

# ONE-TO-ONE COMPUTING

## A Revolution in Education is at Hand

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### EXECUTIVE SUMMARY

What began as a visionary experiment a few years ago is fast becoming a widespread and highly effective educational practice: one-to-one student computing. In 1:1 computing, each student is assigned a notebook or Tablet PC, connected to the Internet, and taught by a classroom teacher with a similar device. The result has been a transformation in education.

“Tablet PCs bring an electricity to student learning,” says Dr. Joe Hofmeister, technology director at Cincinnati Country Day School in Ohio. “The opportunities for collaboration and student leadership are unmatched,” adds Dr. James Polzin, assistant superintendent of the Hinsdale Township High School District 86 in Illinois.

This paper profiles how 1:1 computing, using notebooks and Tablets on mobile wireless carts or individually assigning mobile PCs to students, helps improve student learning. Today’s students come to the classroom comfortable with technology. Therefore, they are good candidates to benefit from Department of Education Secretary Rod Paige’s vision of “digital age educational opportunities to match the expectations of digital-age students.”

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**A RECENT INDEPENDENT STUDY OF TEACHERS' USE OF TECHNOLOGY**, sponsored by CDW Government (CDW•G), found that a key issue driving the effectiveness of technology as a teaching tool is sufficient access to computers. Ninety-three percent of teachers consider classroom-based computers to be either “very useful” or “somewhat useful.” (Complete results of the 2004 CDW•G Teachers Talk Tech™ survey can be found at: <http://www.cdwg.com/TeachersTalkTech2004>.) While these survey results and other studies demonstrate how computers connected to the Internet can enhance student research and facilitate collaboration, a lack of hardware resources impedes the potential technology brings to the education process.

Over the past few years, school districts around the country have experimented with 1:1 laptop and Tablet programs. At first these initiatives were controversial, with school leaders and parents questioning the allocation of resources, but the efforts are now paying enormous dividends. Several large deployments have demonstrated the effectiveness of 1:1 computing programs.

Administrators also have noted remarkable changes that students using notebooks have on the culture of learning. As one superintendent recently wrote in a major educational technology journal, “If you want to see how technology expands the bounds of learning, you can look not only at our classrooms, but also at our track meets, school bus stops and other places...where students have their notebooks open and their minds engaged.”

<http://eschoolnews.com/news/showStory.cfm?ArticleID=4848>  
With strong results from pilot projects, 1:1 computing programs are spreading across the country. Statewide initiatives are now either underway or proposed in Maine, Michigan, New Hampshire and New Mexico, with deployments established in dozens of districts including Beaufort County, North Carolina; Latrobe, Pennsylvania; Minneapolis, Minnesota; and Palo Alto, California.

To Don Knezek, Chief Executive Officer of the International Society for Technology in Education, increased student computer access is an essential component in garnering the full beneficial potential of technology on learning. “We weren’t very surprised that access by students in the 1990’s—often totaling no more than an hour or two per week—resulted in limited gains in productivity and learning. Comparable access would likely have little impact in business and industry as well. It is refreshing, however, to see such positive results accumulating among students with greater levels of access to computers.”

Based on its successful pilot program, selected classrooms at the 4,200-student Hinsdale Township High School District 86 in Illinois will begin the 2004-2005 school year with new Toshiba Tablets. These Tablet PCs give students the full functionality of a laptop computer but, unlike a laptop, also have a large pen-sensitive screen that allows students and teachers to write directly on the screen and have it captured by the computer. Annotations can be saved as handwritten notes or can automatically be converted into printed text. Most schools that have made the move to the new Tablets see this technology as the next frontier.

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**HINSDALE 86, LOCATED NORTHWEST OF CHICAGO,** is giving teachers 320 new Tablet PCs to replace their desktop machines. An additional 250 Tablets are being made available to students who will use them in math, social studies, business, science and humanities classes. Some subjects will be given a higher priority -- for example, all honors biology classes will have access to the new Tablets.

Hinsdale expanded its pilot program after an encouraging trial year. Last year, 50 Tablets were provided to faculty and students in a variety of departments. With the Tablets, Assistant Superintendent Polzin and his colleagues found, "There's a greater interaction between the teacher and the students. Because it's a Tablet, the student can use it as an electronic laptop. While a teacher is presenting a PowerPoint, students can make notes directly on their screens."

Dr. Polzin believes the ability to annotate on the fly is a unique strength of the new technology and one that refocuses students' critical thinking. In a high school algebra II/trigonometry class, for example, the classroom teacher begins by downloading an outline to students and discusses the day's lesson while walking around the room with his Tablet. Rather than struggling to take exhaustive

notes, students annotate the outline, jot down questions and make observations. "Tablets help the students be critical thinkers not after the lecture, when they're reviewing their notes, but while the material is being presented," Polzin said.

In this year's expanded program, teachers and students will have access to LCD projectors in classrooms that use the Tablets. Students in a biology class might be asked to take their annotated data from research on the human genome project, plug into the projector and lead the class. "It's less intimidating to share a computer screen than working a problem out on the board," Polzin said. "Students end up coaching one another."

If educators continue to be impressed with how Tablets change the quality of student learning, Dr. Polzin said that for the 2005-2006 school year, the district plans to ask some 150 families to voluntarily purchase a Tablet PC for their student. For this commitment, the district will guarantee that the student will be working with other students with Tablets, and that they will be led by a teacher with a Tablet.

Dr. Polzin said this expanded pilot is an incremental step towards the districts' ultimate 1:1 computing vision. "By 2007-2008, if we can show the community that Tablet technology has a positive impact on instruction, we want to ask each parent to purchase a Tablet for their student."

Dr. Joe Hofmeister, director of technology at Cincinnati Country Day School in Cincinnati, Ohio, said that the positive impact on instruction of their 1:1 computing initiative has a long history. The school has had a 1:1 model in place for seven years and this year will be moving all 885 pre-k to 12th grade students to Tablets. Dr. Hofmeister said they made the move from notebooks to Tablets because of the PC's increased functionality.

"We're much more interested in having students express themselves than operating a computer. With the laptop, you have to use the keyboard to type in information. With the Tablet, you have the keyboard, but also handwriting, drawing and voice recording capabilities."

**“**

**While a teacher is presenting a PowerPoint, students can make notes directly on their screens.**

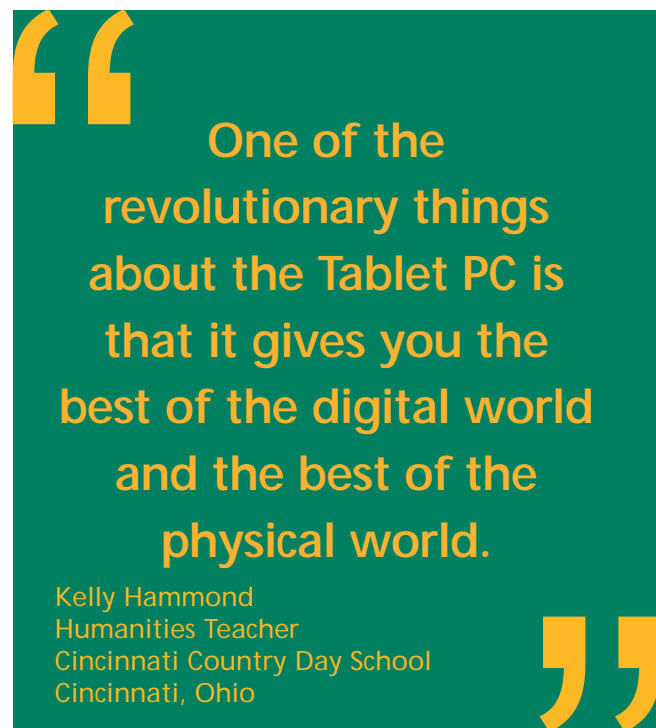
James R. Polzin  
Assistant Superintendent  
Hinsdale Township High School District 86  
Hinsdale, IL **”**

Hofmeister sees this advancement in practice everyday. Students studying a specific local flower can locate an image on the Web and then take the Tablet outside and write down their observations of that exact flower in nature. “They also use the voice recording feature to record oral descriptions of what they’re observing,” he said. Back in the classroom, they can use the Tablet’s advanced voice recognition software to translate their recordings into text, or use the audio file in a presentation.

“One of the revolutionary things about the Tablet PC is that it gives you the best of the digital world and the best of the physical world,” said humanities teacher Kelly Hammond. “A student has the benefit of paper and pen—freedom to write, freedom to draw, freedom to create as they see fit, with all the benefits of technology—the benefit to share, the benefit to change.” Hammond believes Tablets make computers more transparent and free students to express themselves in a wider variety of ways.

The ability to engage the whole student, regardless of individual learning style, distinguishes the Tablet from the laptop, explains Hammond. “For each of my students to have a Tablet has leveled out their abilities. Suddenly the student who could only learn visually doesn’t have to demand it in class. I think the Tablet PC gives kids choice about their education.”

Adam Fischer, director of information services and technology at Kent School in Kent, Connecticut, said his school also is moving its 1:1 initiative from notebooks to Tablets. He looks to educators like veteran physics teacher Peter Goodwin to illustrate the effectiveness of his 1:1 program. Goodwin’s students solve physics equations directly on their Tablets and then e-mail their work to him. By reviewing their step-by-step work, he can isolate exactly where students make mistakes. Goodwin then works the problems out in class using the Tablet and an LCD projector. He posts both the problem and the annotated solution on the class Web site. After 25+ years of teaching, Goodwin finds he can cover significantly more material with a higher rate of student mastery.



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Kelly Hammond  
Humanities Teacher  
Cincinnati Country Day School  
Cincinnati, Ohio

Adequate teacher training also is important, says Fischer. Instead of dry tutorial sessions, it’s important to let teachers in 1:1 programs experiment with the machine. “In addition to regular training sessions, we let our teachers take the Tablets home over the summer. By letting them ‘play’ with the Tablets, the excitement of what the technology can do just flowed,” Fischer said.

Educator, author and 1:1 computing advocate Gary Stager in Los Angeles, California, said allowing teachers intellectual freedom in their technology training gives them a unique perspective on classroom instruction. “Educators in 1:1 computing schools become acutely aware of new ways for students to learn. They also realize that many of the traditional ways we expect youngsters to learn are ineffective.”

Providing notebooks and Tablets, along with proper training to educators, elevates teachers’ commitment to classroom efforts. “Teacher professionalism is enhanced when they are equipped with the tools of 21st century professionals,” Stager said.

## CONCLUSIONS

Districts pioneering 1:1 computing with notebooks and Tablet PCs are providing the blueprint for a new educational model and are finding that technology encourages greater student collaboration, results in more critical thinking and engages students with a wide range of learning styles. As more schools around the country follow this lead, educators find themselves at the apex of a major advancement in student learning.



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Gary Stager  
Educator/Author  
Los Angeles, CA



## ABOUT CDW•G

CDW Government (CDW•G), which commissioned the Teachers Talk Tech™ survey, is a wholly owned subsidiary of CDW Corporation (NASDAQ: CDWC), ranked No. 376 on the FORTUNE 500 list. Known as the technology provider that responds to the needs of government and educational institutions with a sense of urgency, CDW•G provides quick answers to product questions and ships quickly from the industry's largest in-stock inventories. The company is known for its knowledgeable account teams that provide expert advice across a broad spectrum of technology products. More information about CDW•G can be found at <http://www.cdwg.com>.

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