

# Toward a One-to-One World

Mobile Computing is the Lifestyle of Learning



A Strategy Paper from



Underwritten by



## One-to-One: Putting the Personal Back Into Personal Computing

Educators have long strived to provide a learning experience that not only reflects but is tailored to the needs and learning styles of individual students. The goal has been to reduce the distance between the student and knowledge, content and learning, experience and education. To that end, educational technology has been instrumental in making information available to students just in time, just in the right quantity, and in just the right way.

During a blush of millennium-related predictions, libertarian futurist Lewis Perelman predicted that schools as we know them would be irrelevant by now as students interacted with teachers, colleagues, and content from any location with their own computer. Looking back, Perelman's vision is still alive in the virtual schools movement — and ubiquitous networked computing is transforming the institutional brick and mortar schools he once decried. Indeed, over the last decade, schools have been wired, classrooms connected, student-to-computer ratios improved, teachers and students trained, and hardware and software now at least rival the blackboard and overhead projector as the dominant technologies in the classroom. But what if, as Perelman predicted, those classroom walls simply stopped mattering? Are we now at a point in our evolution when it is time to move to one-to-one and fully extend our learning environments well beyond the walls of the school?

One-to-one computing — originally defined as each student having access to a computer and software 24/7 — has emerged as a nimble and personalized platform for learning. Now, as wireless access points improve, one-to-one computing includes connectivity to the Internet at anytime and from anywhere.

One-to-one initiatives take various forms. Many schools start out by equipping classrooms with sufficient workstations or laptop carts so that each student has access to a networked computer in each classroom. In some instances, a school may provide laptops to a group of students, to an entire grade level, or to all students school wide — allowing machines to move with the students.

One-to-one programs range in size from small pilot programs to system-wide implementations such as the state of Maine's deployment of 34,000 computers. Whether the program is big or small, the goal of one-to-one computing is to give students access to all of technology's benefits at any time and place of their choosing. Those benefits do not appear by accident — they are the result of deliberate decisions and disciplined planning. Among these benefits are: increased teacher and student use of technology, amplified

student motivation and engagement, improved student-teacher interaction, increased access to “smart” interactive, multimedia content, enhanced student achievement, and better student preparation for higher education or career (Bebell, 2005; Rockman, 2003; Pascack High School District, 2004; Center for Digital Education, 2005b).

This paper has been prepared to assist in the consideration of whether and how to achieve a one-to-one initiative. It presents information to help education leaders understand the vital elements and key considerations of one-to-one computing initiatives and it underscores the value of one-to-one computing to your district, schools, teachers, and ultimately, your students.

This paper also introduces a blueprint for action that features six elements to consider when embarking on a one-to-one computing effort. These elements include leadership, funding, infrastructure/architecture, curriculum solutions, professional development and resources and results. (See page 7.) But before addressing the components necessary for achieving one-to-one, it is useful to think about the propositions for moving in this direction — the what and the why of one-to-one computing.

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# PROPOSITION 1:

## Lifelong Learning and the Digital Majority

As the world shifts from an industrial-based to a knowledge-based economy, students must be prepared to successfully meet the challenges they will face as they enter higher education or a career. Districts and schools have the responsibility to teach students how to use prevalent technological tools to interpret, manipulate, and communicate information, thus enhancing the probability of each student succeeding. And it is not just individual student success that is at stake, as important as that is. The future of our communities, the economy and even national sovereignty is riding on getting education right.

The world increasingly continues to connect and communicate; so much that those accessing the Internet have become the “digital majority.” Approximately three quarters of American households have Internet access, over half of which is broadband (Pew, 2005). According to a recent study of the Internet in schools, the Pew Internet and American Life Project found that fewer than 15 percent of students report not having Internet access from school, home or both.

The number of individuals in the “digital majority” expands each year, extending to demographic cohorts (by ethnicity and age) for whom these technologies were out of reach just a few years ago. From old to young, more people are getting connected. The ability to send e-mail, share digital photographs, find information, bank, download music, get educated, or compare products and prices has made connectivity indispensable.

Whether for informal or formal learning, more Americans are using the Internet for education and training purposes. Over the last few years, universities have begun to understand the power of the online medium in reaching traditional and non-traditional students. Some 90 percent of four-year public institutions and more than half of four-year private institutions offer some form of online education (U.S. Department of Education, 2004). Access to various courses no longer depends on where a student lives, but on access to the school connectivity; that is, home to school online connectivity is now critical to success.

Although schools have connected, many students still face what researchers have called the “digital divide.” When students leave the school environment their access to digital learning tools becomes limited, leaving them without the means necessary to compete fairly, creating a chasm between themselves and their classmates. This divide has been one of the major factors in states and districts organizing one-to-one initiatives (Center for Digital Education, 2005). Another more subtle divide exists also between those who have broadband as opposed to dial-up Internet access (Pew, 2005).

More schools have come to realize the importance of a one-to-one ratio as the need for technology-savvy individuals has intensified around the globe. Providing a personal computer to each student motivates the student and increases both the quality and quantity of their work (Swan, Hooft, Kartcoski & Unger, 2005). It allows each student to master the tools of career and success.

But it is not the numbers of computers alone that drive change in schools. Instead, lowering student-to-computer ratios allows other activities to occur that create a real environment of change and improvement. As students and faculty gain better access, this access increases the value of activities that take place around the implementation of technology initiatives. With more access, professional development can become more meaningful, dynamic curricular solutions become available more frequently, and leaders are able to take more effective steps.

Personal computers with online access now serve as necessary tools in business, available 24/7 — providing workers a private workplace to reach out and collaborate as needed, when and where they want. Likewise, students now have access to learning, assignments and research anytime, anywhere. Just as business has shifted from an industrial to a knowledge-based model, educational institutions must shift from the linear, synchronous, assembly-line style of teaching and learning to student-centered individualized learning to better prepare competitive, successful world citizens.

### Moving Up the Technology Scale

To measure student access to technology, educators typically use a student-to-computer ratio. In the late 80s, schools were considered fortunate to have even a 20-to-1 ratio, meaning 20 students to every one computer. During that time, each machine represented a relatively large financial commitment.

In the early 90s, schools set goals for ratios approximating 10-to-1, meaning 10 students to every computer. As computer prices fell and districts realized the benefit of these machines, 4-to-1 or 5-to-1 goals became more typical.

With each successive step to improve the student-to-computer ratio, the number of computers in schools increased. Typically, computer labs were established and students were rotated through these rooms. As the personal computer evolved, districts gave teachers computers, had older labs upgraded, and then installed mini-labs in the classroom setting. Today districts and schools are progressing toward a one-to-one ratio, in which the computer moves with the student instead of the student moving to the computer.

## PROPOSITION 2:

### Learning Anywhere — in Real Time

#### Learning What's Possible

Classrooms are a learning environment, not *the* learning environment. Learning can take place anywhere, the determining factor being the ability to access resources to learn.

As Perelman expressed, the *place* of learning would become less important. One-to-one computing extends contemporary learning tools to where the action is — even if that is an anthill in the schoolyard or the stars in a backyard sky.

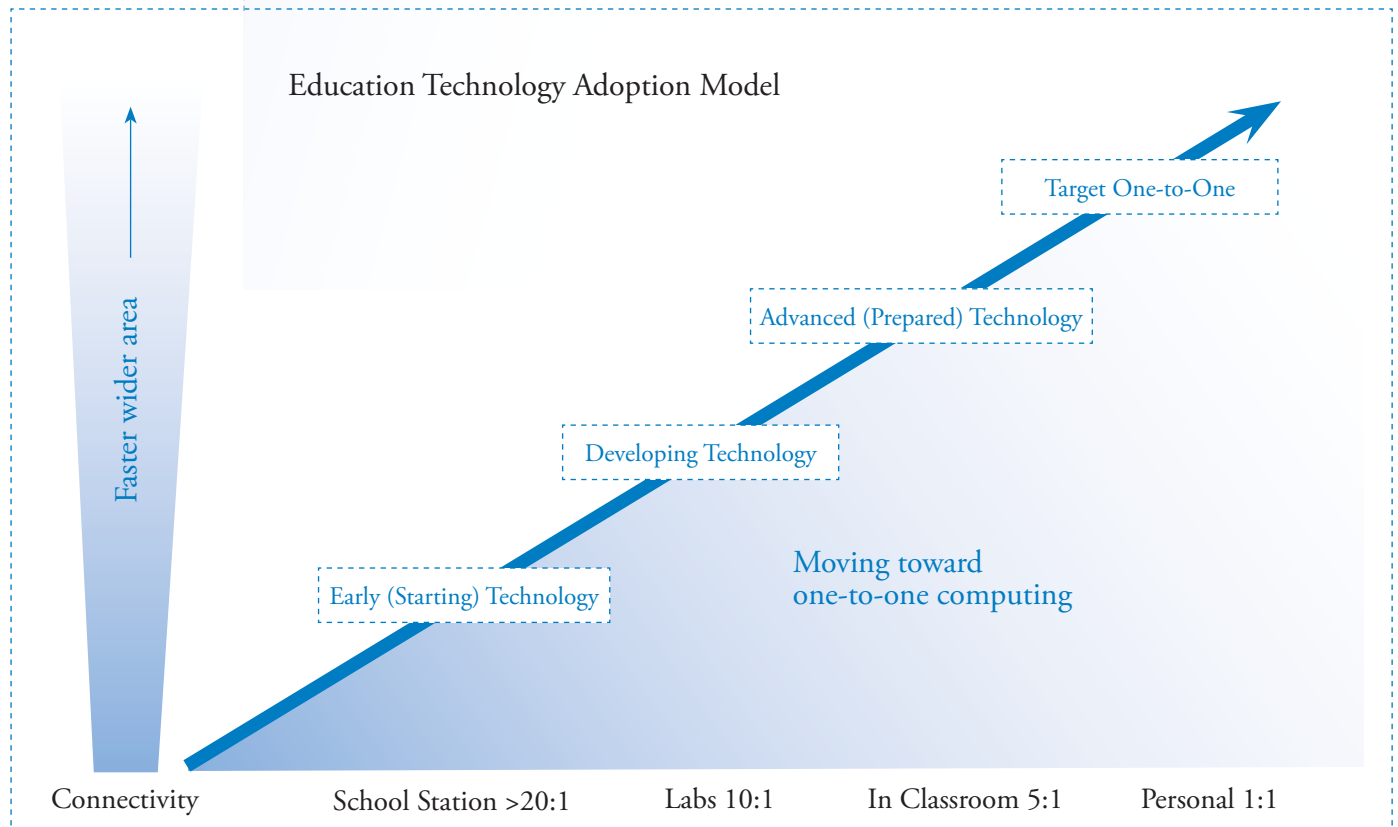
As computing power increases and further technology advances are made, the ability of software to personalize the learning experience will increase. Amplified computing power creates a more realistic multimedia experience that engages students and motivates them to learn — whether inside or outside of the traditional classroom.

One example of *place* becoming less important is the virtual school. A virtual school houses online curriculum and assignments that students can access anytime. Over the past five years, virtual schools have been

created in at least 15 states. Twenty-five percent of public schools have some form of virtual school or online curriculum. Virtual schools offer flexibility to students and provide teachers the opportunity to create a more adaptive instructional environment (National Tech Plan). The flagship of K-12 virtual schooling is the Florida Virtual School. During the 2003-2004 school year, more than 13,000 students enrolled in at least one or two courses and today enrollment exceeds 33,000.

One-to-one computing requires curriculum and content that engages, challenges, and promotes learning anywhere. While it is challenging to keep pace with changing society and culture, advancing technology, curriculum development and digital content are part of the solution for meeting students' new style of learning.

### Education Technology Adoption Model



## → PROPOSITION 3: ↕

### Leveraging Existing Habits

#### Supporting Different Learning Styles

Each student responds uniquely to specific classroom environments and instructional practices based on what they already know and how they are wired to learn. Each student's cognitive approach is as individual as his or her physical make up. Researchers have attempted to categorize the way students learn by using diverse learning theories such as "brain dominance," conceptual tempo, mind styles, modalities and multiple intelligences.

Regardless of the choice of framework, educators have learned that it is vital to vary instruction so that students have the opportunity to learn the best way they can. Video clips, online discussions, instant messaging, access to experts, multimedia, online professional journals, games, simulations, and blogs, all provide different avenues to understanding.

When students have full access to a laptop, they hold the keys to their own learning. No matter the topic or standard to be achieved, students who have expanded access to the Internet and technology's tools have more opportunities to discover information presented in a way that reaches them. For example, one-to-one computing has shown the most impact for low achieving and at risk students (Mitchell Institute 2004).

MacArthur High School, in the suburbs of Dallas, Texas, has earned the state's highest academic ratings for the past four years. MacArthur's one-to-one computing initiative has enabled its diverse student body — with 40 percent of students below the federal poverty level and more than 17 percent non-native English speakers — to improve academic results and to provide all students with a chance for success.

If these students could not get access to the resources most people use today, the school felt these students' futures were in jeopardy. Student Aida Jobe, now adept at technology, claims she is "dreading not having a laptop when going to college and can't imagine living without it."

The new classroom approach at MacArthur is student-directed and student-engaged, which means student-centered. Brandy Wall, instructional technology specialist and history teacher, said that now, after the implementation, suddenly the more introverted kids are also contributing, participating and even sharing their valuable technology skills.

According to Principal Tracie Fraley, "I'm seeing teachers change their instructional style. They are moving away from being the sage on the stage to facilitated learning. Students have ownership of their learning and their products, as opposed to just regurgitating what the teacher says. The level of understanding and higher-order thinking we're seeing our students produce is astounding."

#### Building on Existing Lifestyle

A disparity exists between the culture of schooling and actual technology use and work scenarios. If proficiency in technology is required to be competitive in the workforce, then why wouldn't technology in education be the mainstream tool for learning?

One-to-one computing programs take advantage of how students interact with the world around them and build on deeply imbedded habits. Today's students are accustomed to learning and communicating using technology. They get online whenever and wherever they can. In 2005, more than half of teens reported going online daily with 24 percent announcing that they go online several times a day. These teens access the Internet from home (87 percent), school (78 percent), a friend or relative's house (74 percent), the library (51 percent) or other community settings (9 percent). They get online to communicate, work and play games; 83 percent report that most of the people they know are online also; and 86 percent of all teens believe the Internet helps them do better in school (Pew, 2005). To them the physical and electronic worlds are one.

In their school life, teens find creative ways to harness the power of technology to be more successful students. Students described using technology in school as a virtual textbook, a reference library, a virtual tutor and study shortcut, a virtual study group, a virtual guidance counselor, and as a virtual data storage area (like a locker, backpack, and/or notebook) (Pew 2002). Giving students access to computers and connectivity outside of the school day is vital, allowing students to perform these functions anytime or anywhere.

#### New Expectations — the Millennial Perspective

Marc Prensky, author of *Digital Game-Based Learning* (2001), describes today's students as "digital natives," who move at "twitch speed," prefer graphics before text, can parallel process and multitask, and who function best when networked. Instant gratification and frequent rewards motivate them. They prefer interactive, graphical, non-linear experiences over didactic, text-based linear interactions. These preferences suggest that high quality electronic content might be more successful in engaging our students than older, print-based materials (2001).

Based on the work of Neil Howe and William Strauss (2000), the U.S. Department of Education (2004) in its National Technology Plan refers to these same students as the "millennials." Millennials value doing well in school, plan on receiving a higher education, use computers frequently, spend more time online than watching television, create personal Web pages, and are "ultra communicators." They use various electronic modes and methods to share, coordinate and complete tasks.

Whatever the label — digital natives, millennials, or Gen Y — students are ready to learn, expand, and grow using technology. Now the challenge is to provide students with the tools that allow them to maximize their learning. And meeting this challenge requires leadership with vision that champions a one-to-one program. (See page 7.)

## PROPOSITION 4:

### **Always-On Schools, Homes and Communities**

As wireless network technologies advance, cities and other government entities have begun to understand that providing Internet access to their citizens, on a limited or no-fee basis, can revitalize and enhance the living experience in their communities. School districts are capitalizing on these efforts to form partnerships. The Fullerton School District (California), for example, decided to begin a one-to-one laptop program when the city installed a wireless network in the downtown area that encompassed the main city library. By provisioning wireless access throughout this space and providing laptops to students, the city and the school district helped students to extend their learning beyond the school day. Since many of the students who visited the library regularly did not have Internet access at home, this insightful wireless initiative allowed these students to have the same advantages as their peers. The Fullerton laptop program was so successful with middle school students that the district plans to expand the initiative into certain elementary school classrooms next year.

As new wireless technologies light up campuses, such as the IEEE 802.16 standard that specializes in point-to-multipoint wireless access — broadband access will become as ubiquitous as cell phone coverage. With greater available connectivity, more districts and parents will see the necessity to help their students connect and learn.

Ubiquitous access to the Internet allows for always-available interactive content, in other words, an always-on school where students can research, study, interact, and successfully learn. Smart programs provide instant individually directed feedback, which gives the student a real-time opportunity to discover what they do not know and what they need to do to learn it.

## IMPLEMENTING ONE-TO-ONE

### **Key Components**

Six key elements are the foundation of a blueprint for action to move toward one-to-one computing:

- **Leadership:** Implementing a one-to-one initiative requires extensive planning, goal setting, systemic change, building a school system, policy development, ongoing communication, and especially a visionary leader to champion the cause.
- **Funding:** Funding methods for a one-to-one program can be challenging; therefore, seek creative approaches to traditional and outside sources.
- **Infrastructure and Architecture:** From hardware and software to connectivity, this component includes such factors as policy (use, refresh rates, equipment replacement, and so on), security and technical support.
- **Curriculum:** From textbooks to Internet and courseware options, developing curriculum solutions must meet the needs of 21st century learning.
- **Professional Development:** PD planning and implementation based on individual assessments must begin early in the process and be ongoing for teachers, administrators and staff.
- **Resources and Results:** Progressing toward learning objectives requires modeling approaches based on other successful programs and ultimately developing methodology for measuring results from your one-to-one initiative.

The following table shows at a glance the key functional areas to address when moving toward a one-to-one initiative. For details on the components and tips on progressing from one stage to the next, see the publication *Blueprint Solutions for K-12 One-to-One Computing Initiatives* (Intel Corporation, 2005).

Also visit the *K-12 Blueprint* Web site at [www.k12blueprint.com](http://www.k12blueprint.com) for a collection of today's resources and research on one-to-one computing in the K-12 education community.

## → BLUEPRINT COMPONENTS:

<b>Stages</b> →  <i>Example Ratios</i> → <b>Students : computer</b>	<b>Early (Starting) Technology</b>  <b>School Station 20:1</b>	<b>Developing Technology</b>  <b>Labs 10:1</b>	<b>Advanced (Prepared) Technology</b>  <b>In Classroom 5:1</b>	<b>Target One-to-One Computing</b>  <b>Personal 1:1</b>
<b>Leadership</b>	<ul style="list-style-type: none"> <li>• Create vision</li> <li>• Look at strategies and options</li> <li>• Build a task force</li> </ul>	<ul style="list-style-type: none"> <li>• Plan and set goals</li> <li>• Ensure ongoing communications with stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>• Develop strategic technology plan and implementation plan</li> </ul>	<ul style="list-style-type: none"> <li>• Plan implemented</li> <li>• Easy access to information and resources</li> <li>• Policy created</li> </ul>
<b>Funding</b>	<ul style="list-style-type: none"> <li>• Disparate funding sources — not focused specifically on technology</li> </ul>	<ul style="list-style-type: none"> <li>• Limited availability</li> <li>• Competing demands</li> </ul>	<ul style="list-style-type: none"> <li>• Funding sources focused on technology</li> </ul>	<ul style="list-style-type: none"> <li>• Seek underwriting</li> <li>• Creative sources</li> </ul>
<b>Infrastructure and Architecture</b>	<ul style="list-style-type: none"> <li>• Basic school administration/ computerization</li> <li>• Limited network</li> </ul>	<ul style="list-style-type: none"> <li>• IT Learning</li> <li>• Labs connected</li> </ul>	<ul style="list-style-type: none"> <li>• IT-enhanced Learning</li> <li>• All classrooms connected with teacher's computer</li> <li>• Few students connected</li> </ul>	<ul style="list-style-type: none"> <li>• Provides anytime, anywhere eLearning</li> <li>• Each student has a computer</li> <li>• Policy in place for security and technical support</li> <li>• Consistent access at home and school</li> </ul>
<b>Curriculum Solutions</b>	<ul style="list-style-type: none"> <li>• Textbook only</li> <li>• Evaluate textbooks</li> </ul>	<ul style="list-style-type: none"> <li>• Textbook/Internet (some Web resources)</li> <li>• Introduce courseware</li> </ul>	<ul style="list-style-type: none"> <li>• Textbook/Internet Courseware</li> <li>• Re-allocate textbook budget to courseware licenses</li> </ul>	<ul style="list-style-type: none"> <li>• Courseware/Internet/ Textbook</li> <li>• Courseware for curriculum; modern apps for alerts and administration</li> <li>• Use eTextbooks</li> <li>• Rich digital content necessary for individualized learning</li> </ul>
<b>Professional Development</b>	<ul style="list-style-type: none"> <li>• Occasional individual training, usually offsite</li> </ul>	<ul style="list-style-type: none"> <li>• Provide training according to initiative plans</li> <li>• Provide basic computer skills training (Microsoft Office, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• Train IT team</li> <li>• Teachers receive computers well in advance of one-to-one</li> <li>• Base instructional competency on instructional goals</li> </ul>	<ul style="list-style-type: none"> <li>• Ongoing professional development for teachers, staff and administrators</li> <li>• Results in increased instructional proficiency</li> <li>• Full instructional integration</li> <li>• Enables systemic change</li> </ul>
<b>Resources and Results</b>	<ul style="list-style-type: none"> <li>• Program created in a vacuum, not looking at other sources</li> </ul>	<ul style="list-style-type: none"> <li>• Research other one-to-one programs</li> </ul>	<ul style="list-style-type: none"> <li>• Model policy, funding structures, and infrastructure on other successful programs</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate and demonstrate successes</li> <li>• Data-driven decisions</li> <li>• Become model program</li> </ul>

# CONCLUSION

Technology is now able to deliver on the promise of enriched educational environments, high-quality content is available, and students have embraced the Internet and they are ready to learn. Today students can learn in *their* way, anytime or anywhere, getting just in time solutions, just the right way.

We are quickly coming to the point at which one-to-one computing will be a non-negotiable part of giving students the ability to be successful. To provide educational technology — in the way that truly reaches all students — requires strong state, district and school leadership to champion one-to-one computing initiatives.

Managing a one-to-one initiative is a comprehensive undertaking. The six blueprint elements mentioned here provide a framework to help shape the conversa-

tion as you involve all stakeholders in making one-to-one computing a reality in your community. Again, for more details, see *Blueprint Solutions for K-12 One-to-One Computing Initiatives* and visit [www.k12blueprint.com](http://www.k12blueprint.com).

It is a changing world; a world that students are going to help create because they have access to these tools. As business and management expert Peter Drucker claimed, “The best way to predict the future is to create it.” This change can be a reality once we put contemporary tools in the students’ hands.

As education evolves and revolves around information access, the question becomes not *if* but instead *how quickly* we will give our students the best access to technology to accelerate their success.

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