't do the assignment."

Robinson's experience with his home computer highlights a quirky wrinkle of the digital divide—one that researchers at Pittsburgh's Carnegie Mellon University outlined in a 1999 study, "Troubles With the Internet: The Dynamics of Help at Home."

The researchers analyzed 93 Pittsburgh families and 237 family members who were recruited from public schools in the city and given computers and Internet access. Among other findings, the researchers discovered that the people who called a computer help desk the most were not those in greatest need of help. Rather, those who sought help most tended to be the most skilled computer users. Many of the people who had the least knowledge simply gave up and chose not to seek assistance from the help desk.

In one interview, a girl told the researchers: "Yeah, it would get me to the point where I would just [say], 'Forget it.'"

Still Struggling for Access

The digital divide can also be seen through the hopeful eyes of Mionna Green, 10, a slight girl with a ponytail tied up in a baby-blue ribbon. She lives in one of the city's poorest areas and serves as an important reminder that, for many children, simply having access to computers remains a serious problem.

On a cold evening, she is sitting in an empty classroom inside the warm confines of Hill House Association, a community center decorated with pictures of the Rev. Martin Luther King Jr., Malcolm X, and other African-American legends. Among a host of other services, the center offers Internet access to young and old alike.

And that's one of the things Mionna likes so much about going there after school. She says "it's hard" not to have a computer at home. "I have things to do for school," she says. "So usually I do them over here."

Her mother, Linda Green, arrives later to pick her up. Draped in a thick black winter coat, Green, a 46-year-old single mother raising four children, sits at a round table near the community center's entrance.

She is working full time and attending school part time to become a nurse. Before going back to school, she had no experience using computers. Now, she says, "I need to use it more and more."

And that has made her believe her children need more access to it, too.

Her voice perks up when she talks about how much it would help her, and her children, if she had a home computer. And she smiles at the thought.

But Green is tired at the end of a long day, rings have formed under her eyes, and she hunches forward. Mionna dons a winter jacket, rests her elbows on the table and her chin in her palms. It is growing dark outside, and she is ready to go home.

Green is asked when she thinks she'll have a home computer. She eyes her daughter, then stares ahead, expressionless, and repeats softly, "at some point ... at some point." ■