Research on
1 to 1 Learning Programs

A Review

A New Generation of Learners and Learning

By virtually every measure, the world is a dramatically different place than it was a generation ago, and nowhere are the changes more apparent than in our schools. Thanks to technology and the Internet, students live, learn, and play in a much more diverse and dynamic environment.

The world surrounding today's students has similarly changed, with technology driving an intensely competitive economy unbounded by national borders or time zones. Success requires mastery of the three "R's," but it also requires new talents—a body of skills and knowledge referred to as 21st century skills.

As a recent report by the National Center on Education and the Economy notes, "[Job] candidates will have to be comfortable with ideas and abstractions, good at both analysis and synthesis, creative and innovative, self-disciplined and well-organized, able to learn very quickly and work well as a member of a team and have the flexibility to adapt quickly to frequent changes in the labor market as the shifts in the economy become ever faster and more dramatic" (*Tough Choices, Tough Times* report, 2007).

Data indicate, however, that despite pockets of success, in general our schools aren't equipping students to succeed in this environment. "The fact is, our young people are woefully under-prepared for the demands of today's workplace," said Ken Kay, president of the Partnership for 21st Century Skills, a group of business and education leaders, including Apple, that advocates education reform. According to a survey cited by the organization, nearly 70 percent of human resources executives said that high school graduates fall short in critical thinking skills. Eighty-one percent believe high school graduates are deficient in written communications. (Partnership for 21st Century Skills and Citizen Schools, 2006).

Defining and Assessing Academic Success in the 21st Century

The challenges schools face in preparing students for this world are difficult but surmountable. Success, however, requires not only a new approach to both how and what we teach but new paradigms for defining and measuring success.

To date, most discussions of student achievement have centered on results from standardized test scores. Those tests are important, but business and education leaders agree we also need to measure students' ability to apply knowledge in complex situations—a skill standardized tests cannot assess. As Ed Rust, Jr., CEO of State Farm Insurance Companies and a member of the Committee for Economic Development, said, "We cannot improve what we cannot measure. Properly designed and aligned tests are vital tools for managing and evaluating efforts to ensure that all children receive a high-quality education that prepares them for college, for the workplace, and for lifelong learning to keep up with the rapid pace of change in the 21st century" (Committee for Economic Development Press Release, February 20, 2001).

1 to 1 learning programs, which provide students and teachers with round-the-clock use of a notebook computer as well as with access to educational software and digital authoring tools, can be a critical component of preparing students for the future. As U.S. Secretary of Education Margaret Spelling noted in a December 2006 speech to business leaders, "Technology can provide a platform to transform education to meet the demands of the 21st century. With education so crucial to our country's future, we must focus … energy, effort and investment into transforming this critical sector." (U.S. Department of Education Press Release, December 12, 2006)

The Results Are In: 1 to 1 Learning Programs Work

Educators and parents alike know that students learn better when they are engaged, and research about what engages them today points to technology (*America's Digital Schools, 2006*). Students not only spend more time with technology-based activities, they think about what they are doing. And more time and more thought generally equals more success.

Dr. Tina Barrios, supervisor of instructional technology in Florida's Manatee County School District, said, "The kids who've been using the Apple notebooks have really bought into what they're doing. Because they've taken ownership of their learning, they realize its importance and take pride in every assignment they turn in now. We wondered if the 'novelty' of the notebooks would ever wear off. But as time goes on, the kids definitely are becoming more engaged ... and they're so much more excited about learning." (Apple Education Profiles in Success)

An increasing number of schools and school districts are experiencing the reality of such observations after implementing 1 to 1 learning programs. In fact, both quantitative and qualitative research shows that students with routine access to notebook computers score higher in writing assessments, demonstrate better analytical skills, collaborate more, and have lower absenteeism and dropout rates.

Quantitative Research

While there are no national standards yet for measuring the success of 1 to 1 learning programs, results from individual schools and districts indicate the programs can boost students' academic performance and test scores.

In Maine, for example, the 33,000 seventh and eighth graders enrolled in a 1 to 1 program improved scores in language arts, math, and science. Twelfth grade students in one Maine district (who used notebook computers for all four years of high school) scored higher than 85 percent of their peers in all five core subjects of the last Maine Educational Assessment (Lemke & Martin, December 2003).

In Pleasanton, California, students from Harvest Park Middle School who participated in the notebook program scored 6 percent to 13 percent higher than their peers without notebooks. Specifically, test scores for language arts and mathematics were higher. In addition, overall GPAs were higher as was the quality of the students' writing (Gulek & Demirtas, January 2005).

Qualitative Results

In addition to the quantitative research, research on the qualitative benefits of a 1 to 1 learning program provides objectively measured benefits, such as attendance, student behavior, class participation, and homework completion. Research consistently cites these areas as being positively affected in 1 to 1 learning programs (Silvernail & Lane, February 2004).

Student engagement and ownership of the learning process are probably two of the most significant findings cited in studies on 1 to 1 learning. Teachers, parents, and students consistently report that students who participate in a 1 to 1 program are more involved in learning activities, spend more time working on schoolwork at home, delve more deeply into learning topics, have improved attendance and fewer behavior problems, and communicate more effectively with parents and teachers than other students. In one district in Maine, behavior letters sent home dramatically decreased 54 percent, while student attendance increased 7.7 percent (Lemke & Martin, December 2003). All of these factors are consistently mentioned as contributing to greater student achievement.

For schools facing declining test scores and apathetic students, a 1 to 1 learning program can boost student performance and rekindle interest in learning. Research results indicate that 1 to 1 learning programs result in significant performance, attendance, and behavior improvements in schools with high populations of disadvantaged students (Bonifaz & Zucker, 2004; Gravelle, April 2003).

Competitive Advantage

One of the critical goals—and successes—of 1 to 1 learning programs is to close the digital divide and equip all students with the skills they need to succeed in the 21st century workplace (Lemke & Martin, March 2004; Lemke & Martin, April 2004). This is especially important for lower income students who may not have access to computers and the Internet at home. By helping to improve students' academic, creative, and technical skills, 1 to 1 learning programs support the needs and interests of local businesses and can help fuel local economic growth and development.

Unexpected Outcomes

While most 1 to 1 learning programs focus on improving academic achievement, equity, economic development, and teaching, outcomes often extend far beyond those areas. One compelling outcome is the role students often play in teaching teachers how to use technology.

In a number of 1 to 1 learning programs, students play an important role in providing the first line of technical support. In Maine, for example, student "iTeams" help troubleshoot routine problems. In other programs, students play a similar role in providing technical support—both formally and informally—as part of the program design. The results can be powerful, as noted by a teacher in the Maine Learning Technology Initiative: "We have a kid who isn't a top student. He doesn't get all A's, but he knows a lot about computers. The other teacher on my team is not very good with technology, and she goes to him and he loves that. It's been a way for him to stand out and make a difference" (Fairman, 2004).

In addition, research shows that 1 to 1 learning programs have a significant impact beyond schools to families and communities, with students acting as mentors to parents, siblings, and other community members. The programs similarly energize parents, with marked improvements in parent-teacher interaction and parent attendance at school events (Lemke & Martin, March 2004; Lemke & Martin, April 2004; Lemke & Martin, May 2004). Moreover, 1 to 1 programs increase teacher retention and enthusiasm (Beaudry, February 2004; Lemke & Martin, April 2004) as well as recruitment efforts (Lemke & Martin, May 2004).

Research Summary

The foremost, and most pervasive, conclusion derived from the available research is that the 1 to 1 learning experience provides many positive outcomes for students, staff, and the affected community. Among the outcomes mentioned the most are:

- Improved writing skills and depth of student research
- Increased student interest in learning and ownership of the learning process
- Improvement in student and staff attendance
- Reductions in student behavior problems
- Increased parental interest in school activities
- Improved student and staff morale
- A reduction in lecture/presentation instruction and increase in project-based learning activities

Research Studies

The following tables present information from research studies on 1 to 1 programs.

Quantitative Research

Study Name	Author or Research	Purpose of Study	Group(s) Measured	Implementation Date	Key Findings	Key Factors	Value Proposition (ROI)
Learning with Technology: The Impact of Laptop Use on Student Achievement, January 2005 http://www.bc.edu/research/intasc/jtla/journal/pdf/v3n2_jtla.pdf	James Cengiz Gulek, Hakan Demirtas	To examine the impact of participation in a laptop program on student achievement by using multiple indicators (state and district test results and overall GPA)	6th graders 2001–2002 pilot program, 7th and 8th graders 2003	2001	• Students who participated in the program tended to earn significantly higher test scores and grades for writing, English-language arts, mathematics, and overall GPAs. • Students are more engaged and motivated in their writing, but also produce work that is of greater length and higher quality, especially at the secondary level.	• 2004—Laptop Total Language for Grade 6—88% vs. Non-Laptop at 78% • 2004—Laptop Total Mathematics for Grade 6—96% vs. Non-Laptop 83% • 2004—Laptop Total Language for Grade 8—89% vs. Non-Laptop 77% • 2004—Laptop Total Mathematics for Grade 8—83% vs. Non-Laptop 77%	• Students produce higher quality work. • Students are more engaged in the classroom. • Teachers use a more constructive approach to teaching and lecture less.
Is a Notebook Initiative in Your Future? 2004 http://www.mcrel.org/PDF/PolicyBriefs/5042PI_PBLaptopInitiative.pdf	Howard Pitler, Kathleen Flynn, Barbara Gaddy McRel	To look at student achievement and other benefits	Maine 7th–12th grades, 9th grade	Cites numerous other studies	• The use of notebooks increased productivity and improved quality of work. • Test scores in Maine increased. • Writing samples increased or exceeded grade levels from 70% in Fall 2002 to 92% in Fall 2003.	• Initiative must have professional development. • Student engagement in learning was higher because of their notebooks.	Restore economic viability to strong status
One-to-One Computing in Virginia A STATE PROFILE May 12, 2004 http://www.metiri.com/NSF-Study/VAProfile.pdf#search=%22A%20STATE%20PROFILE%20One-to-One%20Computing%20in%20Virginia%22	Cheryl Lemke, Crystal Martin, METIRI Group	To measure gains in teaching and learning that hadn't been accomplished through computer labs. To measure improvement in the state's Standards of Learning (SOLs)	37,000 students and teachers, 45 schools in 2 districts	Henry County Public Schools: 1998 Henrico County Public Schools: 2001	• Teacher enthusiasm, retention, and recruitment • Parental involvement in school and increased technology literacy • The project garnered media attention which attracted new businesses to the area. • Henrico has been inundated with applications from teachers in nearby states and counties.	• Better return on technology investment (one hour a week labs did not result in student gains) • Adequate professional development and ongoing training in technology integration • Henrico—80% of schools were state accredited in 2001, and by fall of 2003, all regular schools in district were fully accredited. • 13-point gain in SAT scores • Lowest dropout rate in history and highest attendance rate	• Improving academic achievement (SOL scores) • Preparing 21st century students for the real world/economically viable communities • Improving teaching and learning • Closing the digital divide • Potential for attracting higher caliber of teachers

Quantitative Research (continued)

Study Name	Author or Research	Purpose of Study	Group(s) Measured	Implementation Date	Key Findings	Key Factors	Value Proposition (ROI)
Quaker Valley Digital School District, Early Effects and Plans for Future Evaluation December 2003 http://www.rand.org/pubs/technical_reports/2004/RAND_TR107.pdf#search=%22Early%20Effects%20and%20Plans%20for%20the%20Future%20December%202003%22	Kerri A. Kerr, John F. Pane, Heather Barney	To provide an initial evaluation of the implementation and impacts of Quaker Valley's DSD initiative as of the second year of implementation, as well as provide a conceptual framework and guidance in planning a future, comprehensive evaluation of the project's continuation	3rd–12th grade	Summer 2001	• Increased student motivation and engagement with school activities • Improved student communication with teachers and peers • Teachers reported an increase in workload related to technology use for both administrative and instructional purposes	• 2003—In Quaker Valley's four schools, about 69–85% of school students across grade levels scored proficient or advanced in mathematics vs. 49–56% staewide. • 2003—In the advanced category, 35–46% in the four schools scored in the highest category vs. 19–28% across the same grade levels statewide. • 2003—In the PSSA exams, 66-84% of Quaker Valley students scored proficient or advanced in reading vs. 58–63% statewide. • Considerable time spent planning instruction to utilize computer as well as dealing with technical problems	Teacher better able to customize instruction based on rapid feedback from classroom
One-to-One Computing in Maine, A STATE PROFILE, December 15, 2003 http://www.metiri.com/NSF-Study/ME-Profile.pdf#search=%22A%20STATE%20PROFILE%20One-to-One%20Computing%20in%20Maine%20December%2015%2C%202003%22	Cheryl Lemke, Crystal Martin, METIRI Group	To measure impact ubiquitous computing has had on learning and economic viability	33,000 7th and 8th graders, 3,000 teachers, 243 schools statewide	• Pilot Program: 2001–2002 school year • Year 1 Full Implementation (7th grade and demo sites only): 2002–2003 school year • Full Implementation: 2003–2004 school year	• Students were more respectful, responsible "ambassadors" of program. • Students had renewed interest and engagement in school. • Teacher skepticism is down—student retention up. • Parent-student communication is improving.	• District (PCMS) saw a 54% drop in behavior letters sent home. • Attendance increased 7.7%. • Scores (MEA) increased in language arts (5%), math (8.4%), and science (9.2%). • 12th graders (having used notebooks all four years of high school) in district scored higher than 85% of their peers in state in all five core subjects of the last MEA assessment. • Class of 2003 saw an all-time high percentage of students going on to college. • Auburn Middle School (based on November 2002 MEA test): 10% more students meet or exceed writing standards; 6% more do in reading.	• Increased economic viability for graduates and the state • Higher academic achievement • Digital equity

Qualitative Research

Study Name	Author or Research	Purpose of Study	Group(s) Measured	Implementation Date	Key Findings	Key Factors	Value Proposition (ROI)
A Study of One-to-One Computer Use in Mathematics and Science Instruction at the Secondary Level in Henrico County Public Schools, 2005 http://ubiqcomputing.org/Final Report.pdf#search=%22A%20Study%20of%20One-to-One%20Computer%20Use%20in%20Mathematics%20and%20Science%20Andrew%20Zucker%22	Andrew Zucker, Raymond McGhee	To increase understanding of one-to-one computing initiatives, especially in mathematics and science education	Henrico County Public Schools, Grades 6-12, two middle schools, two high schools	2002–2005 school year	HCPS demonstrated that one-to-one computing can be implemented on a large scale within the context of a large school district (45,000 students enrolled).	• Professional development and training • Framework for research and evaluation focusing on one-to-one computing • Laptop use beyond the classroom	• Improved home-school communication • More flexibility for teachers during instruction • More student interaction with teachers
1 to 1 Notebook Initiative Study at Oak-Land Junior High School in Stillwater, Minnesota, November 2004 http://www.stillwater.k12.mn.us/834/PDFs/NCRELReport.pdf	Gibert Valdez, Ph.D., NCREL	To document changes in the teaching and learning environment as the school responded to both content and technology expectations	8th grade students	January 2004–May 2004	Students if given increasing responsibility can self-manage their notebook environment.	• Many positives occurred as a result of the initiative. • Majority of students thrived in the 1 to 1 program. • Majority of teachers improved the quality of the teaching and learning in their classroom using the notebooks.	• Opportunity to access research information and improve technical skills even though students have high test scores • Improve on quality and quantity of work
Two Teachers Implement One-to-One Computing: A Case Study, Maine Learning Technology Initiative, Research Report #5, July 2004 http://www.usm.maine.edu/cepare/pdf/mlti/MLTI%20Phase%20One%20Evaluation%20Report%205.pdf	Abigail Garthwait, Herman Weller	To study the effect of technological issues on instruction, the tensions between time constraints and other teacher expectations, and educational impact of various policies	Grades 6 through 8	2002–2003	Without changes in pedagogical strategies, students in both classrooms are learning in fertile environments that allow them to construct scientific meaning.	Clear commitment to quality learning from both teachers	Design and implement activities to enhance teaching
Trading Roles: Teachers and Students Learn with Technology, Maine Learning Technology Initiative Research Report #3, May 2004 http://www.usm.maine.edu/cepare/pdf/mlti/MLTI%20Phase%20One%20Evaluation%20Report%203.pdf	Janet Fairman	To evaluate the roles between student and teacher and how they are learning together	7th and 8th grade students	2002–2003 academic year	• Increased interaction with adults • Increased collaboration with peers • Roles shifted between teacher and student	• Students have greater freedom to pose questions and research topics of interest to them. • Notebooks help to differentiate curriculum and instruction.	Increased opportunities for individualized learning

Qualitative Research (continued)

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The Impact of Maine's One-to-One Laptop Program on Middle School Teachers and Students' Use of Laptop Computers and Classroom Assessment: Are Teachers Making the Connection?, Research Report #4, February 2004 http://www.usm.maine.edu/cepare/pdf/mlti/MLTI%20Phase%20One%20Evaluation%20Report%204.pdf	Jeffrey S. Beaudry	To link the effects on teacher practices with classroom assessment practices	7th and 8th grade students	2002–2003 academic year	• Teachers are energized. • Students are more engaged.	• Just-in-time classroom environment • Powerful environment for learning	• Flexibility to customize teaching style whether teacher or student centered • Ability to quickly adjust regimen to retain students' interest
Notebook Use by 7th Grade Students with Disabilities: Perceptions of Special Education Teachers, Maine Learning Technology Initiative, Research Report #2, Feb. 2004 http://www.usm.maine.edu/cepare/pdf/mlti/MLTI%20Phase%20One%20Evaluation%20Report%202.pdf	Walter J. Harris, Lori Smith	To examine special education teachers' perceptions of MLTI and its impact on students with learning disabilities	7th and 8th grade students	2002–2003 academic year	Special education teachers perceive notebooks to be highly effective instructional tools for students with disabilities and have increased the quality and quantity of their writing.	• Organization of schoolwork • Increased task completion	• Provides increase in self-esteem and confidence • Increases sense of independence
The Impact of Maine's One-to-One Notebook Program on Middle School Teachers and Students, Phase One Summary Evidence, Feb, 2004 http://www.usm.maine.edu/cepare/pdf/mlti/MLTI%20Phase%20One%20Evaluation%20Report%201.pdf	David L. Silvernail, Dawn M. M. Lane	To analyze data collected during the initial phase in relation to teaching and learning	7th and 8th grade	2002–2004	Evidence collected indicates the large majority of Maine's middle schools have successfully implemented the one-to-one program reflecting increased and improved student learning.	• Over 90% of teachers surveyed participate in at least one professional development plan. • Over 75% of students surveyed say the notebook keeps them better organized.	• Increase in technical skills to provide a customized curriculum • Improvement in student engagement and participation

Qualitative Research (continued)

Study Name	Author or Research	Purpose of Study	Group(s) Measured	Implementation Date	Key Findings	Key Factors	Value Proposition (ROI)
Great Maine Schools Project, One-to-One Notebooks in a High School Environment, Piscataquis Community High School Study, February 2004 http://www.mitchellinstitute.org/Gates/pdf/One-to-One_Laptops_Report.pdf	Mitchell Institute, Bill & Melinda Gates Foundation	To study the experience of those involved in the first two years of a one-to-one notebook computing program in a high school environment	9th–12th grade, 285 students	2001–2002	• Improved student motivation and interest in school • Improved interaction among students and between students and faculty • Increased access to educational resources	• Attendance increased from 91% to over 98% since notebook program began. • Notebooks promote more student/teacher and student/student collaboration. • The greatest proportion of students use laptops for classwork or projects in Language Arts and Social Studies (98% and 95%).	• Improved academic achievement • Students more engaged in classroom • Effective at promoting equity in high schools
Lesson Learned About Providing Laptops for All Students http://neirtec.org/laptop/LaptopLessonsRprt.pdf	Alejandra Bonifaz, Andrew Zucker, NEIR*TEC	A "how-to" guide for implementing a one-to-one	NA	NA	Helping achieve the notebook program's goals while minimizing unexpected problems	Pay careful attention to planning, training and professional development, hardware, software, managing change, and program monitoring and evaluation	• Increasing student engagement • Improving classroom culture • Increasing economic competitiveness • Narrowing the digital divide
One-to-One Computing in Maine, A STATE PROFILE, December 15, 2003 http://www.metiri.com/NSF-Study/ME-Profile.pdf#search=%22A%20STATE%20PROFILE%20One-to-One%20Computing%20in%20Maine%20December%2015%2C%202003%22	Cheryl Lemke, Crystal Martin, METIRI Group	To measure impact ubiquitous computing has had on learning and economic viability	33,000 7th and 8th graders, 3,000 teachers, 243 schools statewide	• Pilot Program: 2001–2002 school year • Year 1 Full Implementation (7th grade and demo sites only): 2002–2003 school year • Full Implementation: 2003–2004 school year	• Students were more respectful, responsible "ambassadors" of program. • Students had renewed interest and engagement in school. • Teacher skepticism is down—student retention up. • Parent-student communication is improving.	• District (PCMS) saw a 54% drop in behavior letters sent home. • Attendance increased 7.7%. • Scores (MEA) increased in language arts (5%), math (8.4%), and science (9.2%). • 12th graders (having used notebooks all four years of high school) in district scored higher than 85% of their peers in state in all five core subjects of the last MEA assessment. • Class of 2003 saw an all-time high percentage of students going on to college. • Auburn Middle School (based on November 2002 MEA test): 10% more students meet or exceed writing standards; 6% more do in reading.	• Increased economic viability for graduates and the state • Higher academic achievement • Digital equity

Qualitative Research (continued)

Study Name	Author or Research	Purpose of Study	Group(s) Measured	Implementation Date	Key Findings	Key Factors	Value Proposition (ROI)
Early Evidence from the Field, The Maine Learning Technology Initiative: Impact on the Digital Divide, April 2003 http://www.usm.maine.edu/cepare/pdf/mlti/Iimpact%20on%20the%20digital%20divide%20as%20OCCASIONAL%20PAPER%202.pdf	Paula B. Gravelle	To examine the impact that the distribution of notebooks to students in Maine is having on their learning in relation to the digital divide	7th & 8th grade students and teachers	2002–2003 school year	• Beginnings of bridging the digital divide in Maine for 7th grade student and teachers • Positive effect on teaching and learning using this technology tool	• Technology tools to all students and teachers • Access to notebooks vs. sharing at a computer lab • Reported increase in interest of schoolwork • Reported increase in the amount of work done both in and out of school	• Well prepared children for the highly technological workforce • Digital equity • Improving access to information that increases knowledge, inquiry, and depth of investigation
Early Evidence from the Field, The Maine Learning Technology Initiative: Impact on Students and Learning April, 2003 http://www.usm.maine.edu/cepare/pdf/mlti/Impact%20on%20Students%20and%20Learning%20as%20OCCASIONAL%20PAPER%201.pdf	Dawn M. M. Lane	To examine the impact the distribution of notebooks to students in Maine is having on students and their learning	7th and 8th grade students	• Pilot program: Spring 2002 • Full Implementation: Fall 2002–2003 academic year	• Student engagement and attendance increased. • Classroom atmosphere has shifted including more student/teacher and student/student collaboration. • Use of notebook increased at home.	• Since notebook program 61% of students report using computers at least 5 hours per week vs. 10% before notebooks. • Better understanding of how to use computer and Internet • Faster, easier access to communicate more readily with teachers and peers • Gather knowledge not available with standard textbooks	• Students more prepared for IT focused jobs • Improved academic achievement

Competitive Advantage

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One-to-One Computing in Michigan, A STATE PROFILE, April 7, 2004 http://www.metiri.com/NSF-Study/MIProfile.pdf#search=%22A%20STATE%20PROFILE%20One-to-One%20Computing%20Michigan%22.pdf	Cheryl Lemke, Crystal Martin, METIRI Group	To measure impact ubiquitous computing has had on learning and teaching	6th, 7th, and 8th graders	• 2002–2003: Pilot Phase • 2004–2006: Continuation of demonstration sites; Implementation of wireless notebook program	• Teacher retention and enthusiasm are on the rise. • Parents are becoming more involved in student learning. • Students are responsibly caring for the technology.	• Visible success of notebook programs in Henrico County, Virginia and the state of Maine • Successful training for teachers • Parent training to be participants	• Increased student achievement • More empowered thoughtful teachers • More involved parents • A leveled playing field • 21st century skill development for a 21st century workforce
One-to-One Computing in Indiana, A STATE PROFILE, March 3, 2004 http://www.metiri.com/NSF-Study/INProfile.pdf	Cheryl Lemke, Crystal Martin, METIRI Group	To measure academic achievement with a focus on writing and technology and also ensure affordable models through which student learning can be augmented	2,935 6th through 12th grade students and teachers, 5 schools in 2 districts	• Year 1 Implementation at 1 middle school, Crawfordsville: 1997–1998 school year • Year 1 Implementation at 3 middle schools, Indianapolis: 2001–2002 school year • Pilot in 3 high schools in fringe areas beginning in 2003	• Improved relations between teachers and students • Increased involvement of parents and communities with students and schools • Increased teacher engagement and enthusiasm	• Students act as mentors to parents, siblings, and other community members. • Teachers are able to access resources quickly and thoroughly through web.	• Economic viability through a higher tech workforce • Improved teaching and learning • Digital equity • 21st century skill building • Increased writing achievement • Increased parental involvement

Unexpected Outcomes

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One-to-One Computing in Michigan, A STATE PROFILE, April 7, 2004 http://www.metiri.com/NSF-Study/MIProfile.pdf#search=%22A%20STATE%20PROFILE%20One-to-One%20Computing%20Michigan%22	Cheryl Lemke, Crystal Martin, METIRI Group	To measure impact ubiquitous computing has had on learning and teaching	6th, 7th, and 8th graders	• 2002–2003: Pilot Phase • 2004–2006: Continuation of demonstration sites; Implementation of wireless notebook program	• Teacher retention and enthusiasm are on the rise. • Parents are becoming more involved in student learning. • Students are responsibly caring for the technology.	• Visible success of notebook programs in Henrico County, Virginia and the state of Maine • Successful training for teachers • Parent training to be participants	• Increased student achievement • More empowered thoughtful teachers • More involved parents • A leveled playing field • 21st century skill development for a 21st century workforce

Unexpected Outcomes (continued)

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The Impact of Maine's One-to-One Laptop Program on Middle School Teachers and Students' Use of Laptop Computers and Classroom Assessment: Are Teachers Making the Connection?, Research Report #4, February 2004 http://www.usm.maine.edu/cepare/pdf/mlti/MLTI%20Phase%20One%20Evaluation%20Report%204.pdf	Jeffrey S. Beaudry	To link the effects on teacher practices with classroom assessment practices	7th and 8th grade students	2002–2003 academic year	• Teachers are energized. • Students are more engaged.	• Just-in-time classroom environment • Powerful environment for learning	• Flexibility to customize teaching style whether teacher or student centered • Ability to quickly adjust regimen to retain students' interest

More and Better Assessment Tools Needed

While the body of research on 1 to 1 learning programs is positive, to date, research has not kept up with the rapid expansion of the initiatives. More and better-designed studies must be conducted to quantify the benefits of the initiatives and the impact they have on student achievement and state test scores.

Similarly, as noted earlier, current measurement practices must be updated to reflect 21st century teaching, learning, and curriculum. As Dr. Margaret Honey, special advisor to the Partnership for 21st Century Skills and vice president of the Education Development Center said, "Most educational assessments in widespread use today have thus far only measured a student's knowledge of discrete facts, rather than a student's ability to apply knowledge in a real world environment. The assessment of 21st century skills will help foster the application of higher-order thinking skills and provide critical feedback to inform instruction and student learning" (Committee for Economic Development Press Release, February 20, 2001).

Apple Will Continue to Lead Change

The 21st century poses significant challenges for schools, educators, parents, and students. Today's students need to be well schooled in the traditional curriculum, but they also need 21st century skills to succeed personally, academically, and professionally. 1 to 1 learning programs are ideally designed for 21st century education, providing students and teachers with the tools and environment to access information, think, collaborate, create, and acquire new skills—anytime and anywhere.

Implementing a 1 to 1 learning program is not something that districts and schools can accomplish overnight. It's a long-term undertaking that requires leadership, vision, and a master plan to guide every aspect of the process. But it can be done. And there has never been a better time.

As a partner to education for nearly 30 years, Apple has led the way in providing educators with powerful, easy-to-use technologies to advance teaching and student learning. Apple digital tools used in teaching today include iWork, iPhoto, iWeb, iMovie HD, iDVD, GarageBand, and iTunes. Apple notebooks and iPod have also become common fixtures in schools, with Apple providing lesson plans and sample projects teachers can use to put these tools to work in the classroom and beyond.

Apple also provides a range of resources for districts and schools considering 1 to 1 learning programs, and Apple professionals are available to partner with them to evaluate, design, and implement 1 to 1 learning programs. For more information, call an Apple consultant toll-free at 800-800-2775.

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