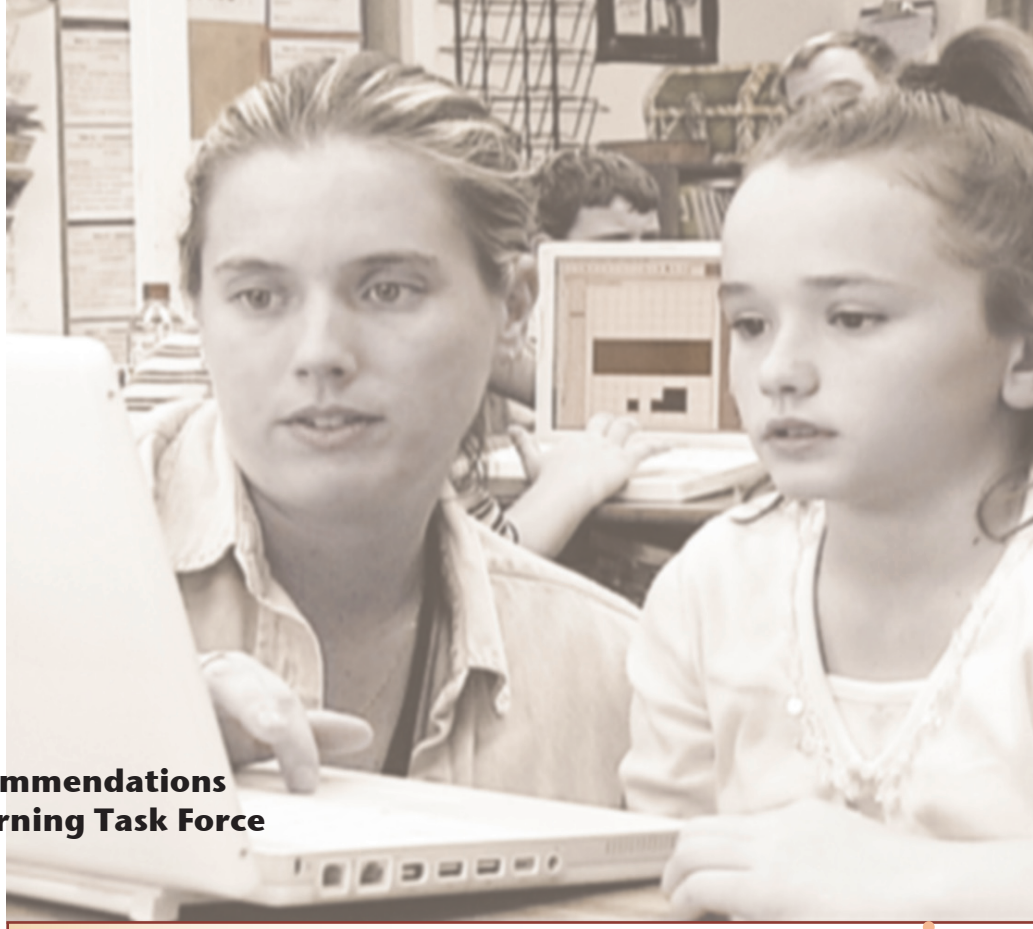

Laptops for Learning

Final Report and Recommendations of the Laptops for Learning Task Force March 22, 2004

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Dear Commissioner Horne:

In October of 2003 you asked me to chair the "Laptops for Learning" statewide ad-hoc advisory task force with the following charge:

> *The "Laptops for Learning" Task Force is charged with assessing the use of mobile laptop computers in all learning environments as it relates to student success in grades K–12. The Task Force is charged with producing a final report that addresses, at a minimum, the following issues:*
>
> *1. Studying national and state laptop initiatives to identify best practices as measured by student achievement or other measures of success;*
>
> *2. conducting a cost/benefit analysis of mobile technology as defined by anytime, anywhere authentic learning; and*
>
> *3. examining the equity of educational opportunities to ensure that students will have 21st century learning skills.*

After a careful consideration of existing laptop initiatives, the needs of our students, and the readiness of many Florida school districts for mobile technology, the Task Force is pleased to recommend that Florida begin a measured implementation of mobile laptop computing. Many of our districts are ready for such an initiative and a statewide coordination of this project will allow for valuable research to guide future decision-making. The costs of a properly implemented demonstration project are manageable and the benefits innumerable. We owe it to our students to give them every opportunity for success in a world that demands a higher level of skills than ever before. The prosperity of our state depends on the quality of its workforce. There is no better investment in the future of Florida than to develop 21st century learning skills in all of our students.

With the submission of this report, the Laptops for Learning Task Force has completed its charge. It was a pleasure to work with such a qualified group of professionals representing a broad spectrum of experience with technology in Florida schools. On behalf of all of the members of the Task Force, I thank you for the opportunity to provide direction and recommendations on this important subject.

Respectfully submitted,

Tina Barrios
Chair, Laptops for Learning Task Force

Table of Contents

Laptops for Learning

"Early last century, technological advance required workers with a higher level of cognitive skills—for instance the ability to read manuals, to interpret blueprints, or to understand formulas.

"Our educational system responded: In the 1920s and 1930s, high school enrollment in this country expanded rapidly, pulling youth from rural areas, where opportunities were limited, into more productive occupations in business and broadening the skills of students to meet the needs of an advancing manufacturing sector. It became the job of these institutions to prepare students for work life.

"But in the past two decades, our system has had obvious strains, apparently reflecting an inability of our workforce to fully meet the ever-increasing skill requirements of an economy whose GDP is becoming more conceptual.

"We need to be forward looking in order to adapt our educational system to the evolving needs of the economy and the realities of our changing society. Those efforts will require the collaboration of policymakers, education experts, and—importantly—our citizens. It is an effort that should not be postponed." (Alan Greenspan, chairman, Board of Governors of the Federal Reserve System, February 20, 2004)

As Mr. Greenspan points out, the challenge to educate a workforce prepared to meet the increasing skill requirements of the 21st century is complex and requires the collaboration of many segments of society. It also is a challenge that cannot be postponed. Fortunately, there is a clear path to provide the needed 21st century skills and technological literacy to Florida students. Mobile, wireless computing, for the first time, makes it practical to empower all students with the cognitive tools they will need to compete in the new world economy. The dated textbooks of a past century can no longer guarantee student success in school or in life. We must prepare our students to become lifelong learners in a world of increasingly fast-paced change.

As Florida considers implementing one-to-one technology for our students, we need to consider carefully the lessons learned from similar initiatives in other states, identify potential barriers to success, and recommend a direction that will be cost effective and have the greatest impact for transforming teaching and learning in our state.

A number of other states have pilot or full-scale projects implementing one-to-one computing with their students. Some projects are across an entire grade level, some are by school or district, and some are classroom by classroom. From hundreds of classrooms participating in such projects we hear consistently positive reports. We also hear of many lessons learned. Projects have regularly underestimated the need for quality professional development. The least successful projects have simply dropped hardware into classrooms.

Compared to other states, Florida is well positioned to begin an effective one-to-one laptop program. We have many online resources created by districts that can be shared statewide. We have up-to-date

information about the readiness of each of our schools. We have an excellent pattern of communication and cooperation between state agencies and the districts. And we have substantial expertise within the state from districts that have already begun one-to-one programs. In comparison with other states, Florida has the necessary prerequisites for a successful program.

Extremely successful pilot programs have already been implemented in Florida. For example, a current program in Manatee County involves 22 classrooms ranging from elementary through high school. After just one year of implementation, dramatic results have been observed. Teachers are teaching differently and students are markedly more engaged in their work. Student work has improved in quality, classroom space has been maximized, and absences have declined nearly 40% among students with laptops. While many might be satisfied with such results alone, the Task Force believes that by standing on the shoulders of those programs that have gone before, we can design a one-to-one program that will even surpass the successes currently enjoyed in Manatee and other counties.

The members of the Task Force, although all advocates for the use of technology, are agreed that hardware alone cannot bring about change in our schools. Experience has taught us that a holistic approach is always required for success in any technology rollout. All members of the Task Force are well aware that a successful implementation must address many concerns: the needs of teachers, students, administrators and parents; curriculum integration and teaching styles; infrastructure; support; economics; and sustainability.

The members of the Task Force believe that all students can learn given access to the proper tools. We believe that teaching and learning must transform to prepare students for a rapidly changing world. And we believe that access to the same level of technology common in the business world is essential for student achievement.

We can no longer even imagine a world of work where executives, engineers, secretaries, and salespeople all wait at their desks for a once-a-week opportunity to use a computer lab at the end of the hall. The days of students waiting for their turn with technology tools must likewise end. The tools for learning must be available where students work, not in a special room at the end of the hall.

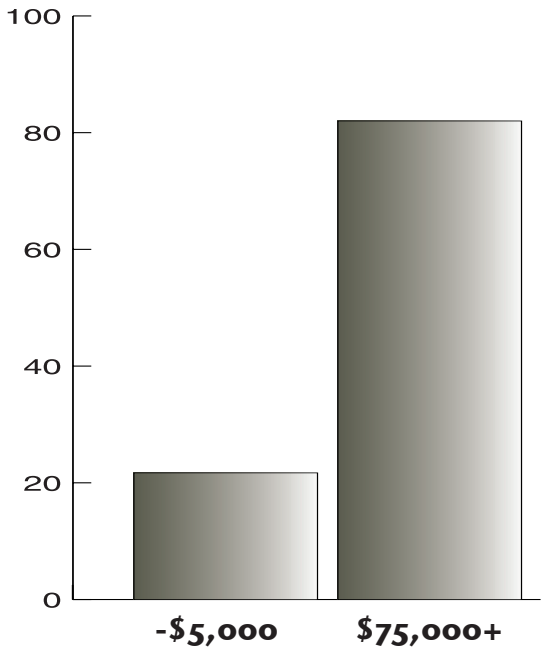
Technology alone is not the answer to the challenges facing education in the 21st century. But with technology, our schools and teachers can leverage resources, individualize instruction, and open the door to lifelong learning opportunities for all of Florida's students.

The question is not "Can we afford to equip our children for life and learning in the 21st century?" The question is "How can we afford not to do so?"

1) Bridge the Digital Divide

"To ensure that all children have a fair, equal, and significant opportunity to obtain high-quality education and at a minimum, reach proficiency on challenging state academic achievement standards and state academic assessments." NCLB

The passage of the federal No Child Left Behind (NCLB) Act of 2001 reinforced the belief that all children can learn and that high standards must be set for all children. This landmark legislation reauthorized the Elementary and Secondary Education Act of 1965 through the appropriation of the largest funding in history for Title I schools to pursue a standards-based reform agenda (Borman, 2003; U.S. Department of Education, 2002). In a speech to the Commonwealth Club of California, U.S. Secretary of Education Rod Paige emphasized the same belief of NCLB that all students can learn.

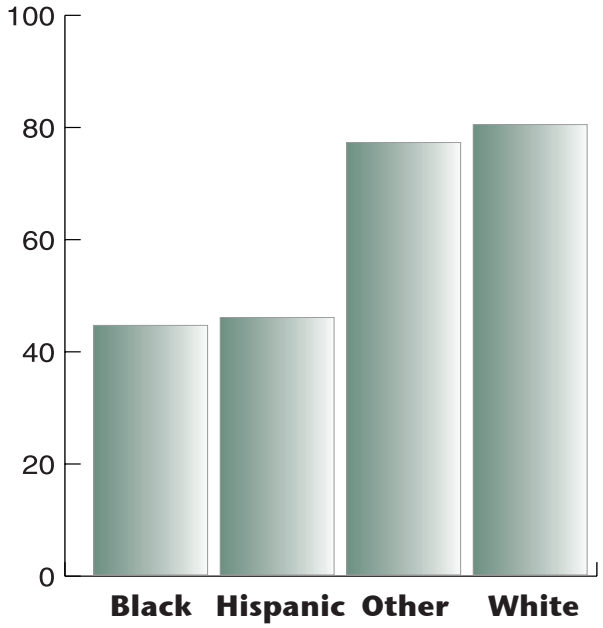


Percentage of 10–14 year old students using computers at home for school work. Children in high income families are four times more likely to use computers than those in low income families. Statistics are from a 2001 survey conducted by the US Department of Commerce, Bureau of the Census.

He stated that educators must "let go of the myths and perceptions about who can learn and who can't" to ensure that all students, despite their level of poverty can reach high academic standards (Paige, 2003).

While great strides have been made over the years in access to the Internet, a digital divide still occurs in the way technology is often used with low-income students. Providing universal access so that everyone can have access to the Internet regardless of income level or job status is only one part of the solution. Students must improve technology literacy so that they can participate intelligently and thoughtfully in the technical world around them. It is critical that students not only be given access, but training to better understand the Internet and its value, because the more likely they will be to make the effort to learn how to use it.

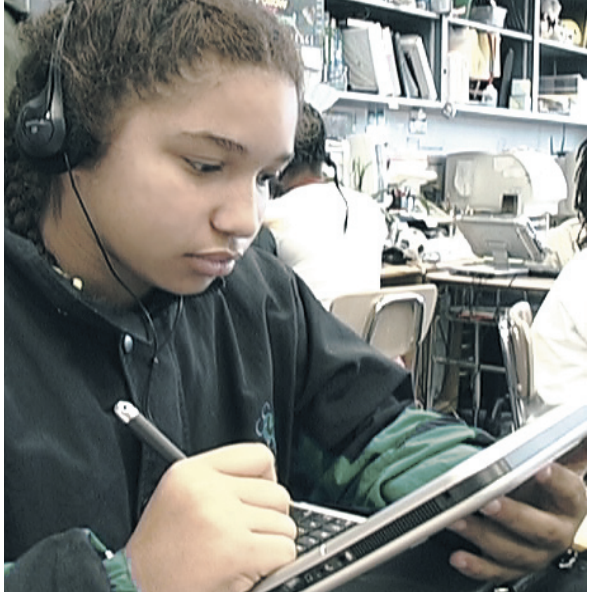
The disparity in available computer hardware between the "haves" and the "have-nots" is striking. Providing every student with a laptop that can be taken home will have a tremendous impact upon those who are shut out from the world of technology, but only if we implement it fairly. Maisie MacAdoo has summarized the importance of equity extending beyond boxes and wires. "The issue of equity now centers not on quality of equipment but on the quality of use. The computers are there, yes, but what is the real extent of access? What kind of software is available? How much computer training are teachers getting? And are schools able to raise not just students' level of tech-nical proficiency, but also their level of inquiry, as advanced use of technology demands?"



Percentage of students aged 10–14 who use computers at home for school work. Black and Hispanic students are more than twice as likely to not have computer access than their white and other race schoolmates. Statistics are from a 2001 survey conducted by the US Department of Commerce, Bureau of the Census.

❑ **Guiding principle:** All students must have access to appropriate tools and to challenging curriculum in order to bridge the digital divide by moving beyond basics and towards 21st century skills.

2) Teach 21st century skills



In the past, it was not considered essential for every student to learn rigorous content. Many jobs were available for students with minimal academic skills. In today's information age, jobs that once required only low levels of reading and mathematical skills now require higher-level skills. In the future, there will be more to know and more to answer.

Today's students are growing up in a digital environment. Almost 100 million young people born between 1976 and 2000 will come to adulthood having grown up with the Internet and the use of digital technologies. Often referred to as "Millennials," these children and teenagers use computers and the Internet more than any other age group. According to the United States Department of Education, 90% of children between the ages of 5–17 use computers and more than 90% of students in the 12–18 age group use the Internet. These students are readers and enjoy a learning environment that includes teamwork, technology, multiple focal points, action and interaction, movement, and materials that are visual and dynamic. "Millennials" expect to receive frequent and instantaneous feedback and to learn skills and concepts that will help make their working lives less stressful and increase their marketability (Blake, 2003).

Schools that do not infuse 21st century skills into the traditional curriculum are not meeting these children's expectations and needs. Generally, these 21st century skills are identified as information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills.

> **"Students who have access to technology outside of school will find schools without access to and integration of technology into their coursework to be antiquated and irrelevant to their world."**
>
> *Partnership for 21st Century Skills*

While it might be argued that these skills are often included at a basic level in today's curriculum, the skill level necessary for success in the 21st century workforce far exceeds the basic. Content must be taught in a 21st century context with the use of relevant and real world examples, applications, and settings to frame academic content for students, enabling them to see the connections between their studies and the world in which they live. (Partnership for 21st Century Mile Guide) Additionally, students must be given the tools they need to simulate an authentic work environment in order to achieve these skills at a higher level than is currently expected of them as students.

These 21st century skills do not make up an additional course, but rather they must be integrated within the traditional curriculum to be authentic. At work, adults solve problems related to the goals and objectives of our jobs, we communicate specific concepts and information, we adapt to the personalities and varied roles and responsibilities of co-workers within the scope of the work environment, and we find motivation and inspiration that drives us to do our best at our work.

❑ **Guiding principle:** 21st century curriculum must be infused with skills necessary for living and working in an ever-changing society. Relevant, real world education should include:

- information and communication skills
- thinking and problem-solving skills
- interpersonal and self-directional skills

3) Reform teaching methods

"A massive amount of research has made it clear how people learn and don't learn. All human beings learn by doing, analyzing, talking, processing, and problem-solving. Talking at kids never has been and never will be an effective way to help them learn." (Reeder, from Salpeter, 2003)

The most difficult hurdle to overcome in the pursuit of these new educational goals will be to change the way we teach. Change will not come easily. There are approximately 285,700 public school teachers in Florida, many of whom teach as they were taught a generation ago by educators who emulated their own teachers: the "sage on a stage." When teachers comfortable with this "broadcast" method of teaching first encounter technology, they are likely to envision students learning from the technology in the same way that they expect students to learn from their teachers.

For years, however, educators have realized that relying solely on the "sage on a stage" or "broadcast" method of teaching was not ideal. This is especially true now that the millennial generation of students has arrived in our schools. Today's students often come to school with more technological sophistication and experience than their teachers. Many have greater access to technology at home than they do at school. They use the Internet to communicate across boundaries and to access a repository of information and ideas unimaginable to their teachers a few short years ago. Today's students expect their school assignments to be relevant, challenging, and related to the real world. They value problem solving, communication, and the chance to collaborate as adults do in real world occupations.

"It's a waste to use these powerful new technologies simply to reinforce our traditional mindsets about learning and our traditional teacher-learner relationships.

"What's the definition of insanity? It's doing the same thing you always did, but expecting, wanting, or needing completely different results. If we continue to use new technologies to reinforce what we've always done, we'll continue to get the same results we've always gotten."

Ian Jukes

Yesterday's methodologies will not work with today's students.

Portable, wireless, connected laptops give us an unprecedented opportunity to reform teaching practices. Laptops provide the means for students to become active learners with their computers, not passive receivers of knowledge. With laptop computers, students can research and explore areas of interest, construct meaning or knowledge, collaborate with others across the room or across the globe, and work on significant projects that have value beyond school. Students' work in school must prepare them for complex, authentic tasks that will be demanded of them beyond the classroom and as adults. The portable laptop computer can become the most important tool available to an active learner.

The desktop computer labs at the end of the hall are not as conducive to reforming teaching practice. In fact, many labs are used solely to deliver instruction to students who are expected to learn from the technology. Learning from technology is akin to the old "sage on a stage" notion of teaching. The technology is used solely to deliver or broadcast information to students. While some direct instruction certainly has its place in an effective teaching environment, an exclusive diet of direct instruction will never give students the higher order thinking skills they desperately need.

Learning with technology, on the other hand, empowers students with the tools to take responsibility for their own learning. Whether they are researching information on the Internet to solve a problem, communicating with experts, or sharing their work in a presentation or on the web, it is raising the bar for all students to create their own learning. The FCAT measures more than just remembered facts.

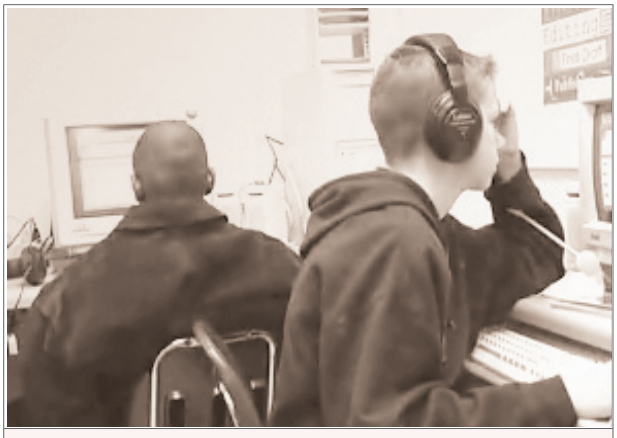
Learning *from* Technology	Learning *with* Technology
	
• teacher centered	• student centered
• provide/deliver instruction	• produce learning
• transfer knowledge from faculty to students	• elicit students' discovery and construction of knowledge
• single sense stimulation	• multi-sensory stimulation
• single-path progression	• multi-path progression
• single media	• multimedia
• isolated work	• collaborative work
• information delivery	• information exchange
• passive learning	• active learning
• factual, knowledge-based	• critical thinking and decision-making
• reactive response	• proactive-planned action
• isolated, artificial context	• authentic, real world context

Table 1. A comparison of approaches to utilizing technology in education.

It requires a higher level of thinking and problem solving that is best accomplished with an emphasis on project-based learning with technology.

"We must educate all teachers and students to use the computer as a productivity tool as well as a tool for learning, research, networking, collaboration, telecommunications, and problem solving. Always using drill-and-practice software does not allow students to participate in meaningful and engaging learning environments." (Swain & Pearson, 2001)

"Many schools have simply applied technology on top of traditional teaching practices rather than reinventing themselves around the possibilities technology allows. The result is marginal—if any—improvement.

"Dream how technology can not only improve education but also transform what we think of as education."

Rod Paige,
United States Secretary of Education

❑ **Guiding principle:** Teachers must create instructional environments in which students use higher-order cognitive skills to construct meaning or knowledge, engage in disciplined inquiry, and work on products that have value beyond school.

4) Provide effective professional development

One cannot assume that our K–12 teachers have either the 21st century skills or the natural capacity to change their teaching methods simply upon demand. Only through professional development and with the support of school leadership can these changes in the classroom occur. Professional development provides educators with the skills and knowledge necessary to cross the bridge to the 21st century. Leadership at the district and school level must provide the motivation for change.

Technology implementation is enhanced when teachers are trained by "seeing, demonstrating, and practicing" methods. Effective models are promoted teacher to teacher and in small clusters of professional educators who come together as communities of learners connecting with trained facilitators. ("State of Maine," 2001, p 23).

A well-planned, ongoing professional development program that is tied to the school's curriculum goals, designed with built-in evaluation, and sustained by adequate financial and staff support is essential if teachers are to use technology appropriately to promote learning for all students ("Critical Issue," n.d.). Online staff development, courses, models, expectations and best practices for teachers and administrators should be a part of this plan.

"At the heart of our laptop program is a firm commitment to teacher training. Embracing the concept of a learning community means giving teachers the skills and tools they need to be effective."

Mark A. Edwards, Superintendent of Schools, Henrico County, Virginia

Individual tutoring, peer coaching, collaboration, networking, and mentoring have been used successfully over extended periods to help teachers at all levels of technology implementation develop technology applications that promote engaged learning. Teachers at the novice stage who need to develop basic computer skills will require more individual attention and should be given ample time to practice their skills. If learning by doing is important for students, it is crucial for teachers. As teachers begin to regard technology as a tool to accomplish instructional goals, they will learn best when engaged in meaningful projects that relate to their own classrooms. Appropriate individualized support from peers as well as experts encourages teachers to experiment with new strategies for technology use. Teachers should have the option to participate in the type of workshops, seminars, and online professional communities that will help them use technology effectively. Time for independent study, experimentation, and curriculum development is also important.

❑ **Guiding principle:** Successful professional development:

- must be held on a continuous basis
- provides mentors, coaches, or peer teammates to model appropriate integration strategies in actual classrooms
- gives teachers feedback on their own performance
- holds teachers accountable for implementing instructional strategies and student learning

5) Prepare preservice teachers for 21st century classroom

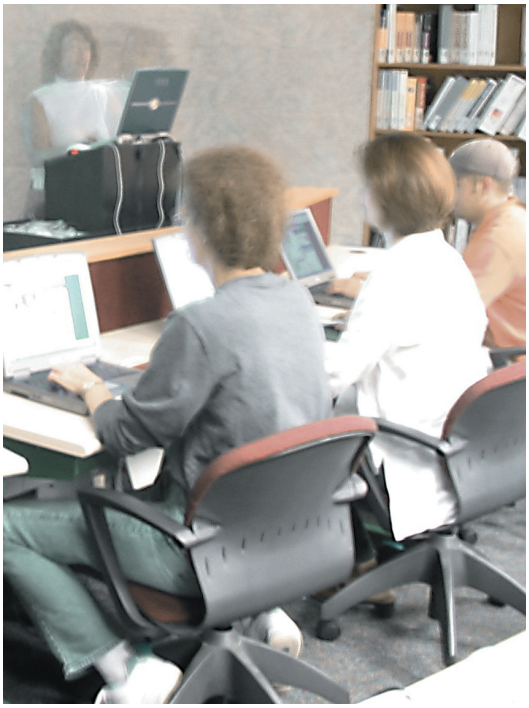
The National Council for Accreditation of Teacher Education (NCATE) calls for teacher preparation institutions to provide an "understanding of how knowledge, skills, and dispositions related to educational and information technology are integrated throughout the curriculum, instruction, field experiences, clinical practice, assessments, and evaluations."

Three conditions are necessary for graduating teachers to meet the standard set by NCATE.

First, college instructors in preservice programs must consistently model exemplary technology integration in all of their courses. It is not enough for instructors to talk about technology integration, but then leave it up to a special technology course to train the preservice teachers how to do it. Appropriate technology must be infused throughout the curriculum.

Second, preservice teachers must have access to their own laptop computers as they work through their teacher preparation program. Younger children tend to dive right into computer use with little need to understand why it works. Adults usually need longer with the computer before they are comfortable and therefore can focus on the task rather than the tool. Preservice teachers need to have the regular use of a computer during their college program so that they are comfortable and competent with the technology when they go out into the classroom.

Finally, preservice teachers should have the opportunity for field experiences in classrooms with a range of technology, including 1:1 laptops. There simply is no substitute for actually using technology with students during an internship. The whole purpose of an internship is to practice teaching in the type of situation they will encounter in their own classroom.



"Today's preservice teachers are the essential key in reaching the current generation of media-savvy, digitally-literate P–12 students. Preservice teachers and their students expect teaching and learning to involve technology. Not only will preservice teachers change schools for the benefit of today's students, they are already changing the culture of schools one classroom at a time as they infuse technology integration during their undergraduate field experiences."

Dr. Catherine Cavanaugh
University of North Florida

College students beginning an education major in the fall of 2004 will not begin teaching in their own classrooms until the fall of 2008. While no one can predict exactly what the ratio of students to computers will be in 2008, we can say with certainty that there will be many more computers available in classrooms four and a half years from today. Many, perhaps most, classrooms will have one to one computing by then. Our teachers must be prepared to enter this world.

❑ **Guiding principle:** Preservice teachers must:

- experience good models of technology integration in all their preservice classes
- have access to a laptop computer to support their coursework and field experiences
- have field experiences that include an opportunity to teach in a 1:1 environment

6) Provide rich multimedia resources

Multimedia is typically defined as an electronic document that can include text, sound, graphics, animation, video, and interaction. National standards require students to exhibit substantial multimedia literacy skills by grade eight. Even elementary students are expected to author in multimedia. For example the ISTE National Technology Standards expect students completing second grade to "create developmentally appropriate multimedia products with support from teachers, family members, or student partners." Students completing fifth grade are expected to "use technology tools (e.g., multimedia authoring, presentation, web tools, digital cameras, scanners) for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom." These national standards may seem high, but they reflect the important educational outcomes that multimedia authoring produces.

"Students learn best by teaching each other."

Bonnie Milligan
Florida Teacher

As any educator quickly discovers, the surest way to learn something yourself is to teach it to others. Students, who produce multimedia projects designed to teach something to others, have worked through the content at a much higher level and will retain much more than those who have been simply taught the content. The higher level of understanding and retention is a result of having interacted with the same content from four different perspectives:

- **as researchers**, students must locate and select the information and resources necessary to understand the concept
- **as authors**, students must consider the intended audience and decide what type and amount of information is necessary to teach the concept to their intended audience
- **as designers**, students must select the most appropriate media to share their content and decide how to structure their material to communicate it effectively
- **as producers**, students must think carefully about how they can use the media's capabilities and features to represent their content and then they must interact extensively with the material as they build the final product

Additional benefits flow from such project based learning. Not only have students mastered the content, they have also practiced 21st century skills such as communication, self-direction, and problem-solving. Many students are also highly motivated because they are creating something for a wider audience than the audience-of-one-teacher a traditional term paper is written for.

To create effective multimedia projects, students and teachers will need access to a rich storehouse of information and multimedia elements. The Internet can provide much of what is needed. State agencies and other institutions can also contribute by building repositories of copyright-free artifacts and other learning objects that can be freely used by students and teachers alike.

❑ **Guiding principle:** Students and teachers must have access to rich multimedia resources to:
- extend their world and life experiences
- engage their senses
- incorporate into their own multimedia projects
- provide building blocks of instruction

7) Provide the appropriate tools to all students and teachers

"In a digital world, students need to learn to use the tools that are essential to everyday life and workplace productivity." (Learning for the 21st Century, Partnership for 21st Century Skills)

"Education is the only business still debating the usefulness of technology."

Rod Paige
US Secretary of Education

Our guiding principle for teaching methods requires that teachers "create instructional environments where students use higher order cognitive skills to construct meaning or knowledge, engage in disciplined inquiry, and work on products that have value beyond school." The choice of hardware and software must support this goal of reforming teaching and learning practice. The laptop computer and accompanying software selected for this project must, first and foremost, form a cognitive tool enabling students to create meaning in real world contexts using real world media. Three factors must be considered for this to occur.

First, the laptop computer itself must be capable of the production demands of real world projects. It should be sufficiently powered to allow for video and audio editing as well as multimedia production. It must also have necessary ports (USB, FireWire, etc.) to connect to other digital devices such as video cameras or scanners. The screen resolution should be sufficient for productive tasks. The laptop should also be lightweight so that it can easily be transported around the school or to the students' homes and it should have adequate battery life.

Secondly, the installed software should be adequate to the task of content creation. A full range of software should be available that enables the student to do word processing, concept mapping, spreadsheets, audio, photo, and video editing, multimedia authoring, Web browsing, and communication. As much as possible, software should be chosen to allow maximum integration among the separate programs.

Third, the student should have access to the laptop whenever it is needed. Students who have access to computers at home and at school have shown an increase in writing skills, a better understanding of math, greater problem solving and critical thinking skills, ability to teach others, greater self confidence and self esteem, and more confidence with computer skills (Coley, 1997; Rockman & Sloan, 1995). To reserve the use of the laptop to the school setting is to waste more than half of its potential use by students.

❑ **Guiding principle:** Laptop hardware and software must be sufficient to allow students to be creators of content, not merely passive receivers of content. The laptop must be available to use as a cognitive tool wherever and whenever the student is working.

8) Provide adequate technical support

"Each student using a laptop for real time classroom instruction and taking it home to continue school work requires a substantial increase in the amount of technical support required and also the times when it must be provided. Technical support is one of the more expensive elements of providing technology in K–12 education." (Florida Senate Interim Project Report)

In reviewing some fifty laptop initiatives across the country, the Task Force found a remarkable range of experience with technical support.

In the worst of cases, an inadequate response to equipment failure or virus attacks can begin a downward spiral in which the laptops are used less frequently. This leads to less interest in and respect for the equipment resulting in the need for additional repairs. Technical support personnel can then develop a siege mentality, locking down the machines in ways that make them less useful as an educational tool and restricting student access to the laptops by not allowing students to take them home.

"If technical problems arise frequently and teachers have to wait hours, days, or weeks to get them resolved, they will abandon their efforts to incorporate technology."

Singh and Means
DOE 1994

"I feel privileged to be trusted with the computers and with the knowledge I need to fix them. I also like knowing there are some things I know more about than my teachers!"

Adriana Huerta, eighth grader
South Gate Middle School

In the best of cases, technical support is considered an integral part of the overall program beginning with the initial planning. Students and teachers are taught how to care for and respect the machines. A sense of ownership is encouraged and students and teachers alike are expected to problem-solve minor difficulties they encounter to the best of their ability. Many schools have found success in programs that identify certain students as tech assistants. The tech assistants receive additional training and are able to free up school personnel to concentrate on more serious technical problems. Such programs can provide opportunities for success to students, who may not have fared well in a traditional classroom environment. They also help to create a culture of respect for technology tools, thereby reducing mistreatment of equipment and the need for repairs.

Each school should also have a site-based tech support person to handle more difficult problems and there should be a plan in place for laptops that need extensive repairs to be sent to a central district location or otherwise outsourced for repair. A loaner laptop should immediately be made available to the student or teacher. The policy at some schools is that no student or teacher should be without a laptop for longer than one hour.

❑ **Guiding principle:** Tech support procedures and planning must be adequate to prevent disruptions in laptop availability. Support should be handled at the lowest level practical.

- The end-user (teacher or student) should be taught to exercise problem-solving skills in handling routine maintenance.
- A school-based support staff should be able to handle the majority of technical issues.
- District support or other outsourcing should be available to handle major repairs.

9) Assess 21st century skills

"The infusion of technology in schools has opened the door for opportunities…to provide student assessment that will measure their abilities for connecting knowledge learned with real-world applications." (Moore, 2003, p. 22)

While it is important to measure basic skills, it is increasingly necessary to measure those skills which students will need in order to succeed in the 21st century workplace. These two goals are best achieved through a strategy involving multiple modes of assessment, including technology-infused objective and alternative assessments. Incorporation of multimedia elements and simulations in innovative items can elevate traditional tests to measure higher-level thinking. Technology also makes it much easier to create and administer alternative assessments (i.e., authentic tasks such as performance or portfolio assessment).

> **"...Classroom assessment must change... to better represent important thinking and problem solving skills in each of the disciplines.... Therefore, a broader range of assessment tools is needed to capture important learning goals and processes and to more directly connect assessment to ongoing instruction."**
>
> *Lorrie Shepard*
> *Dean, School of Education*
> *University of Colorado at Boulder*

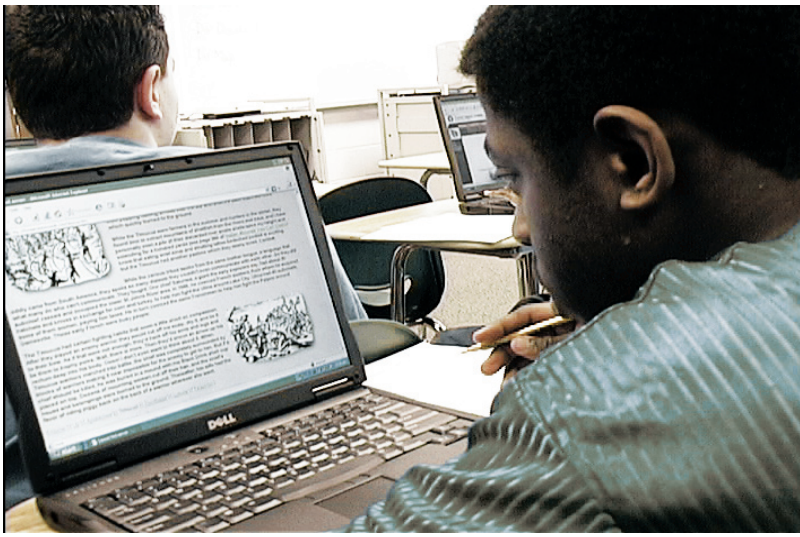
The portable laptop computer allows us to turn the corner in assessment practices. Instead of having students stop their school work to go to the computer lab to complete drill and practice exercises, the computer now comes to them to be used as an essential tool in completing their tasks. Authentic assessments can be made of student productions using real world tools to solve real world problems. Electronic portfolios can be created incorporating many types of electronic media. Technology-infused performance assessments often results in positive externalities. For example, a performance task might require a student to create a multimedia module to teach a science concept. One of the outcomes of this assessment might be a class presentation. Thus, not only has the student producing the product learned the concept through creating the module, but also other students in the class have learned through the presentation of their assessment outcomes.

While improvement in summative (end-of-unit or course) assessment is very beneficial, perhaps an even greater benefit of technology-enhanced assessment is the ability to improve and increase formative (ongoing) assessment. Measurement experts are recommending that assessment become more closely integrated within instruction (Brookhart, 2003; Shepard, 2000). Great strides can be made toward this goal through improving and increasing the use of formative assessment. Portable laptop computers can greatly enhance a teacher's ability to make authentic assessments part of day-to-day instruction. As students are engaged in authentic, creative tasks, the teacher can provide continuous, individual feedback. Thus the assessment can become more meaningful, as students can be involved in evaluating their performance and setting learning goals (Brookhart, 2003).

❑ **Guiding principle:** In addition to the testing of basic skills, students should be given the opportunity to demonstrate 21st century skills through the use of technology-infused, authentic assessments. Assessment should become more integrated with instruction.

Costs

The costs of a statewide laptop initiative are much more complex than simply pricing a laptop computer. Hardware, software, professional development, technical support, access and capacity, and digital content must all be carefully considered.



Laptop computer

The largest expense of any laptop initiative is, of course, the laptop itself. A full-featured laptop computer that would allow students and teachers to be content creators, rather than merely consumers, has a retail price of about $1000. There are less expensive devices such as PDAs, media players, or dedicated word processors that do not meet the recommended specifications of the Task Force and should not be considered for purchase under this initiative.

It is essential that any laptop device purchased have the capacity for multimedia authoring or it cannot be used in a way that will meet the Task Force guidelines for promoting 21st century skills, reforming teaching practice, and providing the appropriate tools for all teachers and students. As specified by the Task Force, a suitable laptop should include wireless connectivity, USB and FireWire (IEEE 1394), and have adequate battery life. Education technology professionals believe that it would be possible to negotiate a statewide purchase of laptops for somewhat less than half the retail price, so a reasonable estimate of cost per unit would be just under $500. Even with the optimal replacement cycle of three years, the cost per full-featured laptop computer per student per school day would be under one dollar.

93¢

The daily cost of a laptop figured at 180 school days per year over three years.

If students are permitted to take the laptop home over weekends and vacations, the cost drops to under 50 cents per day of use—less than the price of a can of soda.

46¢

The daily cost of a laptop figured at 365 days per year over three years.

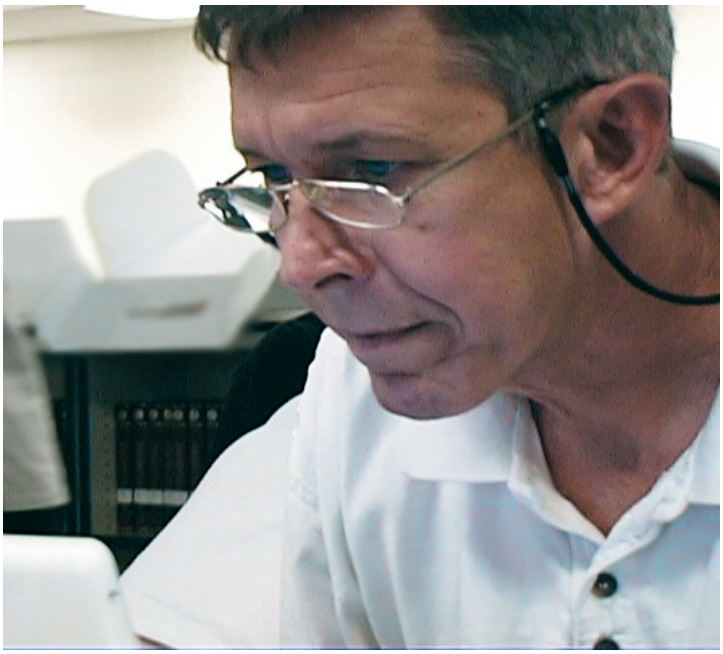
Software

The Task Force has recommended that "tool-based" software be included on each laptop. Software should be adequate to the task of content creation. A full range of software should be available that enables the student to do word processing, concept mapping, spreadsheets, audio, photo, and video editing, multimedia authoring, Web browsing, and communication. As much as possible, software should be chosen to allow maximum integration among the separate programs. (For an explanation of software types, please see Appendix H.) The following is a brief survey of software prices to serve as a reference point. Fortunately, many of the necessary programs are often supplied at no additional cost with a laptop purchase or are available as freeware.

Cost	Application	Notes
free	Word processing	A number of suitable word processors are available. Most laptops will come with a productivity suite that includes a word processor. If the laptop does not include a productivity suite (word processing, spreadsheets, etc.) the additional cost is $39–$69 for the suite.
$20	Concept mapping	The concept mapping programs typically used in schools run about $20.
free	Spreadsheets	A spreadsheet program is usually included in a productivity suite.
free	Database	A database program is usually included in a productivity suite.
free	Audio editing	Multiple free programs are available.
free	Photo editing	Multiple free programs are available.
free	Video editing	Multiple free programs are available.
free	Painting	Some productivity suites include a painting program. Lower-end programs are available as freeware.
free	Drawing	Some productivity suites include a drawing program.
free	Animation	Multiple free programs are available that can do GIF animation. More sophisticated commercial programs are available for animation, but would only be needed for specific secondary courses.
free	Music editing	Included free with some computer systems.
free	Presentation	A presentation tool is typically included with a productivity suite.
$20	Multimedia authoring	A multimedia authoring tool (as opposed to a linear presentation tool) is available for under $20.
free	Web browsing	Every laptop will come with at least one free Internet browser.
free	Calendar	Laptops usually come with a free calendar or scheduling program.
free	Email	Every laptop will come with at least one email program.
free	Instant messaging	Multiple free programs are available.
free	Videoconferencing	Every laptop will come with a videoconferencing program.
free	Website authoring	Any text editor can be used to create Web pages. At least one free Web authoring tool is available to assist with more complicated projects.

Reviewing the above list, it becomes apparent that a wide range of tool-based software is available for student use at a minimal cost. If a productivity suite is included free with the laptop, then the only additional expense would be for a concept mapping tool and a multimedia authoring tool for a total list price of $40 per laptop. Significantly lower prices could be negotiated for a large purchase.

Professional development



The integration of technology in the teaching and learning process is not guaranteed by just providing that technology. Lack of targeted, sustained support for teachers on integrating technology with the curriculum, has been identified as a major barrier to a successful one-to-one computing environment. According to the Florida STaR Chart, 25% of technology funds should be devoted to ongoing professional development at the "Advanced" level. This is a substantial increase over the 14% average for Florida schools.

According to the most recent STaR Survey of Florida schools, two-thirds of professional development time related to technology is spent on learning to use applications and only 28% is devoted to curriculum integration of technology. A common teacher complaint in existing laptop initiatives is that not enough time is spent on technology integration. Often teachers are taught how to use a program, but not shown how to integrate it into their curriculum. The knowledge gained in training quickly fades because it is not put to use in the classroom.

A more effective approach is to provide an ongoing hands-on professional development program in which teachers learn applications in the context of an actual project that they will be implementing with their classes. The advantages of a problem-based, authentic task in learning are not reserved for students alone.

Undoubtedly, a large collection of online application training already exists among Florida's 67 counties and other educational entities for most tool-based software programs a teacher is likely to want to use. A pooling of existing training resources would be a cost-effective way to provide online, just-in-time training for any teacher who has a specific application training need. A portion of professional development funds should be reserved to support a state center tasked with collecting, reviewing, cataloging, and hosting existing online computer application training modules from around the state. The center would then create additional modules and update existing modules as needed.

More important is the need to provide statewide curriculum integration models. The statewide center should also be charged with collecting appropriate technology integration examples specifically related to laptop implementations. These should also be shared statewide to all participating schools in any laptop initiative.

One size will not fit all. We have long realized that there is no single instructional plan that is appropriate for all students. Likewise, no single professional development plan is appropriate for all teacher-learners. Professional development must be tailored to the teacher's and school's needs, readiness level, school culture, and current teaching styles.

Technical Support

The most cost-effective method of technical support is a three-tiered approach in which problems are taken care of at the lowest level possible. In this way, support costs are kept down and laptops are returned to service more quickly than if every problem is sent off to a specialist for repair.

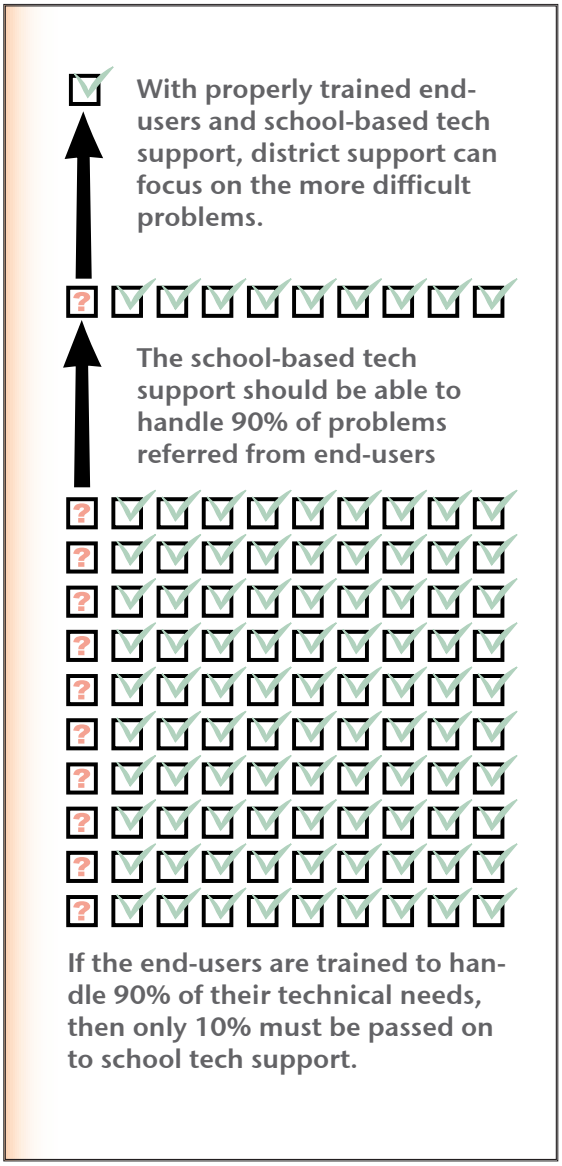
The first tier is the end-user. Both students and teachers should receive a short training in trouble-shooting and problem-solving frequently encountered glitches. Students, teachers, and parents must be provided with training that includes basic operation, troubleshooting, and proper care of the laptop.

Some schools have also implemented effective student help programs. Students who have an interest and aptitude for problem-solving are given the opportunity for extra training and responsibilities in a laptop program. Noted one middle school tech assistant, "I've learned something new every day that can help me have a good career. I've gained confidence from having the responsibility for all the equipment, and having students and teachers count on me. It's a good feeling to help teachers with computers, and to get noticed in a large school." With effective teacher and student training, many technical difficulties can be averted or solved, thereby freeing the second tier to concentrate on more difficult issues.

The second tier of support should be a skilled individual at the school site. This person should be able to deal with software and most network issues. Routine hardware tasks such as the replacement or upgrading of memory chips should be done at the school level. The fall 2003 STaR Survey reports that 93% of Florida schools already have on-site technical support. Of these schools, 91% have a technical support person, who is able to maintain and troubleshoot hardware and software and perform network administration.

The third tier of support is the district. Non-routine hardware problems and difficult network issues should be handled at this level. In this way, technical support is always handled at the lowest level so that no one becomes overwhelmed with a large quantity of technical issues that could have been best solved at a lower level. The several schools that had overwhelming technical difficulties in our review of laptop initiatives were cases in which the end users either mistreated the machines or received no basic troubleshooting skills to handle day-to-day issues with the laptop. The resulting backlog of machines awaiting "repairs" stacked up in a tech support office and were unavailable for student use.

In addition to the above plan regarding personnel, some districts have also implemented a web-based online support database or knowledge base with support tips and instructions. In a wide rollout of laptops, such an online support resource would be best handled at a central location for all of the participating schools.



School Networks

Wireless laptop computers leverage the investment in existing school networks. According to the fall 2003 Florida STaR Survey, 90% of instructional areas in Florida schools already have direct connectivity to the Internet. Adding a wireless access point to these areas involves little more than plugging in a small piece of equipment and properly configuring it. Therefore, adding wireless capability does not obsolete a school's existing investment in wiring. If areas of a school do not currently have network access due to prohibitive installation costs caused by the type of construction or asbestos issues, adding a wireless network can result in considerable cost savings over difficult retrofitting or asbestos removal.

Wireless networking is already used to some degree in 42% of Florida's schools. Statewide, 7% of instructional areas already have wireless access.

It goes without saying that a 1:1 laptop initiative will increase the demand on network capacity as students connect to school servers and out to the Internet. Several schools have encountered network capacity problems, often as a result of two factors: 1) a reliance on integrated learning systems or 2) an inordinate amount of unstructured Internet surfing by students.

Throughout this report, the Task Force has recommended the use of tool-based software in support of project-based learning rather than a reliance on a commercial integrated learning system (ILS). That recommendation is based on pedagogical considerations, but there are also technical advantages. With an ILS, students are often all trying to hit the same server at the same time. All requests have to be routed to a central school, district, or Web server causing steady traffic across the entire network. If students are engaged in project-based learning, there can be much collaboration and filesharing as projects are created and turned in to the teacher, but if the network is properly configured, all of the traffic among students and with the teacher is handled locally without impacting the entire network.

The other common cause of network capacity problems appears to be the indiscriminate use of the Internet. Using the Internet is an important 21st century skill that is essential in many teaching situations. However, it is not uncommon for a school to implement a laptop program and not give their faculty sufficient training in using cognitive software tools with students. In some of these cases, the majority of student laptop use consists of surfing the Internet without much direction. This can result in a severe strain on the school network.

Rather, the Task Force recommends that teachers embrace project-based learning with technology, which requires only a short amount of time doing targeted research on an assigned problem. The majority of the time is then spent in writing, designing, and producing a product—activities that do not require network access.

If a laptop initiative is careful not to create excess network traffic by these means, many schools will find that they will need only modest additions to network capacity that can be accomplished without exorbitant expenditures. Although the cost to upgrade a school network will vary from school to school based on existing capacity, building construction, and floorplan, the following can serve as examples of the cost involved.

> School "A" has 1000 students in 40 classrooms where each classroom already has at least two network drops per room, however, most of the existing network is running at the older speed of 10 MB/sec. This school would be able to upgrade their network with a new router, five new switches, and 60 wireless access points for under $10,000.

This expenditure of less than $10/student would provide a wireless environment in every classroom and instructional area, as well as the surrounding grounds.

School "B" has the same number of students and classrooms, but has already upgraded their network to 100 MB/sec, a speed which is available in many Florida schools. This school would only need to purchase the 60 wireless access points at a cost of approximately $5,000 or about $5/student to provide wireless access throughout the school and surrounding grounds.

These examples show how adding wireless capability to an existing school network can dramatically expand its usefulness without, in many cases, incurring the high costs of running additional cable throughout the school.

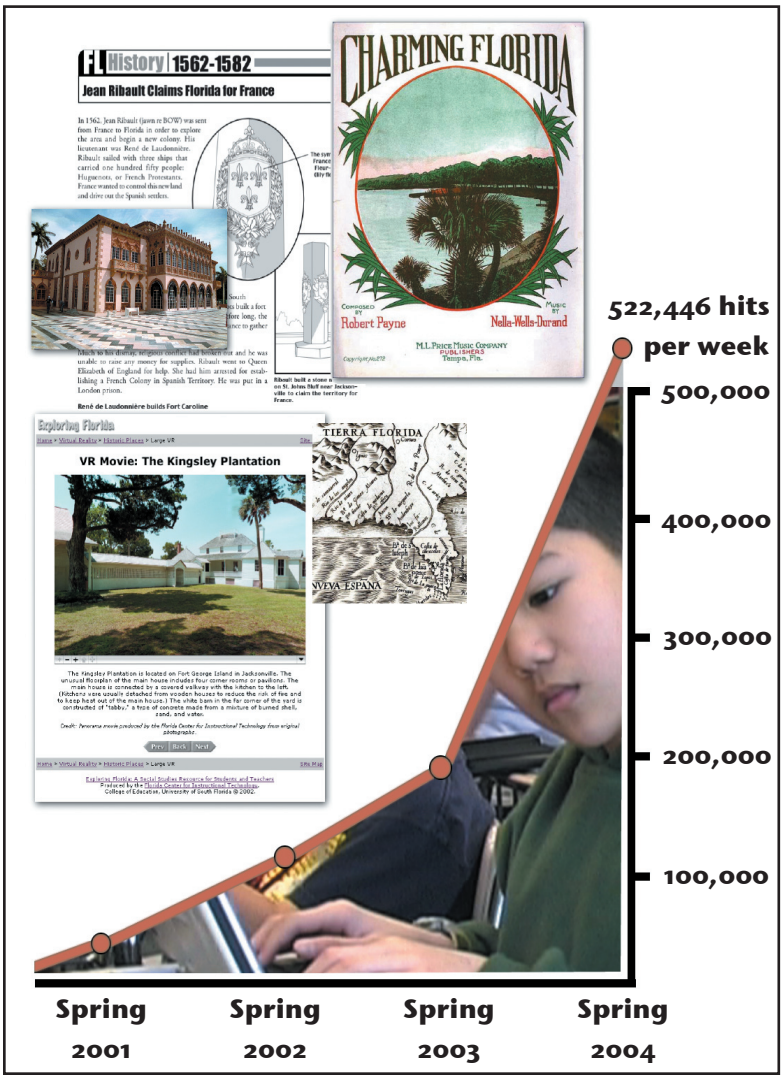
After-school and Community Access

According to responses on the January, 2003 STaR Survey, one third of Florida schools offer after-school computer access to all students. Almost 16% of the schools offer after-school access to technology for the community. As laptops become more common in schools, districts should consider means to offer equality of access for their students outside of school hours. As a starting point, schools can simply ensure that their wireless network can also be used outside of the school buildings. Students, who do not have Internet access at home, are often seen with their laptops on school grounds after hours and on weekends. This extension of the school network can be accomplished by adding a couple of access points that cover an appropriate outside area. The cost for equipment to do this is only about $150.

Some schools and districts have experimented with providing dial-up access to students. A more ambitious solution is to provide a district wide wireless infrastructure by placing towers at school sites. Depending on the population density and location of schools, such towers might reach 75% of the homes. For further distances, repeaters are necessary and partnerships with utility companies prove beneficial. When contracting for the services, districts can apply for E-rate. If districts construct a wireless district wide network, there would be a one time cost, plus on-going support cost. The price for a tower ranges from $1,500–$3,500. If districts own the tower they can lease out space for other wireless providers. Most wireless companies can't purchase property to build a tower, but schools can erect a tower without too much of a problem. This gives the school a revenue source to support the connectivity. Monroe County is planning to offer a wireless canopy at their Key Largo Middle School community beginning in fall, 2004. Green County School District in North Carolina is in discussion with the county government to provide wireless access for the whole county.

Digital Content

The Task Force has recommended that teaching and learning in schools move away from teacher-centered, textbook-driven methods to student-centered, project-based learning. This shift would substantially reduce the need for textbooks whether in print or electronic format. (A textbook merely ported to an electronic format is not a shift to project-based learning. Electronic texts are a digital means of doing the same thing we have done before and will not lead to educational reform.) Unlike textbooks, online collections of digital content can easily be updated and can be expanded by contributions from many sources.



The Exploring Florida website contains many types of multimedia resources and now receives over half a million hits per week.

For example, all Florida students currently study Florida history, typically in fourth grade. There are 179,000 fourth grade students in Florida's schools. The current adopted textbook is priced at nearly $40 so it costs Florida schools over $7 million to supply a textbook for every fourth grade student in the state. However, a free online resource for Florida history has already been created with a Technology Literacy Challenge Fund grant. "Exploring Florida" is on the web at http://fcit.usf.edu/florida. It has over 70 reading passages that include "FCAT-like" question sets, plus a collection of copyright-free multimedia resources students can freely explore and incorporate into their own projects. Thousands of historic and contemporary Florida photographs, 2,800 Florida maps, virtual reality movies, 3-D stereoview photographs, as well as movie and music clips, are all available for instant downloading and use.

Reducing the reliance on printed textbooks will provide funds to create free online content in many areas and result in substantial savings that can be applied to the support of a laptop initiative.

Other Savings

In addition to the savings on textbooks, there are a number of other ongoing costs that could be substantially reduced in schools implementing 1:1 laptops. For example:

Teacher printing. All documents (handouts, activity sheets, tests and quizzes, supplementary materials, etc.) that teachers create for students can be delivered electronically in a 1:1 classroom. Teachers no longer need to print one copy of everything for each student. If students are absent or lose a sheet, an electronic document is instantly available, saving not only printing costs, but valuable time as well.

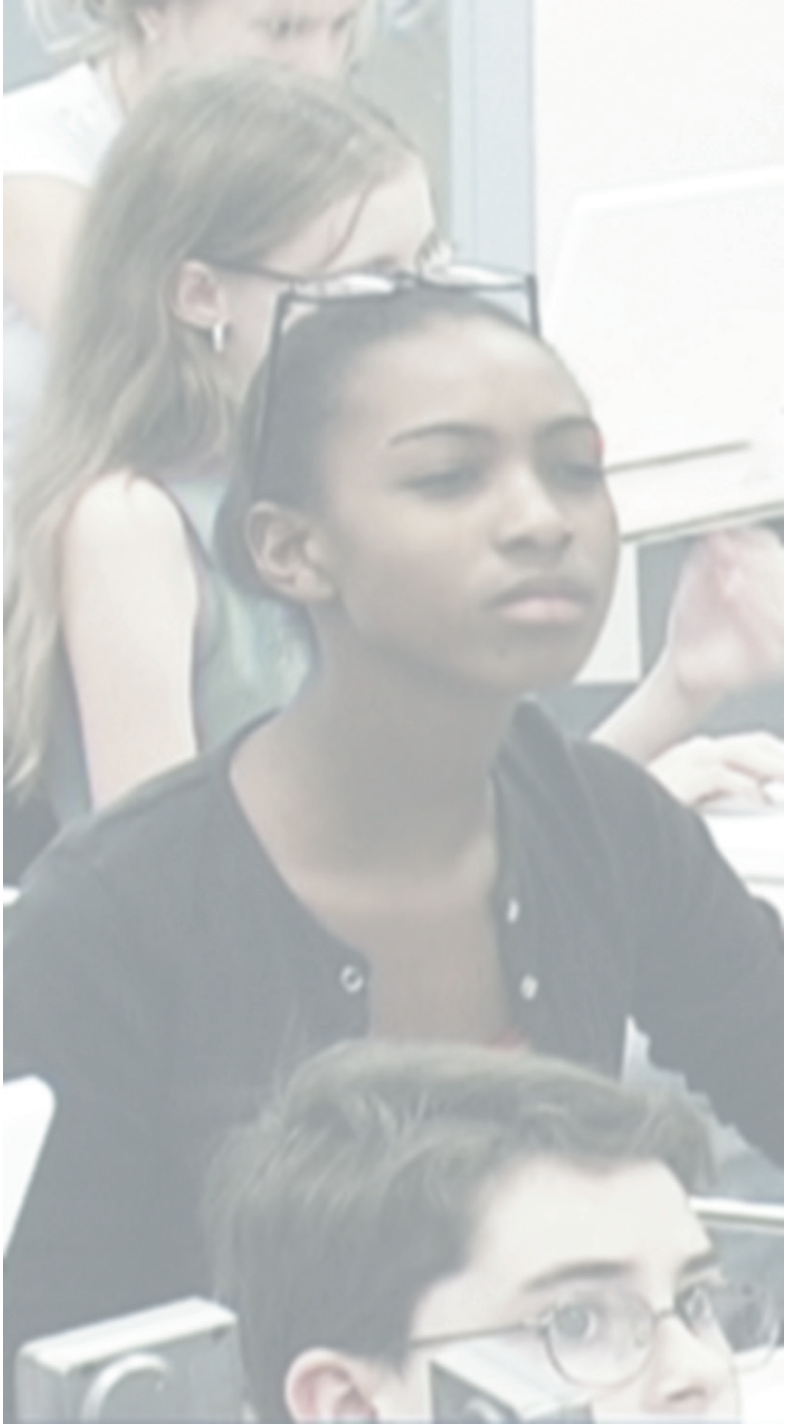
Student printing. When students share access to only a few desktop computers in a classroom, much information needs to be printed out, so that students can continue to work on projects when it isn't their "turn" to use the computers. In a 1:1 laptop classroom, projects can be entirely digital from start to finish, so no printing costs (paper and toner) are required. An added benefit is that, unlike printed products, digital projects can all be done in color at no additional expense.

One school contacted by the Task Force estimated that over $15 per student per year could be saved if students and teachers adopted a "paperless" classroom.

Maps. Large, roll-up maps are about $100 apiece and often become outdated. Laptops would afford students access to current, free maps on any part of the world. The CIA Factbook (http://www.cia.gov/cia/publications/factbook/) is a very well organized and free resource for current maps of any country in the world.

Science charts and other visuals. The information that traditionally was presented on large flip-charts and other visuals in the paper-based classroom can now be presented to the students in digital format. For example, a science flipchart on human body systems costs $175, but this information is also available in a more engaging interactive format from a number of free websites. Teachers will still want to have a number of visual teaching materials in the classroom, but a move toward digital content could significantly reduce the amount that must be spent on such printed materials, while at the same time dramatically increasing the scope of what is available for students.

Computer labs. One-to-one laptops will eliminate the need for many existing computer labs in Florida. Re-purposing these labs as classrooms will produce a tremendous savings in new construction costs across the state.



Benefits

21st century skills

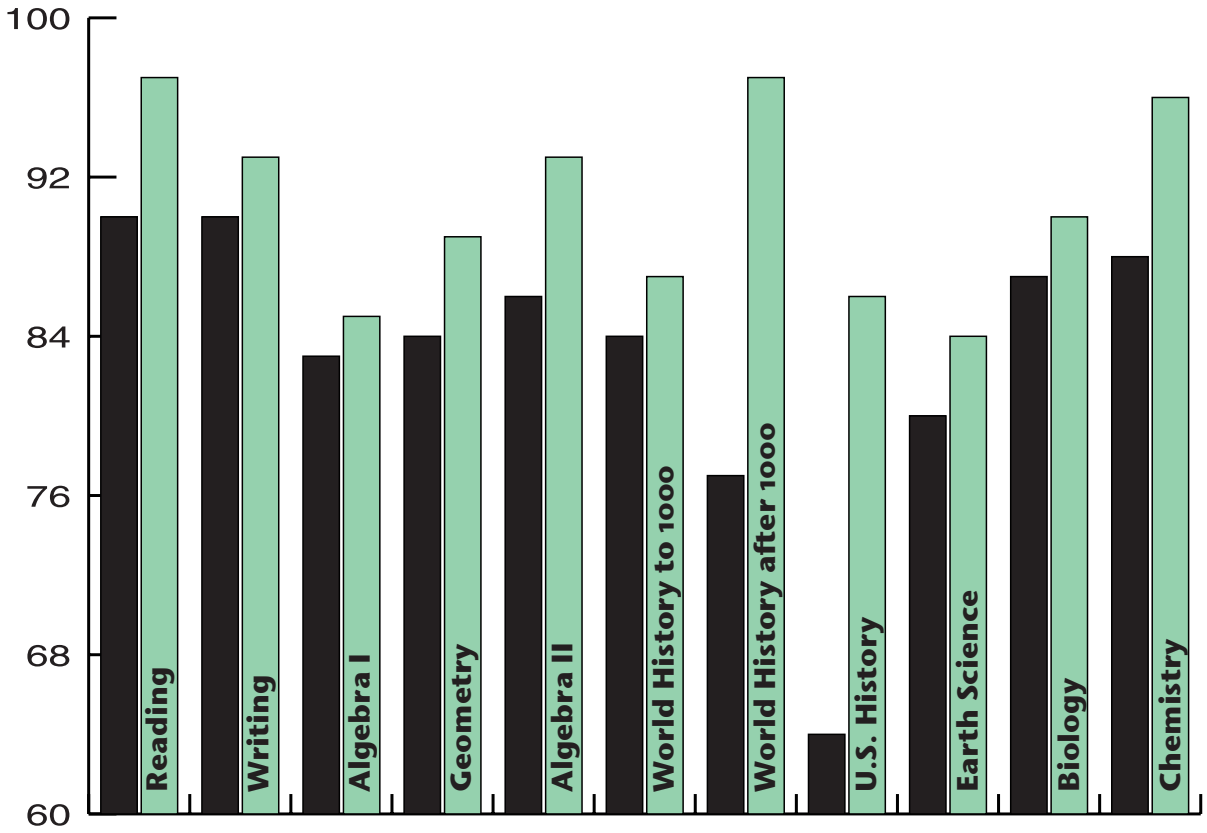
State standards

Classroom teaching

Student changes

Community

After more than 10 years studying laptop computing in schools, Saul Rockman (2003) concludes that one of the most important benefits of a laptop program is an increase in 21st century skills. “Developing the ability to learn independently, collaborate with peers to accomplish work, and communicate the conclusions of your work are the core of 21st century skills, and a highly valued set of competencies in the world outside of school. These accomplishments are seen in many laptop programs, especially those that permit students to take their computer home in the evening.” (Rockman, 2003) A workforce with accomplished information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills will attract new businesses to Florida and contribute to our state’s economic well-being.

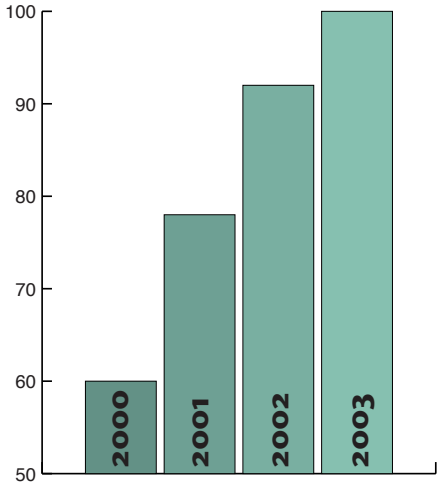


Percent of high school students in Henrico County passing the Virginia Standards of Learning by subject for the school years 2000-2001 (shown in black) compared to 2002-2003 (shown in green).

State Standards

Although laptops primarily provide students with opportunities to develop 21st century skills, their use also impacts state achievement tests. This has been demonstrated dramatically in Virginia.

After two years of a laptop initiative in Henrico County, high school score results increased on all eleven of the Virginia Standards of Learning tests. In 2000, only 60% of Henrico's regular schools were accredited according to Virginia Standards of Learning criteria. By 2003, 100% of Henrico's regular schools were accredited. This includes 40 elementary schools, 11 middle schools, and 9 high schools.



Percent of regular schools in Henrico County receiving accreditation for the years 2000 through 2003.

Change in classroom teaching

Laptops in the classroom can be a compelling force for change in teaching practice. Rockman (2003) notes that "very quickly, an observer in a laptop classroom would see that there is less lecture and more individual and group project work....Students can do more work on their own and at their own pace, and the teachers can act more as consultants to them, offering individualized suggestions, mid-course corrections, and more frequent assessments of individual and group progress."

A 2000 study, also by Rockman, found that teachers in laptop schools showed significant movement toward constructivist teaching. Laptop teachers were more likely to encourage student-led inquiry and collaborative work, while non-laptop teachers did not exhibit this trend.

In a study of over 3,000 teachers in Maine's laptop program, researchers found significant increases in the teachers' use of technology, especially in conducting research, developing materials, managing student information, and communicating with colleagues, students, and parents (Silvernail, 2004).

Bette Manchester, a teacher in Maine's labtop initiative, summarizes the effect of technology on classroom teaching. "One-to-one computer access changes everything. But let me make this crystal clear: This is not about technology or software, it is about teaching kids."

Change in student attitudes and work habits

Even informal studies of laptop use in schools have identified an increased student enthusiasm as one of the program outcomes. This anecdotal evidence was confirmed in a recently released study of middle school students participating in the Maine laptop initiative (Silvernail, 2004). Over 12,000 students returned surveys in the fall of 2003. Students indicated their level of agreement with a list of statements about laptops and school. The results are extremely positive about laptop use in school:

80% "I would rather use my laptop"

75% "Laptops help me be better organized"

70% "Laptops improve the quality of my work"

70% "I do more work when I use my laptop"

80% "I am more likely to edit my work with a laptop"

70% "I am more involved in school with a laptop"

70% "Laptops make school more interesting"

Many laptop schools also report a substantial drop in student absenteeism. Manatee County experienced a near 40% drop in absentee rates in classes with laptops. Maine schools have reported up to a 50% decrease in student absences. In one Maine high school the rate dropped from 9% to only 2%. Schools have long valued a high attendance rate as one measure of success. A number of laptop schools have also reported a decline in discipline problems among students.

Parents and Community

Laptop schools often report a surge in parental and community involvement once laptops have been introduced. Schools have reported a 100% participation in events that are prerequisite to laptop distributions. Rockman (2003) states that laptop schools typically "see higher attendance at PTA meetings; increased communication via e-mail, phone, or face-to-face meetings; parent participation in tutoring programs and parent-student computer classes offered through the school; and more volunteering at the schools."

Parental satisfaction is also a measure of success. A national Gallup poll reports than 71% of parents are satisfied with their children's education. In Henrico county, that number is a remarkable 94%. Schools note that parent satisfaction, support, and communication is increased in those programs where the laptop is permitted to be taken home. In these cases, the laptop opens a new means of communication and sharing between school and home.

Some laptop programs have even instituted parent training on the laptops in an effort to contribute to the economic well-being of the community.

Recommendations

After careful consideration of existing laptop initiatives, relevant research and literature, and the personal experience and professional expertise of individual members, the Laptops for Learning Task Force hereby makes the following recommendations for the implementation of a statewide laptop initiative in Florida.

I. The Task Force recommends that any laptop initiative conform to the following nine guiding principles:

- All students must have access to appropriate tools and to challenging curriculum in order to bridge the digital divide by moving beyond basics and towards 21st century skills.

- 21st century curriculum must be infused with skills necessary for living and working in an ever-changing society. Relevant, real world education should include:
    - information and communication skills
    - thinking and problem-solving skills
    - interpersonal and self-directional skills

- Teachers must create instructional environments in which students use higher order cognitive skills to construct meaning or knowledge, engage in disciplined inquiry, and work on products that have value beyond school.

- Successful professional development:
    - must be held on a continuous basis
    - provides mentors, coaches, or peer teammates to model appropriate integration strategies in actual classrooms
    - gives teachers feedback on their own performance
    - holds teachers accountable for implementing instructional strategies and student learning

- Preservice teachers must:
    - experience good models of technology integration in all their preservice classes
    - have access to a laptop computer to support their coursework and field experiences
    - have field experiences that include an opportunity to teach in a 1:1 environment

- Students and teachers must have access to rich multimedia resources to:
    - extend their world and life experiences
    - engage their senses
    - incorporate into their own multimedia projects
    - provide building blocks of instruction

- Laptop hardware and software must be sufficient to allow students to be creators of content, not merely passive receivers of content. The laptop must be available to use as a cognitive tool wherever and whenever the student is working.

- Tech support procedures and planning must be adequate to prevent disruptions in laptop availability. Support should be handled at the lowest level practical.
    - The end-user (teacher or student) should be taught to exercise problem-solving skills in handling routine maintenance.
    - A school-based support staff should be able to handle the majority of technical issues on a timely basis and provide a loaner laptop while the repair is being made.
    - District support or other outsourcing should be available to handle major repairs.

- In addition to the testing of basic skills, students should be given the opportunity to demonstrate 21st century skills through the use of technology-infused, authentic assessments. Assessment should become more integrated with instruction.

II. The Task Force recommends that school-site projects include the following elements:

- The laptop computer designated for this project should be selected from among those in current use in Florida schools based on demonstrated promise in current initiatives and should have the following minimum characteristics:
    - wireless connectivity
    - adequate battery life for school use
    - FireWire (IEEE 1394)
    - USB

- The laptop computer designated for this project should come equipped with and be capable of running the following software:
    - word processing
    - graphic organizer
    - spreadsheet
    - multimedia authoring
    - video and sound production
    - web browser with links to state curriculum resources
    - e-mail, messaging, and conferencing capabilities subject to school site control

- Teacher machines should match student machines and include links to training resources.

- Projects must provide professional development for all teachers and administrators in 21st century skills, their implementation, and assessment using technology, as well as training in the integration of technology into the teaching of basic skills and content. Such professional development must:
    - be held on a continuous basis
    - provide mentors, coaches, or peer teammates to model appropriate integration strategies in actual classrooms
    - give teachers feedback on their own performance
    - hold teachers accountable for implementing instructional strategies and student learning

- Projects must provide for equity of access at school and at home for all students.

- Projects must provide for equity of curriculum for all students. A project must not provide an environment of learning with technology for some students, while limiting other students to learning from technology.

- Projects must be designed so that the laptop computer becomes an integral part of all subject areas.

- Projects must include a technical support plan designed to minimize disruptions in the availability of technology to students and teachers.

III. The Task Force recommends that a statewide initiative include the following elements:

- **Research Team.** A research team should be assembled representing academicians from major Florida universities who are nationally recognized for their experience and expertise in educational research. The first responsibility of the research team will be to carefully design the implementation of the initiative in order to optimize conditions for rigorous, scientifically-based research. Additional recommendations and specific guidelines for the research team are included in Appendix I.

- **Preservice Education.** The implementation of this initiative should be designed to coordinate and support efforts in the preservice program of at least one Florida college of education to prepare graduates to teach in the 21st century classroom. The designated college(s) must agree to allow researchers access to their efforts and must be willing and able to share the results and products of their efforts with other colleges of education in Florida.

- **Advisory Board.** An advisory board of Florida educators, business and community leaders, parent partnerships, LEA representatives, and experts in the field of foundation management should be convened to develop a plan for long-term sustainability of a state-wide laptop initiative. The plan should include the establishment of a foundation to continue fund-raising activities and serve as economic advisors to a statewide laptop initiative.

- **Center of Academic Excellence.** A Center of Academic Excellence should be established to administer the statewide laptop initiative. The center would be responsible for facilitating and monitoring the implementation of the program and related research.

- **Multimedia Repositories.** The implementation of this initiative should also be designed to coordinate and fund efforts to create free online resources to support student access to rich, multimedia sources for use in student-created projects and to support teacher access to learning objects and other resources for the development of lessons.

Appendix A

Review of State and National Laptop Initiatives

Review of State and National Laptop Initiatives

This appendix profiles the experiences of several dozen schools with laptop initiatives. The schools included represent a mix of approaches, goals, and outcomes. While most of the initiatives are considered successes by their respective schools, even the successful initiatives can provide "lessons learned" to help guide the planning of those who would like to introduce laptops into the classroom. Many of these lessons were used in the development of the guiding principles outlined at the beginning of this report. The information in this appendix was gleaned from articles included in the References Appendix, the schools' own websites, and the contributions of Task Force members.

Florida Schools:

- Broward County, North Broward Preparatory
- Hernando County, Moton Elementary School
- Jefferson County, Howard Middle School
- Manatee County
- Miami-Dade County, Carrollton School of the Sacred Heart
- Miami-Dade County, Palmer Trinity School
- Monroe County, Key Largo School
- Orange County, Ocoee Middle School
- Palm Beach County, Pine Crest
- Pinellas County, Clearview Avenue Elementary School

Schools outside of Florida:

- British Columbia, Peace River North
- California, Evergreen Valley High School
- California, Gunderson High School
- California, San Lorenzo Unified School District
- California, South Gate Middle School
- California, Urban School of San Francisco

- Kansas, Smoky Valley High School
- Illinois, Schaumburg
- Kentucky, Jefferson County
- Maine
- Michigan, Malcolm X Academy
- Minnesota, Oak-Land Junior High
- New Hampshire
- New Jersey, Summit High school
- North Carolina, Green County
- Ohio, Cincinnati Country Day School
- Oklahoma, Frontier School District in Red Rocks
- Pennsylvania, Greater Latrobe School District
- Pennsylvania, Irving Elementary School
- Pennsylvania, Quaker Valley School District
- South Carolina, Beaufort County
- Tennessee, St. Paul Christian Academy
- Texas, Ursuline Academy of Dallas
- Vermont, Sharon Academy
- Virginia, Henrico County

Florida Schools

Broward County, North Broward Preparatory

In the fall of 1998, all of the students in the middle and high school grades of this private, college prep school were provided with "StudyPro" laptop computers from NetSchool Corporation. By the following year it became apparent to both students and teachers that the limited capacity of the StudyPro laptops was not meeting the needs of North Broward Prep. The StudyPro was not capable of running the many programs demanded by the curriculum. A full-featured wireless laptop computer with CD-ROM was needed. So, for the 2000–2001 school year every high school student was required to have a full-featured, wireless laptop computer. This requirement was expanded to middle school students in 2002–2003 and to lower school students in 2003–2004. In the current school year, CD-ROM and on-line texts have replaced heavy, printed textbooks. Headmaster Michael Rossi notes, "Laptops are considerably lighter and students are much more engaged. With a computer, the textbook comes alive." Rossi says that it is a challenge to train teachers to keep up with their students. The school has hired two trainers to work exclusively with faculty. Says Rossi, "A teacher who wants to work here knows the expectation is that they are computer literate. You walk around and see kids connected to the Internet all over campus."

"Making the trade" The Miami Herald, July 27, 2003

Hernando County, Moton Elementary School

Although not a true 1:1 school, Morton Elementary achieves 1:1 computing in scheduled classrooms through the deployment of mobile laptop labs. The school's technology coordinator, Carla Schutte, has advice that is pertinent to 1:1 initiatives. "These days, no matter what profession they [the students] go into, the knowledge and use of technology as tools is essential. It's the difference between doing something by hand versus doing something with a machine. The tool helps get the job (done) better and faster." Schutte believes that the most difficult obstacle was getting the teachers comfortable with the technology. "Anything new is going to meet some resistance. Computers were foreign to veteran teachers." Schutte began a program where she trained selected teachers to be trainers of the remaining faculty, a method that she has found successful. On the other hard, Schutte has found little trouble getting the students to use the technology. "It's so much a part of their lives these days, they think nothing of working on a keyboard. When it comes to explaining things to them, they seem to get it right away." Schutte believes the cost of technology is money well spent. "I don't think you can put a price tag on the benefits these kinds of things ultimately will bring to children in the future. In societies that put a premium on technology in education, these aren't special projects, they are the norm. We need to continue to do more not less when it comes to technology. Some day our kids will thank us for doing it."

"Into the world of wireless" St. Petersburg Times, October 2, 2003

Jefferson County, Howard Middle School

Each of the 450 students in Howard Middle School has been issued a laptop computer. The school serves grades five through eight. While individual teachers and students have experienced some successes with the laptops, overall this initiative provides more lessons learned for other schools that will be starting laptop programs. Initially, the laptops had little tool-based software that the teachers were made aware of. (Most teachers were not even aware that the laptops contained a word processor.) Instead, students were expected to utilize a number of web-based content and testing providers. The drill-and-practice exercises did little to raise student interest or achievement. Rather than reforming educational practices in the school, the laptops tended to reinforce existing, traditional methods of teaching. The lack of appropriate inservice training and the isolation of the school (Howard is the only middle school in the county) meant that teachers had very little direction aside from the vendor presentations supplied by the web-based content and testing service providers.

Lessons learned:

- Laptop computers should include appropriate tool-based software and teachers should be given sufficient inservice training to utilize it effectively with their students.
- When the predominant teaching style in a school is "instructionist," extensive professional development is required to model ways of integrating project based learning into the curriculum.
- Several laptop initiatives give their teachers laptop computers a semester or even a full year before their students so that the teachers can get comfortable with the capabilities of the computer and explore ways of integrating it into their curriculum. This practice could have eased the transition for the Howard faculty, many of whom stated that they had limited experience with computers and were very uncomfortable using them in the classroom.
- Given the isolation of the district, the opportunity for key faculty members to visit other districts with successful laptop initiatives could have contributed greatly to the faculty's vision for integrating laptops into the curriculum.

"The 21st-century classroom" Tallahassee Democrat, October 18, 2003

Manatee County

Manatee County School District began their laptop initiative as a pilot program in 22 classrooms involving four elementary schools and one high school. Funds were generated through Enhancing Education Through Technology (EETT) grant monies to provide technology-savvy teachers with the tools they needed to get the program rolling.

"Using the laptops forces the teachers to teach differently. It enables us to develop lesson plans that advance higher level learning skills and project based learning. The 'drill and skill' method just doesn't work for students anymore," remarked Kim McAfee, one of the teachers involved in the pilot program.

In 2003, after the success of the pilot, 2.2 million dollars was allocated to expand the program to include two high schools, one middle school and four elementary schools. The elementary schools' distributed laptops to all students in 5th grade. Bayshore High School was selected to become the first school in

Manatee County to issue laptops to every teacher and students. Two additional elementary schools are participating on a limited basis.

Frequent parent night gatherings are critical to the program and keep the community informed. "Tech Time," a locally produced community access show, broadcasts iMovies and other student created projects to homes in the area. Parents and teachers note students are spending less time watching television and more time with sharing with their parents what they have learned using their laptops. Absences by students with laptops have declined by almost 40%.

Tina Barrios, Supervisor of Instructional Technology for the Manatee School District, feels confident that the district is giving students and teachers what the need most: better access to information.

Miami-Dade County, Carrollton School of the Sacred Heart

All 400 students in grades 5–12 carry their own laptops as a part of the Anytime, Anywhere Learning program. The school website states, "The dynamics which characterize today's age of information and communication dictate that lifelong learning must become the dominant paradigm for education. A desire to learn now and in the future must guide every classroom. The administration and faculty at Carrollton School considers technology to be a valuable tool to support and increase students' desire to learn, enhance instruction and increase productivity and efficiency."

Miami-Dade County, Palmer Trinity School

Palmer Trinity School is an independent, college preparatory, coeducational Episcopal day school with 600 students in grades six through twelve. The school's Wireless Laptop Computer Program enables students to connect anywhere on campus, including outside areas. Palmer Trinity has a very successful support program and has posted a number of tutorials covering basic tasks and programs on its website. The school credits its success with laptops to "the positive, supportive climate at Palmer Trinity [which] encourages both students and teachers to experiment with new technology. Administrators and teachers are not afraid to forge new ground, this flexible attitude has made it possible to operate on the 'cutting edge' of school technology."

Monroe County, Key Largo School

Project Connect is a three-year Laptop Pilot Project that is serving as a model for a district goal of a laptop for every student in grades 6–12. Currently 120 seventh grade students use wireless computers daily, which were issued to them as 6th grade students. Parents were required to participate in an evening training and sign a contract prior to their students receiving the computer. Students take the laptops home and provide their ISP to continue their assignments "anytime."

Teachers have developed project-based learning lessons, collaborative projects, which integrate the curriculum and the laptops, and assignments that extend learning with laptops beyond the school day. Courses developed with Blackboard enhance and enrich the curriculum. All students have district email accounts and communication between teachers, parents and students is paramount to the success of the program. Teachers and students use web-based programs in class to develop authentic and for-

mal assessment, create and deliver multimedia presentations and utilize Internet resources for research, collaboration and real world tasks. The second year's evaluation will be complete in June 2004, with a final evaluation when the students have had the laptops for grades 6, 7, 8.

In year three, the 2004–05 school year, a wireless canopy will provide students with wireless access to their homes. The initial design phase is underway, with installation and implementation planned to begin at the start of the 2004–05 school year.

Orange County, Ocoee Middle School

According to a school profile on the Microsoft Education website, Tablet PCs have transformed the learning experience at Ocoee Middle School. Principal Katherine Clark says, "I truly believe that they will have the greatest impact on education since we first brought computers into the classroom." The project is a joint effort of Microsoft; Holt, Rinehart and Winston; and HP designed to measure how well students learn using a Tablet PC and a web-based curriculum. When participating seventh grade students enter their classroom, they use their Tablet PCs to log onto a server where they find their assignments, worksheets, and quizzes. The teacher accesses and corrects their assignments via the same server.

Palm Beach County, Pine Crest School (Boca Raton)

Pine Crest is a private school in Boca Raton. All seventh graders are required to carry their own wireless laptop to school. Seventh-graders must sign up for a one-day mandatory laptop training course.

Costs: Pine Crest School parents must purchase the laptops for their children. The school is an authorized reseller for Gateway, IBM, and Dell laptops. Non-warranty repair provided by the school is charged at $50/hour. Student laptops must be dropped off at the school for configuration prior to the start of the school year. If they are dropped off before July, there is no fee for this service. Laptops dropped off in July incur a $100 "technology services fee." After July the fee rises to $250.

Pinellas County, Clearview Avenue Elementary School

During the 2001–2002 school year, the Florida Center for Instructional Technology worked closely with Clearview Avenue Elementary School to supply laptop computers and training assistance to selected classrooms as a part of an action research project to better understand issues related to the integration of technology in the elementary classroom. While much analysis remains to be done on the data collected, researchers have noted that there appears to be a relationship between teaching style and the success of the laptop implementation measured in terms of student and teacher satisfaction, quality and variety of usages, and seamlessness of integration.

Teachers who tended toward constructivism reported greater satisfaction with using the laptops and related digital devices. They exhibited a greater fluency and flexibility of integration approaches, often repurposing software in unexpected ways such as using a spreadsheet program to draw floorplans. Their students took ownership and pride in their computers and learned to be problem-solvers when technical

difficulties arose. Student collaboration increased. All told, students in the constructivist-oriented classrooms used the laptops more than students in the traditional classrooms. Perhaps more telling, when asked at the end of the year to reflect on their experiences, the students enthusiastically recounted the projects they had created on their laptops without referring to the computers themselves—the technology had become a transparent tool to them within a single school year.

The experience was markedly different in the more traditional classrooms. The computers were used significantly less and teachers and students expressed less satisfaction with them than did their peers in the other classrooms. Any apparent glitch would bring the entire classroom to a halt. Rather than responding as problem-solvers, students having a problem would take their hands away from the laptop and request help from the teacher. The more traditionalist teachers were often observed touching the students' trackpads—an activity almost never observed in the more constructivist classrooms. When asked to reflect at the end of the year, these students dwelt on the technology and the difficulties they had rather than on the projects they had done.

While this implementation was limited in scope and much analysis remains to be done, it does suggest that a school consider carefully the teaching styles of its faculty when implementing a laptop program and designing the professional development to support it. It stands to reason that teachers who have been accustomed to playing the sage-on-a-stage may need additional assistance adjusting to their students having a device that empowers them to take more responsibility for their education and opens additional avenues of knowledge to them. Perhaps it's no accident that laptop implementations are often tied to school reform efforts.

Schools outside of Florida

British Columbia, Peace River North

This initiative in northern British Columbia is very instructive because it was designed as a systematic action research project. Although the initiative is called the "Wireless Writing Project," the results go well beyond an examination of student writing performance. The project was implemented in five classrooms of sixth and seventh grade students using Apple iBooks.

The results after one year are extremely positive. The percentage of students whose writing met expectations of the BC Performance Standard increased from 70% on the pretest to 92%. The percentage whose writing exceeded expectations rose from 0% to 18%.

Perceptions of writing improvement also surged. The teachers indicated that they strongly believed that the laptops had made an extensive or substantial contribution to student improvement. Over 93% of the parents believed that the laptops were responsible for the improvement in student writing. The degree of improvement was seen as extensive or substantial by 70%. Ninety percent of the students reported that the laptops had improved their writing "a lot" or "quite a bit."

The use of the iBooks was similarly positive. Using a five-point scale, all five teachers involved in the project answered with a 5 to the questions "How important is it to you to have iBooks next year?" and "How important do you think it is for schools to provide iBooks for students in grades 6/7?" When asked

"How much does your child like having an iBook?" 92% answered either "extensively" or "a great deal; substantially." In response to additional questions parents overwhelmingly indicated support for continuing the program and expanding up upward into the high school grades. Students indicated that is was important for them to have an iBook the following year and, like their parents, they thought it was important to extend the program through high school. Nearly all (97%) of the students indicated that finding information with the iBook helped them to improve their work "quite a bit" or "a lot."

Perception of technology skills was extremely high. All five teachers gave their highest rating (5) when asked to describe the impact of the project on student technology skills. All of the parents indicated that their children's technology skills had improved; 92% identifying the improvement as "extensive" or "substantial." Half of the parents reported that their children were able to help other family members with their computers either "extensively" or "substantially." Over 68% of the students reported that they are able to help others with their computers "quite a bit" or "a lot."

Finally, the research showed noteworthy improvements in student attitude, motivation, and work habits. Teachers reported students taking an increased responsibility for their learning specifically in the areas of organizing and keeping track of their work, on-task behavior, and taking responsibility for their own work. Nearly 90% of the parents indicated an improvement in their children's attitude in response to the laptop initiative. Three quarters of the students indicated that their attitude toward school had improved "a lot" or "quite a lot" due to having an iBook.

Outcomes: Dr. Jeroski noted the following additional insights related to the one-to-one implementation.

- "Students report strong ownership and a sense of responsibility to 'their' computer; that is supported by extremely low incidence of any kind of damage. Students are clearly very careful when handling their laptops."
- "Students describe how important it is to have their 'own' computer that they can access whenever they need it at school or at home. They are able to personalize their operating environment to suit their learning styles."
- "Teachers who are accustomed to a lab or cart system for sharing computers among classes, notice a dramatic decrease in the amount of 'maintenance' or 'startup' time required each time they want to use the computers."
- "Because students are able to take their iBooks home, parents have increased access to their day-to-day school work, as well as major assignments."
- "One-to-one assignment allows for serendipitous and spontaneous use of the iBooks as opportunities naturally arise."

Sharon Jeroski, "Wireless Writing Project, Research Report Phase II" Horizon Research & Evaluation, Inc., 2003.

"Studies validate laptop programs in U.S., Canada" eSchool News Online, February 6, 2004

California, Evergreen Valley High School

All 1500 students in this Silicon Valley high school carry their own laptop computers. In its second year, the size of the program has skyrocketed as the student body increased from 850 in the first year to over 1500 currently. In the first year of the program, students were permitted to take the laptops home with them. With increased enrollment in the second year, coupled with a higher than expected breakage rate and insurance increases, the school no longer allows the laptops to be taken home. School officials were also concerned that they could not control the types of activities students could use the laptops for when they were away from the school.

Evan Hansen "Public schools: Why Johnny can't blog" CNET News, November 12, 2003

California, Gunderson High School

All students in this San Jose high school have been issued Apple iBook computers. They and their parents picked them up before school started. In the first two months of the program the school has reported one broken laptop and one stolen on the light rail transit system. The biggest problem has been insufficient infrastructure to connect so many laptops to the Internet. District officials say that problem will soon be solved.

The school will measure the success of the program against three goals: increased test scores, improved attendance, and a decline in behavior referrals. The program will be expanded to the feeder middle school for Gunderson next year and to fourth and fifth-graders at a local elementary school the following year. The $6,000,000 project was funded through a Federal bond program.

Larry Slonaker, "Gunderson High's laptops: Educational blessing or expensive distraction?" Mercury News, October 15, 2003

California, San Lorenzo Unified School District

According to a school profile on the Microsoft Education website, the district's Dell laptops enable "students to achieve higher levels of learning, while providing teachers and administrators the tools they need to manage and enhance the curriculum." The district has also seen an increase of parental involvement, attributed to the laptop initiative. Two local libraries are installing wireless access points for students who do not have Internet access at home.

Four Intel master teachers in the district have provided Intel Teach to the Future training to more than 150 teachers. Teachers are trained to create "standards-based, thematic, project-based units of study." Teacher lessons are then posted on the district website.

Educational Technology Director, Georgeann Hardy says "Our eLearning laptop teachers have made a strong commitment to using project-based learning strategies which engage our students in their learning and prepare them with 21st century skills to be ready for future education and employment. The bonus is that parents and community are also involved and are supporting our students!"

California, South Gate Middle School

According to a school profile on the Apple Education website, South Gate's 4400 students are "excited, engaged, and happy to be there." One of the largest secondary schools in the country, South Gate is located in a crowded urban area and serves an almost exclusively Latino/Hispanic student population 90% of whom qualify for free or reduced lunch.

South Gate's year-round schedule means that three teachers share two classrooms. This created numerous problems regarding the care and maintenance of the desktop computers that were in each of the more than 100 classrooms according to Instructional Technology Coordinator Robert Craven. "You end up with three teachers sharing two rooms, which means the teachers must move everything to another room every eight or sixteen weeks. If the outgoing teacher wasn't keeping things up, the desktop computers could be inoperable or vandalized, or have other problems. This was a huge issue for us. With over 100 classrooms on campus, making sure all of the systems were running was becoming really difficult."

Now South Gate utilizes a fleet of mobile iBook carts which the teachers typically check out for a week at a time. On Fridays, AirPort Base stations and printers are set up in the classrooms that will be using the mobile labs the following week. The carts of laptops are rolled into the classrooms each morning and returned at the end of the school day.

Some of the tech support is provided by the students themselves. Craven explains, "We're really lucky that we get a lot of sixth- through eighth-graders who are very talented technically. They do everything from cutting CAT-5 cables, to setting up the AirPort Base Stations, to taking hard drives out and replacing motherboards. The students also serve as peer tutors in the classes, giving other students assistance with the iBooks and their technology-based lessons. We generally have about 30 to 40 students helping out during the year ... the level of self-esteem this gives them is just off the charts."

Students confirm Craven's assessment. Says one eighth-grader, "I really enjoy being a technology worker, because I feel privileged to be trusted with the computers and with the knowledge I need to fix them. I also like knowing there are some things I know more about than my teachers! Working here helps build skills for the future. Now that I'm gaining those skills, I won't have to stay at home."

Another eighth-grader agrees, "As a service worker, I've learned something new every day that can help me have a good career. I've gained confidence from having the responsibility for all the equipment, and having students and teachers count on me. It's a good feeling to help teachers with computers, and to get noticed in a large school."

South Gate's professional development model has been successful. Each teacher receives an initial two days of training before they can use the mobile labs. Additional training is scheduled throughout the year following a plan worked out between the school and Apple Professional Development. The school also has a Teacher Integration Mentor Program run by a number of tech-savvy teachers. Craven claims that even teachers accustomed to the traditional classroom model have begun to integrate the available technology.

Sixth-grade humanities teacher Mike Albert praises the use of laptop computers in the classroom. "With the iBooks, students can find a lot more information than they can with traditional sources, a lot faster. They can also evaluate those sources, using much higher-order thinking. Using the iBooks actually helps them synthesize their information, instead of just reporting it. Also, presentation skills are one

of California's state standards, yet they often get short shrift. Having the chance to present something, defend it, and convince others is tremendous preparation for life after the classroom."

Lessons learned. South Gate has shared some advice for other schools about technology use:

- "Pay attention to your hardware and software usage. If your technology tools are sitting idle, it's time to reevaluate their usefulness."
- "Even if you don't have a dedicated computer lab, you can still use technology in the classroom—consider a mobile computer lab."
- "Solicit input from and provide an ongoing forum for your teachers who are 'on the front lines.'"
- "Technology is constantly changing. Ensure continuous training for all faculty."
- "When doing your cost estimates, don't forget to factor in after-purchase maintenance. A less-expensive system may be far more costly to repair and service, doubling or tripling its initial price."
- "Actively involving your students in the upkeep of your computers increases their self-esteem, creates positive role models, and encourages everyone to take better care of the systems."

California, Urban School of San Francisco

At the Urban School of San Francisco, all students in grades nine through eleven and the 35 faculty members use laptop computers. Technology Director, Howard Levin claims, "With technology, the nature of collaboration dramatically increases. The sharing of info has skyrocketed—with the blessing of the teachers, students share notes, and they work together on research projects. Also, the level of confidence students have in technology has increased, especially among girls. Students are developing confidence in using all sorts of technology, such as digital cameras, not just computers." Levin also notes that originally, the English department was most resistant to the move toward technology. However, after implementation, they are among the strongest supporters. "They've discovered that computers offer the tools to expand the students' abilities to comment and critique each other's work, as well as to comment and critique literature."

"Apple succeeds in 1:1 educational computing solutions" MacCentral, October 30, 2003

Illinois, Schaumburg

Based on the results of a pilot implementation of iBooks in nine classrooms during the 2002–2003 school year, the district is providing iBooks to all 5,200 of its fourth, fifth, and sixth graders. Nearly 3,500 laptops were distributed during the 2003–2004 school year. The final 1,700 are scheduled for distribution in fall of 2004. District superintendent, Lynne Rauch, believes standardized test scores will increase. "The amount of writing a student can do typing on the laptop compared to handwriting is amazing. You become a good writer the more you write."

Costs: The total cost of the program is $6,600,000. This includes the hardware, wireless Internet access for classrooms, and 21 video cameras.

"Schaumburg schools buying thousands of laptops for kids" Chicago Sun-Times, September 8, 2003

Kansas, Smoky Valley High School

The Smoky Valley High School has just taken delivery of 340 laptop computers. The laptops were distributed to teachers in January and a pilot program with students will be run during the spring 2004 semester. The remainder of the laptops will be distributed in August. The $450,000 cost of the program is partially offset by a savings of $93,000—the amount the district had planned to spend replacing 75–80 desktop computers. It is anticipated that students will be charged an annual $50 rental fee. The initiative will accommodate parents who are unable to pay the fee. Principal Fred Van Ranken justifies the expense in the face of budget cuts based on the expectation that the laptops will decrease the drop-out rate, attract new students, teach students 21st century skills, and have the potential for allowing elective online courses. "We can't lack vision in the midst of these budget cuts. We still have to help our students be successful in society."

Kentucky, Jefferson County

In fall of 2004, more than 3,200 iBooks will be distributed to students and teachers at two middle schools and two high schools in Jefferson County, Kentucky. All four schools are underperforming and have low percentages of students with access to a computer at home. School officials anticipate three outcomes: students will spend more time on learning, students will have equal access to technology, and students will become better prepared for a world in which computer skills are indispensable.

Costs: The total cost of the program is $5,000,000 divided over four years. The price of the laptops will be $4,500,000. The other $500,000 will be used to purchase online materials, a part-time technician, and other materials. About $450,000 annually will come from district funds. The remainder will come from state and federal funding. Parents will be charged $51 annually for insurance. Principals at each of the four schools are prepared to work out a payment plan or subsidies for parents who cannot afford the insurance fee.

"Laptops approved for four schools" The Courier-Journal, January 13, 2004

Maine

The state of Maine in the year 2002, under the vision of former Governor Angus King embarked on an initiative to provide all middle school students and teachers in the state of Maine with laptop computers. The Maine Learning Technology Initiative (MLTI) was designed to "transform Maine into the premier state for utilizing technology." The initial phase of the MLTI has provided all 7th and 8th grade students and their teachers with laptop computers, technical assistance, and professional development for integrating technology in the curriculum.

This statewide initiative contracted with the Maine Education Policy Research Institute (MEPRI) to conduct the Phase One evaluation of MLTI. MEPRI is a research institute funded jointly by the Maine State Legislature and the University of Maine System to conduct policy research for the legislatures and various studies for state agencies such as the Maine Department of Education and Maine State Board of Education. It was the role MEPRI to evaluate and research the MLTI process as it impacted the process of teaching and learning in the state of Maine.

Evaluation evidence indicates:

- Teachers are using the laptop computers in a variety of methods, such as developing instructional materials, conducting research for instructional purposes, and communicating with colleagues.
- Students have reported using the laptops most frequently for finding information, organizing information, and taking class notes.
- The majority of teachers surveyed reported that the laptops assisted them to more effectively meet their curriculum goals, and individualize their curriculum to meet particular student needs.
- The majority of teachers reported that the utilization of the laptop computers has assisted them to better meet Maine's statewide learning standards.
- 4 out of 5 teachers surveyed reported that students are more engaged in their learning, more actively involved in their own learning, and produce better quality work.

Michigan, Malcolm X Academy

Students in this Detroit inner city, African American school have made dramatic academic progress. Seventh graders who participated in the laptop program in sixth grade now score much higher on state standards for writing and reading than the state average. An impressive 83% met or exceeded state writing standards (compared to the state average of 63%) and 63% met or exceeded state reading standards (compared to the state average of 49%).

Teacher Jeffery Robinson notes that "collaborative, project-based learning activities, in conjunction with the digital tools inherent in the Apple iBook computers, have created a whole new level of engagement with our students."

Minnesota, Mounds Park Academy

According to a school profile on the Apple Education website, the curriculum at Mounds Park Academy "has received a radical, wireless-enabled upgrade that has empowered teachers and students to work anywhere within the school." All 300 students and faculty in the upper school use Apple iBooks. The teachers received their laptops in the spring of 2000, with the students receiving theirs in the fall of 2001. School administrators initially considered laptops to ease the heavy demand on the school's computer lab. After visiting other laptop schools, Bob Kreischer, the school's founder, realized that the laptops would also introduce innovative practices to the school and extend the school day into the home as students took their laptops home.

The school's technology coordinator, Theresa Offerman, notes that the students "always have all of their 'stuff' with them, they're more organized, and they're not losing their assignments. Using the wireless iBooks has really changed the way everyone here thinks, as we're no longer confined to any one room or place."

Outcomes:

- Teachers note that the quality of student research has improved.
- Students are devoting more time to their projects.
- Communication between parents and teachers has been enhanced.

Minnesota, Oak-Land Junior High

Oak-Land Junior High has used carts of laptop computers for the past five years. In the fall of 2003, life science classes began using 1:1 laptops. Teacher Todd Rau reports, "The classroom has become much more student driven, with small groups exploring issues and reporting back to class." Rau has also noted that attendance is up, discipline problems are down, and the students have a new-found excitement to learn.

"Classroom laptops a real life trial for new program" Lake Elmo Leader, November 14, 2003

New Hampshire

All seventh-graders at six New Hampshire schools received iBook laptops in January 2004 in a program modeled after the Maine laptop initiative. The initiative is sponsored by the New Hampshire Technology Promoting Student Excellence project, a private, non-profit organization dedicated to expanding learning opportunities and erasing the digital divide for New Hampshire students. Governor Benson states that participating students "are the pioneers of a new educational world. They will be more equipped and better prepared for any challenge that lies ahead, and their participation will help produce one of the most educated workforces in the country."

"Governor Benson launches laptop program" (http://www.state.nh.us/)

New Jersey, Summit High School

Summit High School serves a culturally and economically diverse student population of 700. Nearly forty different languages are spoken at home by students and their families.

Thanks to the Mayor's Partnership for Technology, all 700 Summit students carry their own laptop computers. The Mayor's Partnership for Technology is a public/private collaboration of educators, residents, corporate, municipal and foundation interests, all committed to supporting and investing in innovative education models in the public schools. Its success demonstrates how a public/private partnership can assist with technology funding when school resources are inadequate.

Supporters of the initiative also point to the intensive professional development as a contributor to the success of the program. Initially, faculty were provided with an comprehensive three-day workshop in the use of the laptop and technology integration. Additionally, a cadre of experienced teachers attended ACOT training. This group now provides mentoring to their peers.

Outcomes:

- Teachers' attitudes and beliefs about the importance of technology as a tool for teaching and learning have moved along a continuum from awareness to application and integration.
- Students and teachers have learned and demonstrated effective use of presentation software.
- Classes benefit from shared information and the use of non-traditional sources.

North Carolina, Green County

Green County is distributing about 1,700 iBooks to its students beginning in the fall of 2003. Every middle and high school student is scheduled to receive a laptop. Middle school principal Jeff Parris believes that computers at home and in the classroom have become a necessity for today's school children. Parents must pay a $40 insurance fee for their children to be able to take the laptop home.

"Green County students get laptops," The Free Press, October 15, 2003

Ohio, Cincinnati Country Day School

According to a school profile on the Microsoft Education website, the Toshiba laptops students use in grades five through twelve have transformed the Cincinnati Country Day School. Many teachers have gone beyond the simple posting of syllabi and assignments, and have created interactive websites for their students. Parents are expected to upgrade their children's laptops every three years.

Professional development at CCDS focuses on one department at a time. All teachers of a particular subject are given substitutes for the day so that they can learn new ways of integrating the technology into their curriculum. The teachers themselves decide what topics are to be covered and who should be invited in as a guest trainer.

CCDS uses a series of four questions to evaluate new technology strategies:

- Is it something that can be done without the technology or is it a refinement or improvement of what we've done before?
- Is it something that fully engages the student in the learning activity or just another way to "deliver" instruction?
- Was it a true learning experience for the teacher as well as the students?
- How "invisible" was the use of the technology from the students' point of view? Did the activity bring the students' attention to the technology or to the content/curricular goals?

Oklahoma, Frontier School District in Red Rocks

Frontier School District serves a population where over half of the students are Native American and two-thirds qualify for free or reduced lunch. A two-pronged approach to technology integration has resulted in dramatic student achievement. First, all students in grades 7–12 were issued laptops and two distance learning classrooms were installed in the high school where students could take courses not offered by Frontier. Secondly, all teachers receive one-half day of professional development per week.

The professional development takes place on Fridays, when students are sent home after a half day of school. Superintendent Steve Shiever states, "For technology to be successful, you must have training. It allows us to keep instruction current, and that really pays off for the students."

Each semester seniors learn three to five new programs as they complete an interdisciplinary "Senior Projects" course.

Outcomes:

- High School principal Randy Robinson claims that the technology has resulted in students pushing themselves and adopting a "can do" attitude.
- School officials note that the school's wireless network helps to level the playing field for students with no Internet access at home. On weekends, the school parking lot is filled with students tapping into the school network to complete homework assignments.
- The number of graduates attending college or vocational/technical schools has doubled.
- Many college-bound graduates find that they can convert their computer skills into good-paying campus jobs to help offset tuition costs.

"District profile" District Administration Magazine, April 2002

Pennsylvania, Greater Latrobe Junior High School

At Greater Latrobe Junior High School, every student and teacher has a laptop computer. The junior high has 1050 students in grades 7–9. The laptops are StudyPros, developed by NetSchools. Each computer runs MS Windows 95, Works for Windows, a browser, and a math-graphing program. The laptops connect to the school network via an infrared system installed in the ceiling of every classroom. NetSchools examined the textbooks adopted by the school and developed webpages with thousands of Internet links to appropriate sites based on district and state standards. Each laptop is capable of storing up to 500 webpages for off-line viewing.

Seventh grade students receive 12 weeks of training during school year. Teachers receive ongoing training about two days a week. Students are expected to recharge their laptops for eight hours at home each evening. They also are responsible for uploading their work to the school server each morning when they arrive at school. One teacher is assigned to work in the laptop repair area each period.

Costs. Each laptop cost $1300. The total cost for the project was $2,100,000. This included building infrastructure/wiring, server, management software, state standards correlation, onsite trainer, tech support, and a laser printer in every classroom. The school estimated that it would have cost $1,700,000 to install the "old model" of technology including 6 desktop computers and a printer in each classroom and three computer labs—one for each grade level. The $400,000 difference between the two approaches equals approximately $350 per student to give each student and teacher a laptop computer.

Outcomes:

- Increased test scores. In 1997 and 1998, 70% of the school's ninth-graders met the district's own writing tests. By 1999 after implementation of the laptop program, 81% of the ninth-graders met it.
- Teachers report that they would not go back to the way they operated their classrooms before laptops. "It's a teacher's dream." "It helps me to get them [the students] from Point A to Point B." "The technology isn't driving us. We are driving the technology."

Lessons Learned:

- The support of the principal and the school board is essential.
- The technology must work and be reliable.
- The district must provide accountability to the public.

"Laptops for all at junior high" Pittsburgh Post-Gazette, September 24, 2000

Pennsylvania, Irving Elementary School

According to a school profile on the Apple Education website, the "McAuliffe Heights" program at Irving Elementary School has resulted in a marked increase in student research and collaboration, high student enthusiasm, and innovations in sharing and collaborating among the staff. Each of the 250 students and every teacher received laptop computer. Principal Pat Labriola notes that Irving Elementary always had computer labs, but that students could use them for only 30 minutes a day. "We viewed the one-to-one laptop initiative as the next logical step in our technology integration." The "McAuliffe Heights" program, named after astronaut Christa McAuliffe, was the result of a think-tank of local educators, administrators, and community leaders brought together to improve education in the low socio-economic district.

Pennsylvania, Quaker Valley School District

The Quaker Valley Digital School District project was far from successful by many measures, but several important lessons can be learned from a reading of the RAND Corporation evaluation of the district in December 2003.

The implementation involved giving laptops to every student in grades three through twelve. Home Internet connections were also provided by the district. The home connections provided by the school were little used as the school district serves a fairly affluent area where a full 85% of the student homes were connected prior to the laptop initiative.

While the usual positive outcomes were reported (increased motivation and engagement, improved collaboration and communication skills, and the availability of new materials for lessons), the lessons learned are more instructive. In general, the implementation seems to have consisted primarily of distributing laptops with little accountability from teachers or students for their use, inadequate technical support, and insufficient professional development regarding technology integration.

The authors of the RAND report note that teachers were held accountable for using the technology to perform administrative tasks, but they were not held accountable for integrating the technology into their teaching. Therefore, all teachers used the administrative tools even if they found them to be more time consuming than previous methods, but the use of the laptops as an instructional tool varied greatly depending on the interests and inclinations of the teacher. The lack of accountability extended to the students as well. Students were able to mistreat their laptops and then turn them in for repair without facing any consequences or receiving additional instruction on the care of their computer. The repair rate for laptops, particularly at the middle school level, was astronomical whereas other iBook initiatives report very few repair needs. Additionally, students were not even held accountable for bringing their laptops to class. Sixth grade teachers report that fewer than half of their students would show up with their laptops on days when they were asked to bring them.

The damage to the laptops through student neglect and mistreatment overwhelmed the technical staff, many units were sent out for repairs, and some repair duties fell to teachers.

The professional development offered to teachers consisted mainly of using software or district administrative tools. Some of the software training was on programs that were not subsequently adopted by the district. Technology integration training was not a part of the formal training. However, some teachers did take it upon themselves to plan technology integration lessons and present them on a voluntary basis to other faculty.

Lessons Learned:

- Professional development must emphasize integration of the laptops into curriculum.
- Teachers and students both must be held accountable for laptop use.
- Adequate technical support must be made available.

Kerri A Kerr, John F. Pane, and Heather Barney, "Technical Report, Quaker Valley Digital School District, Early Effects and Plans of future Evaluation" RAND Corporation, 2003

South Carolina, Beaufort County

According to a school profile on the Microsoft Education website, 306 sixth graders in Beaufort County use laptop computers to increase "student options, student motivation, and student ownership over the learning process."

Beaufort Superintendent Herman Gaither says, "Laptop learning represents the transition from traditional learning to an approach that can carry students and teachers well into the next century. It takes students beyond the classroom, beyond the library, beyond anyplace the teachers have taken them before."

The biggest obstacle to implementation was financial. Voters had just recently passed a bond issue and were unlikely to do so again. An alternative source of funding was required. With the encouragement of the school district, a group of business and community leaders formed a laptop foundation to help underwrite the effort. The foundation leased the laptops and, in turn, leased them to parents of district students. Administrators believe the family contributions to the project are in part responsible for the care students have taken of their laptops.

Costs: The cost to the Foundation to lease a laptop for one month was $57. The Foundation was able to raise $22 toward that cost, so the base monthly charge to parents was $35 for the laptop rental. Students who qualified for reduced price lunches qualified for an additional $10 subsidy, bringing the monthly lease down to $25. For students qualifying for free lunches, the lease was further reduced to $10 per month.

Tennessee, St. Paul Christian Academy

In 2001, St. Paul Christian gave each of their teachers and students in grades one through six a laptop computer. The school also purchased a printer for each family with students attending the school. A wireless network was installed and teachers were trained on the use of the laptop. Head of school, Kenneth Cheeseman, noted that formerly it was difficult for teachers to make technology a part of learning. He referred to the problems of designing lesson plans for students to use a limited number of desktop computers in the classroom as a "deal-breaker" for technology use. "If we could make technology as seamless as 'Take out your notebook' … then we'd have a chance to have some authentic integration."

Costs: The 2001 cost of the laptops was $1,400 each, or $700,000 for the entire project. Parents must sign an agreement to take financial responsibility for the laptops.

"School gives students laptops to integrate technology into life" The Tennessean, October 21, 2001

Texas, Ursuline Academy of Dallas

According to a school profile on the Microsoft Education website, technology is a pervasive part of the school culture at Ursuline Academy.

"Our mission is to produce citizens literate in the medium of our times—and the tool of our times is the computer," says Principal Shaun Underhill. "We're seeing students being much more creative then they had been in the past with the same assignments. Because the notebook PCs make it easier to do the work, students can spend more time thinking about what they're doing. Revisions are easier so they can experiment with more alternatives. Students are really thinking more and better. They're really communicating."

Teacher Dina Benson says, "What I see with the laptops is amazing. Girls who've struggled with pen and paper are blooming with our laptop projects. It shows me—and them—that they understand the concepts and are learning. They just need to learn in a different way, and the laptops allow that. Nothing motivates like success, and you can't pay for the type of motivation I'm seeing in the classroom. I wouldn't have traded this year for anything."

Teacher inservice training for the laptop initiative has been especially successful. The faculty had nine months to prepare for the entering laptop class. The regular teacher-training program was expanded with the addition of 2 to 3 classes per week. The trainings were offered from 4 to 6:00 p.m. and gave teachers the opportunity to pick and choose topics that interested them. The classes covered technology integration and changes in the classroom as a result of the technology. They also provided a forum for teachers to exchange views, problems, and solutions.

Costs: In addition to the school's $6,400 tuition, each parent was charged $2,600 for the laptop program of which $2,200 paid for the machine and $400 was retained by the school to cover insurance, loaner laptops, and additional software. Twenty of the 211 entering freshmen received assistance with the laptop fee from a variety of sources. No machine was entirely free because school officials believed that some family contribution was necessary to instill a sense of ownership and responsibility.

Vermont, Sharon Academy

According to a school profile on the Microsoft Education website, the Tablet PC enhances learning and creativity in the middle school classroom at Sharon Academy in central Vermont. Michael Livingston, Assistant Head of the school, says, "There's no question that technology increasingly plays a role in education for all of us. The Tablet PC has become a very popular item here." Teacher Ed Koren notes, "The Tablet PC accents and influences the quality of the work that the students are able to do." Humanities teacher Curtis Koren says, "These are the best computers we have. We've just been having a great time with them. Everyone has an application."

Virginia, Henrico County

Henrico County Public Schools in Richmond, Virginia, deployed a total of 25,000 wireless capable laptops to students and faculty in the district's middle and high schools. High school students and staff received laptops during 2001–02 school year, middle school students and staff in 2002–03, and plans are being made for all elementary students and staff to receive laptops by the end of the 2004 school year. Teachers were given laptops a full year before full deployment increasing their ease of use and confidence in the technology. The school system is currently working on providing low cost Internet access to any student who does not have sufficient home access.

"We wanted fewer lectures and more engaged, active learning using dynamic, current content," explained Mark A. Edwards, Superintendent. "We believe, and now we can demonstrate, that providing universal access to laptops at the middle and high school level connects students to their school work in powerful new ways. This 24-7 access facilitates the kind of hands-on, creative environment where students learn best."

Virginia's Standards of Learning tests support Edward's claims. Scores in Standards of Learning tests showed improvement in 9 of 11 fields, including increases of 14 points in World History and 20 points in US History. High school accreditation increased from 63 to 75% in the districts schools and the number of graduates continuing their education rose 2.5%. A dropout rate of 1.52% is the lowest in the history of the school district.

Henrico County's firm commitment to professional development gave teachers the skills and tools to be effective. Staff development included curriculum writing workshops, summer institutes, site-based institutes, a full time trainer in each high school and middle school, and training CDs and videotapes.

Edwards feels the following principles are instrumental to the success of a laptop program:

- Think big
- Find a business partner
- Sweat the details—network capability is a key issue
- Listen to and train the teachers
- Enlist the broadest possible support—administration, principals, teachers, students, PTA, business and community leaders
- Reach out to parents—provide parent resource centers and offer parent training

Appendix B

National Educational Technology Standards for Students

National Educational Technology Standards for Students

1. Basic operations and concepts

- Students demonstrate a sound understanding of the nature and operation of technology systems.
- Students are proficient in the use of technology.

2. Social, ethical, and human issues

- Students understand the ethical, cultural, and societal issues related to technology.
- Students practice responsible use of technology systems, information, and software.
- Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.

3. Technology productivity tools

- Students use technology tools to enhance learning, increase productivity, and promote creativity.
- Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.

4. Technology communications tools

- Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
- Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.

5. Technology research tools

- Students use technology to locate, evaluate, and collect information from a variety of sources.
- Students use technology tools to process data and report results.
- Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.

6. Technology problem-solving and decision-making tools

- Students use technology resources for solving problems and making informed decisions.
- Students employ technology in the development of strategies for solving problems in the real world.

Appendix C

21st Century Skills

21st Century Skills

The Partnership for 21st Century Skills is a unique public-private organization whose work is supported by the U.S. Department of Education and promotes the goals of the No Child Left Behind Act. Founding members of the Partnership include Apple, Cable in the Classroom, Cisco, Dell, Microsoft, NEA, SAP, and the Time Warner Foundation.

The goal of the Partnership is to define and incorporate into learning the skills that are necessary for students to succeed in the 21st century. To this end, the Partnership has identified the following six elements as critical for creating 21st century learning:

1. Emphasize core subjects

The core subjects provide a foundation for 21st century skills. The No Child Left Behind Act identifies the following as core subjects: English, reading or language arts, mathematics, science, foreign languages, civics, government, economics, arts, history, and geography.

2. Emphasize learning skills

In addition to core subjects, students need to develop the necessary skills to continue as lifelong learners:

- information and communication skills
- thinking and problem solving skills
- interpersonal and self-directional skills

3. Use 21st century tools to develop learning skills.

Students in the 21st century must be proficient the use of 21st century tools including:

- information and communication technologies
- computers, networking, and other technologies
- audio, video, and other media and multimedia tools

4. Teach and learn in a 21st century context.

Students learn academic content best when teachers create an environment that:

- makes content relevant to student lives
- brings the world into the classroom
- takes students out into the world
- creates opportunities for students to interact with each other, with teachers, and with other knowledgeable adults in authentic learning experiences

5. Teach and learn 21st century content

Educators and business leaders have identified additional content areas essential for student success in the community and in the workplace:

- global awareness
- financial, economic, and business literacy
- civic literacy

6. Use 21st century assessments that measure 21st century skills

Teachers and schools must balance standardized testing and classroom assessments.

- standardized tests must measure both core subjects and 21st century skills
- standardized tests must be balanced appropriately with classroom assessments to measure the full range of the students' skills in a timely way
- classroom assessments must be strengthened and integrated with the instructional process to reinforce learning, provide immediate feedback and help students learn core subjects and 21st century skills

The Partnership recommends nine steps to build momentum for integrating 21st century skills:

1. Embrace a powerful vision of public education that includes 21st century skills.
2. Align leadership, management and resources with educational goals.
3. Use this tool to assess where schools are now.
4. Develop priorities for 21st century skills.
5. Develop a professional development plan for 21st century skills.
6. Make sure students have equitable access to 21st century education.
7. Begin developing assessments to measure student progress in 21st century skills.
8. Collaborate with outside partners.
9. Plan collectively and strategically for the future.

Additional information and reports by the Partnership for 21st Century Skills are available on the web at http://www.21stcenturyskills.org

Appendix D

Florida STaR Chart

Florida School Technology and Readiness (STaR) Chart

The Florida STaR chart has been an invaluable roadmap for the thinking of many of the Laptop Task Force members. Given the comprehensiveness of the STaR chart, Task Force members felt that it would be helpful to include the standards in an appendix along with additional comments relating the standards to the use of laptop computers. Please note that for the purposes of this appendix, the STaR chart has been slightly reformatted. In its published chart form, it is designed to be read from bottom to top to facilitate the interpretation of school profile data presented in graph form. For the purposes of this narrative however, it seemed best to present items in a top-to-bottom order. Also, it is important to note that the sections headed "Task Force Comments" are comments by the Task Force on the implications of each section for a laptop initiative. These comments are not a part of the published STaR chart.

Each category has indicators for entry, intermediate, advanced, and target levels. Each level builds upon the previous one, and may retain the same technology traits while expanding in depth and breadth.

Technology Administration and Support:

Technology Planning

Entry	School has a technology plan Planned technology use mainly for administrative tasks such as word processing, budgeting, and attendance
Intermediate	Educational technology planning aligns with District/State technology plans Planned technology use for internal planning, budgeting, applying for external funding and discounts for direct instruction and some student use
Advanced	Educational technology planning is integrated into the SIP process and approved by the school's SAC committee The collaboratively developed technology plan guides policy and practice, planned technology use addresses higher order teaching and learning for ALL students (including ESOL and ESE), and is regularly updated
Target	The school's administration, teachers, and staff actively support technology planning The technology plan focuses on student success; planned technology use is based on needs, research, proven teaching, and learning principles; Revised annually
Task Force Comments	*The need for careful technology planning is magnified by the introduction of laptop computers into the classroom. As indicated in the STaR chart, the focus of any technology implementation (including a laptop initiative) must remain on teaching and learning, rather than administrative tasks. It is critically important that a laptop initiative not leave any child behind either in terms of hardware or curriculum. All students must be given access to curriculum that emphasizes higher order teaching and learning. Furthermore, the need for careful research regarding the use of laptops is necessary, but beyond the means of most schools and even some districts. For this reason, the Task Force is recommending a strong research component as a part of any state-supported laptop initiative.*

Technical Support

Entry	Technical support comes from outside the school Technical support response time greater than 24 hours
Intermediate	Part-time school-based technical support Technical support response time less than 24 hours
Advanced	Full-time school-based technical support capable of troubleshooting basic network and hardware repair including assistive technologies Technical support response time less than 8 hours
Target	Full-time school-based technical support with additional staff as needed (including faculty) to support network and web production Technical support response time less than 4 hours
Task Force Comments	*A lack of technical support can undermine any laptop program. Successful initiatives have often included loaner laptops for students when an extensive repair is needed. Many schools have also trained both teachers and students to solve minor support problems, thereby freeing technical support staff to focus on more serious issues.*

Instructional Technology Support

Entry	Instructional Technology support comes from outside the school
Intermediate	Part time school-based instructional technology specialist
Advanced	Full time school-based instructional technology specialist
Target	Full time school-based instructional technology specialist and additional staff as needed (including faculty) with expertise in specialized areas of integration
Task Force Comments	*The Task Force has noted that the amount of instructional technology support may vary greatly depending on the predominant style of teaching in a school. If a school tends toward a student-centered, constructivist style of teaching, then teachers can often be quite successful with a basic introduction to the capabilities of the students' software followed by examples of technology integration. In the best schools, technology integration can take on a life of its own and creative uses spread rapidly from one teacher to the next. On the other hand, schools that tend toward a traditional teacher-centered model, will often need significantly more assistance from instructional technology specialists. A laptop implementation must be an integrated part of school reform. A teacher who insists on being the sole source of knowledge in a classroom is on a collision course with a class of students who have been given the means to obtain multiple sources of information, develop higher order thinking skills, and collaborate with their classmates and others.*

School Budget

Entry	Budget for hardware and software purchases and professional development
Intermediate	Budget for hardware and software that is accessible to all students, professional development, and some ongoing costs
Advanced	Budget for hardware and software that is accessible to all students, professional development, and ongoing costs
Target	Budget also addresses facilities and investigation of new technologies Budget reflects the goals identified in technology plan
Task Force Comments	*The Task Force agrees that the school budget should provide hardware and software accessible to all students as well as professional development for teachers. Sustainability must be taken into account. Laptops are not simply a one-time purchase. Budget provisions should be made for support and hardware replacement. To be effective, professional development must be ongoing, so provisions must be made for funding.*

Funding

Entry	District, state and federal technology allotments only
Intermediate	In addition to allotments, seeks grants and other funding such as bond funds, business partnerships, donations, foundations, and other local funds designated for technology to meet enhanced technology needs and minimal instructional technology needs
Advanced	Successfully obtains funding from one source other than their allotment
Target	Successfully obtains funding from two or more sources other than their allotments
Task Force Comments	The Task Force recognizes that funding will become a major consideration as laptop implementations transition from smaller pilot or demonstration projects to widespread rollouts. Schools and districts will have to look beyond their continuing technology allotments. Successful laptop initiatives across the country have been funded by a mix of bond funds, business partnerships, donations, foundations, and the reallocation of other local funds. For example, monies can be redirected from textbooks to technology as laptops reduce the dependence on traditional textbooks. The business community, in particular, has been recommending that our schools add important 21st century skills to the curriculum. A laptop initiative that includes such an emphasis may well attract additional community and business support.

Technology Capacity:

Student Computer Access

Entry	One modern computer per instructional area, or 10 or more students per computer; no refresh cycle
Intermediate	Fewer than 10 students per one modern computer; refresh cycle every 5 years Special needs workstations (including Universal Access stations) limited to special education instructional areas Student access to computers for after-school care students or by special arrangement
Advanced	Fewer than 5 students per one modern computer; refresh cycle every 4 years Special needs workstations (including Universal Access stations) limited to some instructional areas and media center After-school access to computers for all students 1–5 hours per week
Target	One computer per student; refresh cycle every 3 or fewer years Special needs workstations (including Universal Access stations) are available in all instructional areas as needed After-school access to computers for all students over 5 hours per week
Task Force Comments	*The Task Force notes that the established target level of student computer access in Florida is one-to-one and that issues of after-school access would be resolved if the students were permitted to take their laptops home with them.*

Teacher Computer Access

Entry	One dedicated teacher computer per 2 or more teachers; no refresh cycle
Intermediate	One dedicated computer per teacher; refresh cycle every 5 years
Advanced	One dedicated modern computer per teacher; refresh cycle every 4 years
Target	One dedicated modern computer per teacher; refresh cycle every 3 or fewer years
Task Force Comments	*The Task Force believes that teacher computer access is a critical prerequisite to any successful student laptop program.*

Internet Access

Entry	Dial-up connectivity to the Internet available to support web-based applications only on a few computers
Intermediate	Direct connectivity to the Internet at the school and accessible in some rooms Adequate distribution of bandwidth to the school to avoid most delays
Advanced	Direct connectivity to the Internet at the school and all instructional areas Adequate bandwidth to each instructional area over the LAN to avoid most delays
Target	Anywhere, anytime direct access to the Internet for any desired application Bandwidth supports multiple web-based applications
Task Force Comments	*A laptop computer with a wireless connection would provide access throughout and around the school campus.*

Video Capacity

Entry	Video available in the instructional area on magnetic or optical media Media is available via instructional area device such as VCR or DVD player
Intermediate	Capacity to schedule and distribute video over school network to the instructional area Capacity to receive via satellite and distribute programming to the instructional area
Advanced	Capacity to schedule and distribute video over district or cable access network to the instructional area Two-way interactive video conferencing used to connect schools
Target	Network provided video on demand Two-way interactive video conferencing used to connect to postsecondary institutions and other education providers
Task Force Comments	*Two-way video conferencing capability should be included in laptop specifications in order to meet this standard*

LAN/WAN

Entry	Fewer than 5 networked computers connected to the LAN (Local Area Network within the school) Some computing devices connected into a server environment Limited print/file sharing capabilities
Intermediate	Most instructional areas connected to the LAN with student access Minimum 10/100 hubbed network Servers are capable of serving some applications for instructional purposes
Advanced	All instructional areas connected to the LAN with student access Minimum 10/100 switched school network Schools are connected to the district via a WAN Servers are used to connect schools
Target	All instructional areas connected to the LAN/WAN with student access WAN has 100 MB/GB and/or fiber switched network that allows for resources in the instructional day (e.g., video streaming, desktop conferencing) Anytime, anywhere access to network
Task Force Comments	*The Task Force notes that a number of laptop initiatives have been victims of their own success. In these schools network utilization rose dramatically as students engaged in research and collaboration activities. A school must ensure that its network can handle the increased demands of a 1:1 student laptop implementation.*

Curriculum-based Tools

Entry	Limited access to some instructional equipment (i.e., televisions, VCRs, digital cameras, scanners, programmable calculators, etc.) Tool-based software limited to word processing and spreadsheets
Intermediate	Shared use of instructional equipment among groups of teachers Tool-based software includes presentation, some graphics and concept mapping
Advanced	Instructional equipment assigned to each teacher/ instructional area including at least a computer with projection device, TV, and VCR or DVD Tool-based software includes some multimedia authoring and video editing
Target	Fully equipped instructional areas with all the technology that is available to enhance student instruction including all forms of software, digital cameras, scanners, other devices specific to content areas resources for students and teachers including some wireless connectivity and off campus access
Task Force Comments	*An essential piece of any laptop initiative must be tool-based software, including multimedia authoring and video editing. The goal of a laptop implementation is not to replace print textbooks with equivalent electronic textbooks. Included software should be sufficient to enable students to be producers, not merely consumers, of content. There should also be a shared supply of digital devices such as scanners, still and video cameras, microphones, science probes, etc., to provide students with multiple sources of digitized content for their projects.*

Educator Competency and Professional Development

Educator Use of Technology

Entry	Teachers use e-mail and word processing programs Technology not used to review student assessment information
Intermediate	Streamlined administrative tasks (grades, attendance, lesson planning, etc.) Technology used infrequently to review student assessment information
Advanced	Technology used for research; creating templates for students; multimedia and graphical presentations and simulations; and correspondence with experts, peers, and parents Technology frequently used to review student assessment information
Target	Teachers explore and evaluate new technologies and their educational impact; technology used for inquiry, analysis, collaboration, creativity, content production, and communication Technology regularly used to review student assessment information which results in needed changes in instruction
Task Force Comments	*A teacher laptop would greatly facilitate many of the teacher tasks itemized above. Every teacher who has ever prepared multimedia presentations at home has dealt with the difficulties of transferring all of the related files to disks, taking them to school, and checking to make sure they work on the classroom machine. A teacher laptop that can be taken home would facilitate presentation, research, and administrative tasks.*

School Administrators

Entry	Recognizes benefits of technology in instruction Limited use of technology
Intermediate	Recognizes benefits of technology in instruction for all students and supports use of technology in instruction Routinely uses technology in some aspects of daily work
Advanced	Recognizes and identifies exemplary use of technology in instruction for all students Models use in daily work including communications, presentations, on-line collaborative projects and management tasks
Target	Promotes exemplary use of technology in instruction for all students; advocates and encourages parental and communal involvement in the training and integration of technology and education Maintains awareness of emerging technologies; participates in job-related professional learning using technology resources
Task Force Comments	*It is essential that the principal or curriculum leader have a vision of how technology can improve the teaching and learning process. Administrators must be equipped to model how technology can be used as a productivity tool in their schools.*

Professional Development Budget

Entry	5% or less of money spent on technology for your school is devoted to professional development in technology-related training
Intermediate	6–24% of money spent on technology for your school is devoted to professional development in technology-related training
Advanced	25–29% of money spent on technology for your school is devoted to professional development in technology-related training
Target	30% or more of money spent on technology for your school is devoted to professional development in technology-related training
Task Force Comments	*The most recent STaR Survey indicates an average of only 14% is spent for professional development. This should be increased to at least 25% to bring it into the "Advanced" range.*

Models of Professional Development

Entry	Leader presents information to group of teachers Training provided by school or district staff
Intermediate	Teachers participate in hands-on instruction with follow-up to activity Additional training provided by outside instructors brought to the school
Advanced	Majority of instructional staff participate in coaching, modeling of best practices, scaffolding, and school-based mentoring Educators participate in workshops, conferences, and seminars outside the school/district
Target	Learning communities created among instructional staff to provide continuous coaching, modeling of best practices, and school-based mentoring to promote individual growth Additional professional development available any time, at any level, through a variety of delivery systems
Task Force Comments	*Just as 1:1 laptop computing encourages a movement in the classroom environment from teacher-centered activities to more effective student-centered activities, a 1:1 laptop initiative for teachers would tend to move professional development from the leader-centered "entry" level to the recommended learner-centered "target" level.*

Content of Professional Development

Entry	Teachers become acquainted with technology (i.e., basic computer skills)
Intermediate	Teachers learn to use technology in the classroom (i.e., administration, management, and or presentation software; Internet as a research tool; vendor-specific training)
Advanced	Teachers learn to use technology with curriculum/students (i.e., integration skills for creating learner-centered technology projects using Internet, applications, multimedia presentations, data collection; making accommodations with assistive technologies; etc.)
Target	Teachers learn about emerging technologies and their uses with curriculum/students (i.e., creation and communication of new technology-supported, student-centered projects)
Task Force Comments	*Learning to use technology effectively is a process that takes place over time. Professional development should be designed to move teachers from lower-order skills such as basic knowledge and comprehension to higher-order skills such as synthesis and evaluation.*

Learners and Learning:

Student Use of Technology

Entry	Infrequent use by students as a basic tool for drill and practice, and/or integrated learning labs
Intermediate	Frequent individual use by students to access information resources for communication and presentation projects
Advanced	Students regularly use technology for working with peers and experts, evaluating information, analyzing data and content in order to solve problems, and evaluating individual progress
Target	Students regularly use technology for working collaboratively in communities of inquiry to propose, assess, and implement solutions to real world problems, and for evaluating and analyzing their own assessment information to improve learning Students communicate effectively with a variety of audiences
Task Force Comments	*Technology is more than a tool to provide content or deliver an electronic textbook. Student must have opportunities to create their own knowledge and products, mimicking real world situations.*

21st Century Classroom

Entry	Teacher-centered learning Teachers allow students to use technology to work on individual projects
Intermediate	Teacher-directed learning Teachers encourage students to use technology for cooperative projects in their own classrooms Teachers support student use of technology to accomplish curriculum goals
Advanced	Teacher-facilitated learning Teachers establish communities of inquiry for students to collaborate with community members Technology is embedded in core curriculum areas
Target	Student-centered learning Teachers act as mentors/ facilitators with national / international business, industry, and university communities of inquiry to develop 21st century skills Technology is vital to all curriculum areas and embedded in daily instruction
Task Force Comments	*If we want the high level of learning we need project based, student-centered learning.*

Secondary Technology Courses

Entry	Offers some technology courses
Intermediate	Offers a variety of technology courses on different topics or at different levels
Advanced	Offers at least one sequential program of study in an area of technology
Target	Offers multiple sequential programs of study in technology
Task Force Comments	*All students need the 21st century skills recommended elsewhere if they are to succeed in the workplace and community. These are skills that should be embedded in all courses. However, we also need to provide additional technology courses for those students who will be entering technical fields requiring prerequisite skills and knowledge.*

Community Outreach

Entry	Uses technology such as voice bulletins, voice mail, and telephone homework hotlines to communicate with parents Parents can access school computers during extended (noninstructional) hours
Intermediate	Uses email to communicate with parents School offers technology awareness programs for parents (e.g., family tech night or through web sites or videos)
Advanced	Uses a variety of technologies, including the Internet, to communicate with parents/community School staff lead technology training for parents/community
Target	Uses a variety of technologies, including radio or television broadcasting, to communicate with parents/community School participates in establishing technology access centers for the community Students lead technology training for parents/community
Task Force Comments	*Laptops going home to students' families will greatly increase communication between school and parents. Many schools with laptop program report a dramatic increase in parent involvement with the school, increased parent attendance at PTA meetings, and opportunities for parent technology training in the evenings. When parents are actively involved in their children's school, student achievement tends to rise. Laptops going home with students ensure that all parents have access to email and a direct method of communication with the school.*

Accountability

Student Technology Standards

Entry	Core curriculum teachers address the technology implicit standards (SSS)
Intermediate	Specific student technology standards beyond SSS adopted
Advanced	A method for monitoring and evaluating student progress established Technology integrated into curriculum areas; grade level and subject-area expectations for technology established
Target	All technology standards for students are accomplished
Task Force Comments	*A 1:1 laptop program is the most effective means of achieving the standards that have been set by the State of Florida and the Federal government for student technology literacy.*

Teacher Technology Standards

Entry	Up to 25% of educators meet Educator Accomplished Practices (EAP) #12 at or above the Professional level proficiencies and utilize them in the classroom
Intermediate	At least 25% of educators meet Educator Accomplished Practices #12 at or above the Professional level proficiencies and utilize them in the classroom
Advanced	At least 50% of educators meet Educator Accomplished Practices #12 at or above the Professional level proficiencies and utilize them in the classroom
Target	At least 75% of educators meet Educator Accomplished Practices #12 at or above the Professional level proficiencies and utilize them in the classroom
Task Force Comments	*Laptops computers would give teachers the tool they need to meet the standards set by the State of Florida for Educator Accomplished Practice #12.*

Appendix E

Florida Educator Accomplished Practice #12:

Technology

Florida Educator Accomplished Practice #12: Technology

Competencies for Teachers of the Twenty-first Century

Revisions to Sample Key Indicators Approved September 5, 2003

(Aligned to the National Educational Technology Standards for Teachers)

	Pre-professional	**Professional**	**Accomplished**
	The pre-professional teacher uses technology as available at the school site and as appropriate for the learner. She/he provides students with opportunities to actively use technology and facilitates access to the use of electronic resources. The teacher also uses technology to manage, evaluate, and improve instruction.	The professional teacher uses technology (as appropriate) to establish an atmosphere of active learning with existing and emerging technologies available at the school site. She/he provides students with opportunities to use technology to gather and share information with others, and facilitates access to the use of electronic resources.	The accomplished teacher uses appropriate technology in teaching and learning process.
Alignment to NETS for Teachers	**Sample Key Indicators**		
1: A, B	Demonstrates technology literacy as defined by Document 1 (Florida Technology Literacy Profile). *(Document 1 follows this chart.)*	Routinely demonstrates a basic level of technology competency, and assures that students have opportunities to attain basic technology literacy skills.	Teaches technology literacy at appropriate skill levels.
2: C 3: A 6: B, C	Uses technology tools on a personal basis.	Uses technology tools that enhance learning opportunities that are aligned with the Sunshine State Standards.	Evaluates and implements technology tools that enhance learning opportunities that are aligned with Sunshine State Standards and meet the needs of all learners.
6: A, D	Demonstrates awareness of and models acceptable use policies and copyright issues.	Models legal and ethical uses of technology.	Teaches legal and ethical uses of technology. Teaches legal and ethical uses of technology.

	Pre-professional	Professional	Accomplished
2: C 3: C 4: C	Identifies and uses standard electronic media.	Identifies and uses standard electronic media to provide instruction at appropriate student skill level.	Evaluates and uses a wide range of instructional technologies (e.g., CD-ROM, interactive video, videotaping, and electronic libraries) to enhance the subject matter, assure it is comprehensible to all students, and develop higher order thinking skills.
2: B 4: A	Uses technology in lesson and material preparation.	Uses technology to construct teaching materials and learning activities.	Uses technology to construct a variety of teaching materials and assessment exercises and applies current research on integrating technology when planning for instruction.
2: D, E 3: D 4: B 5: B	Identifies technology productivity tools to assist with management of student learning.	Uses technology productivity tools to monitor and manage student learning.	Makes classroom management decisions based on data derived from the use of technology productivity tools and monitors student learning in a technology-enhanced environment.
2: E 3: D	Teaches students to use available computers and other forms of technology.	Teaches students to use available computers and other forms of technology as they relate to curricular activities.	Facilitates student learning of technology as it relates to curricular activities.
2: A, B 3: B, C 6: E	Creates authentic tasks using technology tools and recognizes the need for learner-centered environments.	Integrates authentic tasks and provides increased opportunities for independent learning for all students through the use of technology tools.	Facilitates and learns along with the students, empowering all students to become independent learners in a technology-rich, learner-centered environment.
2: C	Selects and utilizes educational software tools for instructional purposes based upon reviews and recommendations of other professionals.	Reviews, and recommends educational software tools for instruction.	Analyzes and evaluates the effectiveness of educational software tools on student learning.

	Pre-professional	Professional	Accomplished
5: D	Uses digital information obtained through intranets and/or the Internet (i.e., email, research).	Uses and disseminates digital information to stakeholders through intranets and/or the Internet.	Develops and publishes digital content and provides students with opportunities to gather and share digital information through intranets and/or the Internet.
5: D	Uses technology to collaborate with others.	Participates in collaboration within the school via technology to support learning.	Collaborates via technology beyond the boundaries of the school to support learning.
5: A, B	Develops professional goals relating to technology integration.	Includes technology integration goals in a professional development plan.	Incorporates technology integration goals in a professional development plan as addressed in the school improvement plan.
	The pre-professional teacher uses accessible and assistive technology to provide curriculum access to those students who need additional support to access the information provided in the general education curriculum as available at each school site.	The professional teacher uses accessible and assistive technology to provide curriculum access to those students who need additional support to access the information provided in the general education curriculum as available at each school site.	The accomplished teacher uses accessible and assistive technology to provide curriculum access to those students who need additional support to physically or cognitively access the information provided in the general education curriculum as available at each school site.

Document 1: Florida Technology Literacy Profile

Note: Document 1 provides a common definition of technology literacy as it is used in the sample key indicators of Educator Accomplished Practice #12.

Technology literacy is the ability to responsibly use appropriate technology to communicate; solve problems; and access, manage, integrate, evaluate, and create information to improve learning in all subject areas and to acquire lifelong knowledge and skills in the 21st century.

Framework for Technology Literacy	Performance Indicators	Profile of a Technology Literate Individual
1. Basic operations and concepts Individuals are able to access resources and utilize them in daily work.	Individuals demonstrate a sound understanding of the nature and operation of technology systems. Individuals are proficient in the use of technology.	The individual will apply strategies for identifying and solving routine hardware and software problems that occur during everyday use.
2. Social, ethical, and human issues Responsibility and citizenship are an essential consideration as individuals learn with technology.	Individuals understand the ethical, cultural, and societal issues related to technology. Individuals practice responsible use of technology systems information, and software. Individuals develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.	The individual will demonstrate knowledge of current changes in information technologies and the effect those changes have on the workplace and society. The individual will exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse.
3. Technology productivity tools Technology plays a pervasive role in the knowledge construction of individual work.	Individuals use technology tools to enhance learning, increase productivity, and promote creativity. Individuals use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.	The individual will use content-specific tools, software, and simulations (e.g., environmental probes, graphing calculators, exploratory environments, Web tools) to support learning and research. The individual will apply productivity/multimedia tools and peripherals to support personal productivity, group collaboration, and learning throughout the curriculum.

4. Technology communication tools Effective communication is enriched through the use of technology.	Individuals use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences. Individuals use a variety of media and formats to communicate information and ideas effectively to multiple audiences.	The individual will design, develop, publish, and present products (e.g., Web pages, videotapes) using technology resources that demonstrate and communicate curriculum concepts to audiences inside and outside the classroom.
5. Technology research tools Individuals leverage learning opportunities by utilizing technology for research.	Individuals use technology to locate, evaluate, and collect information from a variety of sources. Individuals use technology tools to process data and report results. Individuals evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.	The individual will collaborate with peers, experts, and others using telecommunications and collaborative tools to investigate curriculum-related problems, issues, and information, and to develop solutions or products for audiences inside and outside the classroom. The individual will research and evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources concerning real-world problems.
6. Technology problem-solving and decision-making tools Problem solving is a valued individual skill that can be amplified through the use of technology.	Individuals use technology resources for solving problems and making informed decisions. Individuals employ technology in the development of strategies for solving problems in the real world.	The individual will select and use appropriate tools and technology resources to accomplish a variety of tasks and solve problems. The individual will demonstrate an understanding of concepts underlying hardware, software, and connectivity, and of practical applications to learning and problem solving.

Sources for Document 1

Definition and chart: SETDA NLI Toolkit, April, 2003
Framework for Technology Literacy: NETS standards and description
Profile of a Technology Literate Individual: NETS 6–8 grade profile

Appendix F

Florida STaR Survey

Florida STaR Survey

In the Fall of 2003, over 2,500 elementary, middle, and high schools in Florida responded to the STaR Survey. The STaR Survey is a comprehensive inventory of technology readiness. The following items from the 2003 STaR Survey relate to topics covered in this report.

Instructional Areas and Labs

Number of classrooms: 130,024
Number of media centers: 2,755
Number of computer labs serving general education: 4,739
Number of computer labs serving special education: 1,405
Number of computer labs serving vocational education: 2,443
Number of mobile labs: 1,397

Teacher Workstations

Number of modern teacher workstations: 143,985
Number of modern teacher workstations that are mobile: 30,489

Students Assigned Modern Computers

Does your school provide individual students with a modern computer for their exclusive use while at school?

Yes	255 schools	(10.14%)
No	2259 schools	(89.86%)

How many students have been provided a modern computer for their exclusive use while at school?

33,128

Are students allowed to take their assigned computer home?

Yes	85 schools	(33.33%)
No	170 schools	(66.67%)

Internet Connection

Most common Internet connection:

73%	T1
12%	Fibered, wired, connected to another district location

63% of schools reported that 100% of their instructional areas have direct connectivity to the Internet

85% of schools reported that their Internet connection is either dependable or very dependable

Digital Devices

(% of schools that have at least one of the following devices)

99% of schools have VCRs
97% of schools have projection devices
95% of schools have scanners
94% of schools have digital still cameras
80% of schools have digital video (or video/still combination) cameras
58% of schools have hand-held devices
58% of schools have DVD players
42% of schools have dedicated, portable word processors
26% of schools have graphing calculators (other than software-based)
11% of schools have digital probes

Professional Development

What percentage of the money spent on technology for your school is devoted to professional development in technology-related training?

Average amount spent was: 14%

25% of the schools devoted 0% of the technology budget to PD
60% of the schools devoted 10% or less of the technology budget to PD
88% of the schools devoted 25% or less of the technology budget to PD

Student Software Use

Which phrase best characterizes the **primary** way in which students at your school use technology in their class work?

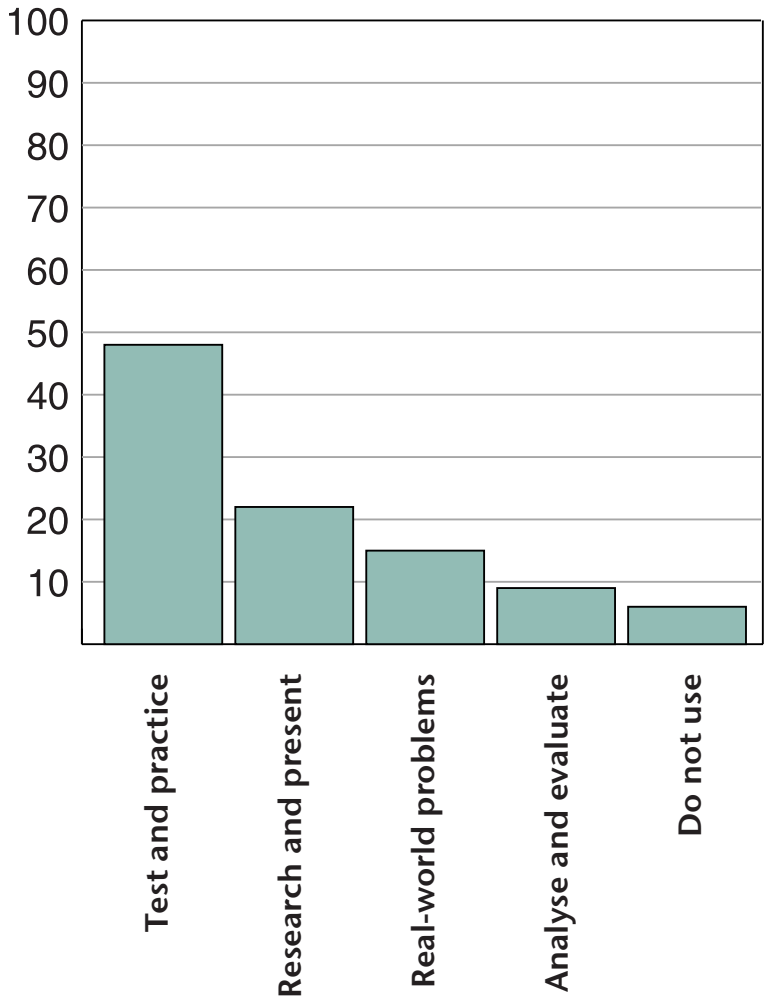
58% Testing and practicing for skill mastery in core curriculum areas

35% Researching and presenting by individual students on a variety of topics in several/ subject areas

4% Collaborating to propose, assess, and implement solutions to real-world problems

2% Working with other students to analyze data and evaluate information

1% Students do not use technology in their class work



Approach to Technology Use

Which of the following is **the most common** approach to technology use in your school? Technology is most commonly used as a

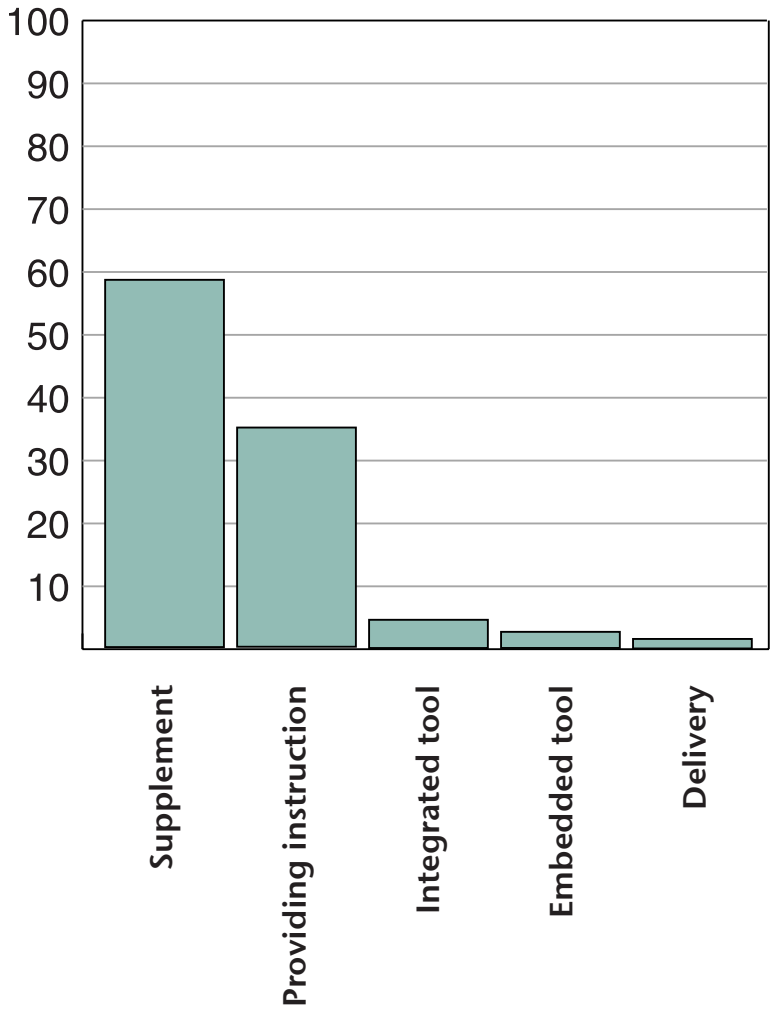
48% supplement to instruction (e.g. programs or games used for skill practice).

22% tool for providing instruction (e.g. integrated learning system)

15% tool integrated into core curriculum areas (e.g. word processors, spreadsheets, probes, etc.)

9% tool embedded in daily instruction for all curriculum areas (e.g. word processors, spreadsheets, probes, etc.)

6% method for delivery of instruction (e.g. lectures with PowerPoint, etc.)



Appendix G

Laptops for Learning Teacher Survey

Laptops for Learning Teacher Survey

In January of 2004, approximately 350 Florida teachers responded to an informal survey of laptop use within their classrooms. The survey was developed by the Laptops for Learning Task Force and conducted over the Internet. About half of the respondents were elementary teachers and about one quarter each were high school and middle school teachers. The results do not represent a scientifically selected, random sample of teachers in Florida. Most of the teachers who chose to participate did so because they were already using laptops to some degree and/or had an interest in technology. The results do, however, help to identify how technology is currently being used in classes that have at least occasional access to laptops. Several dozen teachers who have no access to laptops for their classes also completed the survey. Finally, two teachers completing the survey expressed the opinion that state and district funds would be better spent on teacher salaries than on technology.

1. Type of laptop access for students.

51% of the respondents reported that their class had access to mobile labs (i.e. carts of laptop computers)
28% reported that their students had 1:1 laptop computing, but that their students were not permitted to take the laptops home
8% reported that their students had 1:1 computing and that the students were permitted to take the laptops home

2. Type of software used on the student laptops.

90% reported the use of word processing software
68% presentation software
51% concept mapping
49% graphics
49% spreadsheet
25% video editing
24% multimedia authoring

3. Frequency of use by teacher according to the following scale:

6=Often during the day
5=Once a day
4=A few times a week
3=Once a week
2=Less than once a week
1=Never

5.06 Communicating with colleagues inside and outside the school
4.23 Managing student information
4.00 Developing instructional materials (handouts, tests, etc.)
3.67 Conducting research that contributes to lesson plans and curriculum design
3.58 Communicating with parents and students
3.51 Providing classroom instruction
3.23 Producing homework assignments
3.17 Assessing student work
2.47 Creating and/or maintaining website(s) for instructional purposes

4. Frequency of use by students according to the following scale:

6=Often during the day
5=Once a day
4=A few times a week
3=Once a week
2=Less than once a week
1=Never

2.75 Researching information using the Internet
2.58 Doing drills to increase their competency (educational drill software, online quizzes, FCAT Explorer, etc.)
2.24 Writing first drafts of papers
2.21 Editing papers
2.17 Working on short-term assignments/worksheets
2.09 Taking tests/quizzes
2.08 Creating culminating projects to show what they have learned (web pages, multimedia projects, video, etc.)
2.08 Managing/analyzing information
1.79 Taking notes on the computer
1.66 Working with spreadsheet databases
1.58 Sending/receiving email

Teachers were given the opportunity to comment on any of the questions. A number of their comments follow and have been grouped according to topic. Many of the teachers mentioned how laptops were currently being used in their classrooms:

> Along with another class, our students created a PowerPoint presentation that represented the chapters in the book *Charlotte's Web*. Soon we will be using the mobile lab as part of our differentiated instruction during our language arts period.
>
> My students do research, film the experiments we are working on, and put it all together in a PowerPoint presentation for the others in class. They provide hand outs and write an assessment for their part of the lessons. The retention rate has gone way up when this teaching style is used.
>
> I try to utilize the laptops in ways that allow the students to interact with their environment (Intel Microscope, AirPorts, etc.) so the computer is not stuck to the wall, but an interactive part of the learning.
>
> I use laptop computers for students to take notes on when a debate is being held. It is interesting to see how various students rate the participants and evaluate the material presented. We print out the notes of several students and compare them. Many students are able to take notes faster using the computer. The laptop allows them to be located in various places around the room.
>
> My students have been learning to use digital cameras, download to a computer and then make a book and a movie from the photos. They worked in teams during the 100th Day of School.
>
> My 4th and 5th grade students this year have had the opportunity to use their e-mail accounts weekly since there are not more computers in the classroom that connect to the internet. They are so excited and truly enjoy writing each other and the teachers in this building! It would be fabulous to give these students the opportunity to use laptops daily with their e-mail, typing rough drafts, rewriting, HyperStudio, presentations, and other projects that students could be working on to gain information and knowledge.
>
> Having taught the students PowerPoint early in the school year has reaped many benefits. If they need a cover for a report, they can whip that up in no time. They don't even ask if they can do it on the computer...that fact is just a given now! :) I assigned a rock/mineral report recently and they automatically started doing research on the computer and knew where to go on the Internet to get the needed information.
>
> My 4th graders wrote to various Chamber of Commerce offices in major Florida cities. Then, we researched those cities on the laptop. They will write reports, film the reports with a digital camera and play it through the computer.
>
> I am very pleased to be able to use the laptop laboratory with my students. The organization of subject matter, online research and editing and proofreading to make their work suitable for publishing, is accomplished through the use of our lab. It is wonderful to watch the students enter into writing experiences eagerly!

I have a science lab for grades K–5, so my use of the mobile lab is perhaps more research-based, and project-driven than a regular classroom. We visit LOTS of interesting sites to find out information on particular topics and we use the laptops also for presentation and graphing projects in the context of taking the data we've collected in our experiments and research and organizing it in an understandable way.

Some of the comments emphasized laptop use with early grades:

The earlier the tools (laptops) are introduced, the quicker the basic/functional skills of using these tools are mastered. The K–1 students mastered refreshing screens and opening and closing programs in a matter of days. The potential for their use of these tools is impressive.

The two mobile labs in our school have enabled and encouraged real-world learning regardless of grade level. Grade two students are the most active, especially with multimedia projects.

Nothing is more fun than seeing a five year old using a laptop for the first time. They can lay on the floor where they are most comfortable and "play" on a computer. They don't realize that they are learning. Before you know it there is a whole group gathered around all working together. It is hard to decide who will be able to use the one laptop.

I am amazed at how much I have used my laptop to enhance the curriculum in my first grade class. I find that integrated technology is a powerful tool for motivating students.

It is very important to me, as a first grade teacher, to expose my students to all types of learning. The information on computers is vast and giving children the freedom to explore is critical to learning.

I had a few of my first graders create a PowerPoint for adding doubles plus one. I thought it might be too difficult but I showed them anyway. They did a great job and saved me a lot of time. Now we show it to the whole class to review math facts.

I created a PowerPoint Presentation for my kindergartners "Word of the Day." They really took to it, and I think it helped them to understand the thought processes that are involved with segmentation and blending.

Some teachers commented on their use of technology with special needs students:

The term just changed and Jun, an ESOL student entered my class. He let me know that he had a language "problem" and that he may need extra help. The laptop gave him an unbelievable tool to demonstrate that his intelligence goes far beyond the language concerns, and his work on Keynote and iMovie proved that though he is new to this country, language will not be an issue for long. His language continues to improve every single day.

I teach ESE students and believe that these computers provide motivation as well as the use of software that better enables them to understand information being presented. Also, their creativity is really tapped into.

I've used the settings to have the laptops read the web page or assignment to lower readers. It empowers them to feel competent that the written language is not a barrier. Their interest and performance go up!

I teach an ESE class. Individual instruction using computers is very beneficial since instruction is often very individualized. My class produces a science show each week using IMovie. The show is viewed each week by 650 students. Everyone loves it.

Although not a laptop initiative, I have been instrumental in the process of ensuring students have access to assistive technology and I believe it made a difference in the motivational level of these particular students. I strongly believe the more we incorporate reality into classrooms the more relevant students' learning experiences will be. The more relevant the learning experience the more likely they will be to transfer these skills to real life experiences. Incorporating technology into the classroom is my goal as an educator and I believe it will make a huge difference in my students' ability to experience success at school! Learning can be fun!

I teach children with special needs. Neither I nor my students have laptop computers to use currently. We could greatly benefit from the use of them as our room size and the wheelchairs make for tight situations and we currently use all four of my classroom computers daily.

Other comments noted the results of students using laptop computers:

We conduct our Media Literacy lessons using small groups of 4/5 students using an iBook. The students are much more on task, work together, show excitement about the lesson, and have really produced some creative and encouraging results.

Students love to work on the laptops. They want to stay after school to use them more.

I borrowed my laptops from the county. Those were the most electric lessons the students participated in. They loved having their very own laptops at their desks applying math in a very different manner.

iMovies are an incredible motivator for any activity. Students enjoy expressing themselves through iMovies. Students of all levels enjoy creating the visual displays to present their understanding of difficult science concepts.

Students learn best by teaching each other.

Kevin says, "Having a laptop makes me very responsible." Taylor says, "Using laptops is preparing us for jobs in the future when we will use technology." Grace uses her computer to explore and helps her problem-solving abilities. Kaitlin says, "Using the computers motivates me to do my work. Using paper and pencil is boring!"

It really motivates the kids to want to learn more. They enjoy working together and creating meaningful projects.

I had a student last year say that she was happy that she was working so hard. Apparently, the laptops made learning more complex. She said, "I know you're preparing me for college." I believe that's extremely important. The laptops and the ability to fine tune a project adds importance to a project and makes the student focus on effort and on presentation while paper and pencil work generally only produces weak materials.

Third graders are like sponges and are anxious to absorb any knowledge I throw at them. They are not inhibited by the platform nor type of computer. They are at home on the desktop as well as the laptop. However, when my students had an opportunity to each have a laptop for a week,

it was like the ultimate experience of a life-time. In fact, one mom told me that her son said it was the best school experience that he has ever had.

My school has a cart with only 12 laptops. When I am able to schedule it in my class, the students are excited and engaged with the work they are doing. They not only receive valuable educational/curriculum learning, but also hands-on practical application skills.

My students loved the laptop I received as part of a CTIP grant. Many students had never had an opportunity to use one before.

Mobile labs are nice but they just don't compare to giving each child a laptop. Laptops for students will give each child instant access to e-mail, word processing, film editing, etc. I have found using laptops helps student produce quality work stay organized and love school.

When we first began using the laptops it was difficult to patiently teach students the simplistic uses but now students are not afraid to explore, make mistakes, and correct them!

We are going into our third year of utilizing laptops in the classroom. The most marked observation I can make (as Instructional Technology Facilitator) is the ease with which students use the laptop as a tool for learning has increased tremendously. It has also increased the comfort level of teachers with their own technology use. Teachers are not as intimidated by the new technologies.

J. B. Sanderlin is a new elementary school. Our focus is on using technology as a tool for learning. All of our teacher and student stations are laptops. In setting up the school I was able to train a fourth grade student to "clone" our iBooks. With his help we were able to get up and running very quickly. He "cloned" about 100 stations. Cloning put all of the necessary software and updates on each station. Each cloning took about 5 minutes.

A number of teachers noted that 1:1 laptop initiatives help to bridge the digital divide:

We would love to have the opportunity to have laptop available for check out so our less fortunate students have the chance to use a computer at home.

I believe each elementary student needs to have his or her own laptop provided by the school because the world they will live in is totally computerized. Many families can't afford computers or laptops so their children will be behind. If you provide textbooks for various subjects then you should provide laptops for technology.

My students use the laptops frequently and would really benefit from the initiative to take them home. Most of my students don't even have a computer and I believe they would love it.

I would love to be involved in a one to one classroom situation. I believe the students who do not have a computer or internet at home are at a distinct disadvantage. For instance, the State of Florida offers FCAT Explorer test prep over the Internet, but the children who need it the most don't have access.

Several teachers commented on their own use of the laptops:

> Having a laptop has made it possible for me to continue to optimize my productivity.
>
> Personal laptop kept open in a word processing document that contains my lesson plans and is revised as I teach daily so that lesson plans constantly change for the better and reflect student needs.
>
> The laptop is used for IEP development, lesson planning, PowerPoint presentations, iPhoto, and other related activities.
>
> My first graders are not using laptops because we don't have any access to them but I use mine extensively at school and at home to help me with instructional processes.
>
> The best example I have of using laptops with a group is in a teacher training. We issued laptops to all the participants. It changes everything. We had no handouts; instead we posted things or used websites. I had teachers accessing sites to accomplish five different hands-on activities, all of which we happening simultaneously. All I did was facilitate, but it takes a real paradigm shift as an instructor
>
> I do not have a laptop. I have borrowed one from our mobile lab but I don't like doing this since it takes them away from the students.
>
> I wish I could use the laptop to write IEPs at home.
>
> I think I would have been a better student in school if computers had been available.

One teacher who moved from a 1:1 laptop school to a school without 1:1 noticed her teaching suffered:

> I went from a school that had initiated laptops for each student to a school where I was able to get some or all of my students' access once every three months or so. I found my technology based approaches suffered and I taught with less creativity. Basically you get spoiled, in a good way.

Several teachers who do not have 1:1 laptops in their classrooms indicated they were ready to participate in an initiative:

> I took an integrating technology class given by our tech person in the school and we each developed a unit around technology and learned how to make a Web Quest. Since this class I can't get away from using technology in the class. My students loved it. I loved it and we learned so much!! I wish we could have laptops for each and every student!!
>
> I have seen classrooms with a class set of laptops as well as talked to teachers that have this resource. I believe every student should expect this useful tool in their classroom. I look forward to the day when my classroom has them.
>
> My students have already won second and third places at my county's Educational Multimedia Awards (EMAs) for their multimedia presentations. With a laptop in each one of my students' hands the possibilities are absolutely endless! That would finally bring my classroom teaching and my students learning processes into the 21st century! I beg you to let me pilot this initiative for you!

Appendix H

Software

Software

Student laptops should include software chosen for its potential as a cognitive tool, enabling students to interpret and organize their knowledge. Such "tool-based" software promotes the development of higher order thinking in students. If students are to successfully construct their own learning experiences, they will need access to a complete set of tools, including the following:

Graphic Organizers. Graphic organizers and concept mapping visually represent concepts, providing an alternative method of organization for the learner. The use of symbolism to represent ideas enhances critical thinking skills. Benefits of graphic organizers in the classroom include brainstorming and story webbing, two critical steps in the writing process.

Presentation Tools. Students access, analyze, and frame information in an organized and logical manner and effectively communicate their findings to an audience of their peers through the use of presentation software. Graphic, audio and design enhancements provide visual stimulation to concepts presented, allowing students to create their own multimedia presentation.

Web Authoring. Web authoring software not only allows students the opportunity to publish their work on the World Wide Web but also provides lifeskills such as teamwork, collaborative learning and time management. Students in the Miami-Dade area worked in teams to develop websites for organizations in the community, providing a real world application to learning.

Digital Video. Digital video provides a new dimension to active learning. A video essay or live-action film is an opportunity for multi-dimensional learning. Students engage in a step-by-step process that includes visualizing, storyboarding, writing, organizing and creating. In digital video editing, students' critical thinking skills are enhanced. With the addition of music and audio editing software, customized sound can complement the project. Completed products provide not only alternative means of presentation but also alternative means of assessment.

Multimedia Authoring. Multimedia authoring refers to the presentation of material using more than one "natural sensory" medium. Multimedia presentations include two or more of the following; text, graphics, video, animation, and sound, and can use various means of delivery. Multimedia addresses a variety of learning styles, fosters digital literacy, and improves communication and comprehension skills. Drawing, painting and animation programs as part of multimedia authoring or as stand alone tools supplement any application and can be used as independent learning tools as well.

Word Processing. Word processing is no longer considered a computerized typewriter. This digital document creator provides more than just text. With the integration of graphics, charts, and images and the ability to create templates, a paperless classroom looms in the immediate future.

Spreadsheets. Spreadsheets allow students at all grade levels the opportunity to enter, compare, manipulate and interpret date. Not only do spreadsheets allow students mathematical manipulation of numbers, they also provide visual displays through the use of graphing. Text, too, can be manipulated and organized, providing valuable feedback for the learner. As data can be easily manipulated, outcomes appear immediately, providing the student with answers to the "what ifs?"

Database. By increasing productivity for both teachers and students, databases prove a valuable cognitive tool in and beyond the classroom. The use of databases to organize and classify information into major fields allows both students and teachers the ability to analyze, synthesize and evaluate critical information and to present that information in a meaningful format.

Internet Communication. The addition of a web browser, email, instant messaging and video conferencing software provides opportunities for world-wide communication. Through this global network, students have the means to communicate with a world of experts, providing learning opportunities that were once thought out of reach. Not only is world-wide communication possible, it is also timely, providing immediate feedback in some cases.

Calendar. Calendar software replaces cumbersome homework planners, agendas, logbooks and/or schedulers. Uniformity of such tools allows for organizational ease in the classroom and at home, producing more effective and efficient learners today and more productive workers in the future.

	Graphic Organizer	Presentation	Web Authoring	Photo Editing & Graphics	Digital Video Editing	Multimedia Authoring	E-mail & Conferencing	Word Processing	Spreadsheets	Databases
Information and Media Literacy Skills: Analyzing, accessing, managing, integrating, evaluating, and creating information in a variety of forms and media. Understanding the role of media in society.	●●●	●●	●●●	●●●	●●●	●●●	●●	●●	●●	●●
Communication Skills: Understanding, managing, and creating effective oral, written, and multimedia communication.	●●	●●●	●●●	●●●	●●●	●●●	●●●	●●●	●●	●●
Critical Thinking and Systems Thinking: Exercising sound reasoning in understanding and making complex choices; understanding the interconnections among systems.	●	●●●	●●●	●●	●●●	●●●	●●	●●	●●●	●●●
Problem Identification, Formulation, and Solution: The ability to frame, analyze, and solve problems.	●●●	●●	●●	●	●●	●●	●●	●●●	●●●	●●●
Creativity and Intellectual Curiosity: Developing, implementing, and communicating new ideas to others.	●●	●●●	●●●	●●●	●●●	●●●	●●●	●●●	●●	●●
Interpersonal and Collaborative skills: Demonstrating teamwork and leadership; adapting to various roles and responsibilities; and working productively with others.	●	●●	●●	●	●●	●●	●●●	●	●	●
Self-direction: Monitoring one's own understanding and learning needs, locating appropriate resources, and transferring learning from one domain to another.	●●●	●●	●●	●●	●●	●●	●●	●●	●●	●●
Accountability and Adaptability: Exercising personal responsibility and flexibility in personal, workplace and community contexts.	●	●	●●	●	●●	●●	●●	●	●	●
Social Responsibility: Acting responsibly with the interests of the larger community in mind; demonstrating ethical behavior in personal, workplace, and community contexts.	●	●●	●●	●	●●	●●	●●	●	●	●

KEY: ●●● = Software strongly supports this 21st century skill
●● = Software often supports this 21st century skill
● = Software can support this 21st century skill

Support of 21st century skills by various software types when used in a project-based classroom.

Appendix I

Research Direction

Research Direction

Across the state, there have been several cutting-edge pilot projects using laptops, which have gained national recognition. Anecdotal evidence from these efforts has been largely positive, and encourages us to pursue this concept on a larger scale. Before a complete state-wide implementation of laptops to every student, further investigation should be conducted on a larger scale, and under more controlled conditions. Such research should build upon the lessons learned from previous smaller-scale pilot projects, and should be designed to follow rigorous scientifically-based research methods.

In undertaking a state-wide laptop initiative, Florida has a unique opportunity to conduct and disseminate research that is far ahead of what others have done. However, it is important that the pilot program be carefully designed in a way that is optimal for rigorous academic research to be conducted. A simple project evaluation at the end of the pilot is not sufficient. In order to carry out the research that a project of this scale demands, it will be necessary to assemble a team of academicians who are nationally recognized for their experience and expertise in educational research, and to carefully design the implementation of the initiative to optimize conditions for rigorous research.

Research Team

It is recommended a team be assembled of six to seven researchers from universities across the state of Florida. The lead researcher will be appointed by the task force, and will participate in final selection of the remaining team members. Team members will be identified based upon their expertise in different types of research, covering a range of quantitative and qualitative expertise. Team members should also have presented at state and national conferences on research conducted dealing with educational technology. Selecting researchers who are affiliated with colleges of education in Florida will have an additional benefit of enhancing and informing pre-service teacher education.

Design of the Laptop Initiative for Research Purposes

Select a proven device. It will be critical to select a laptop device that is currently in use in Florida schools, has shown positive results, and has proven ready for use in a larger study. A careful comparative analysis should be conducted of all the leading laptops used in one-to-one initiatives in Florida schools. The laptops selected should have characteristics of those used in the most successful district pilot initiatives. A new or untested device should not be used in a project such as this.

Consistent Implementation. There must be a consistent implementation of the laptop devices across study sites, including hardware, software, teacher training, and technical support. Variations in these elements will greatly diminish the inferences that can be made from research results from this initiative. Another important issue is that the laptop device should be one that is robust with key features, while

requiring a minimum of technical support. If the laptops require extensive initial training and continued support, these factors run the risk of confounding study results.

Deliverables

In order to get a complete picture of results, the Research Team will be charged with completing a series of research studies that employ a full range of educational research methods. These methods should include quantitative, qualitative, and mixed methods approaches. The final report from this team should include a complete set of academic papers, suitable for publication in peer-reviewed educational research journals.

The research team will be asked to present their findings at state and national academic conferences including, but not limited to, Florida Educational Research Association, Florida Educators Technology Conference, American Educational Research Association, Association for Educational Communications & Technology. Given the range of research methods that will be employed and the common theme, the team will be encouraged to submit proposals and present findings in a symposium format. Once the final report is completed, the team should submit individual papers to peer-reviewed academic journals for publication.

Appendix J

References

References

Branigan, Cara. (2003, December 24). MDR: Schools that fail AYP are below average in tech use. [Electronic version]. *eSchool News*. Retrieved December 29, 2003, from http://eschoolnews.com/news/showStoryts.cfm?ArticleID=4798.

Brookhart, S.M. (2003, Winter). Development measurement theory for classroom assessment purposes and uses. *Educational Measurement: Issues and Practice* 22(4), 5-12.

Curriculum reform movement. (n.d.). Retrieved December 8, 2003, from the North Central Regional Educational Laboratory, Pathways to School Improvement website: http://www.ncrel.org/sdrs/areas/issues/methods/assment/as5curri.htm.

Enterprise Florida, Inc. (n.d.). *Partnering To Shape Florida's Economic Future Florida Strategic Plan for Economic Development,* 2002-2007. Retrieved December 8, 2003, from http://www.eflorida.com/strategicplan/2002/PartneringStrategy02-07.pdf.

Essential conditions to make it happen. (n.d.). Retrieved December 8, 2003, from The International Society for Technology in Education (ISTE), National Educational Technology Standards for Students (NETS) website: http://cnets.iste.org/students/s_esscond.html.

Florida Department of Education. (2003). *Reports, Graduation & Dropout Rates by District, 2002-03 School Year.* Retrieved December 8, 2003, from Education Information and Accountability Services web site: http://www.firn.edu/doe/eias/eiaspubs/2003grad.htm.

Gaines, C.L., Johnson, W., & King, D.T. (1996, June). Achieving technological equity and equal access to the learning tools of the 21st Century. [Electronic version]. *T.H.E. Journal.* Retrieved December 8, 2003, from http://www.thejournal.com/magazine/vault/A400.cfm.

Gleeson, P.B., & Matrix Rehabilitation. (2003, February). *Managing and motivating the generations: Implications for the student and the employee.* Retrieved December 9, 2003 from http://www.aptaeducation.org/csm2003/4413.pdf.

Laptop computers in the classroom. (2003). Retrieved December 12, 2003, from the Florida Senate Online Website, Florida Senate 2003-2004 Interim Work Program Reports and Summaries: http://www.flsenate.gov/cgibin/View_Page.pl?File=index.html&Directory=Publications/2004/Senate/reports/interim_reports/&Tab=committees&Submenu=2

McAdoo, M. (2000). The real digital divide: Quality not quantity. In D.T. Gordon (Ed.), *The digital classroom: How technology is changing the way we teach and learn* (pp. 143-150). Boston: Harvard Education Letter.

Meekins, R. (2001, December 13). Strategic goals in educat-ion: The global context. *Florida Board of Education Strategic Planning Workshop.* Retrieved December 8, 2003, from http://www.fldoe.org/meetings/reorgWorkshop/StrategicGoalsEducation.pps

Moore, W. (2003, January). Facts and assumptions of assessment: Technology, the missing link. *T.H.E. Journal* 30(6), 20-26.

Olsen, T. & Beardsley, P. (2003). *Beginning the dialog: A joint forum on technology-based assessment.* Retrieved December 8, 2003, from the CoSn/ISTE/SETDA Joint Forum Summary Report web site: http://www.iste.org/jointforum/summary.cfm

Partnership for 21st Century Skills. (2003). Retrieved December 8, 2003, from http://www.21stcenturyskills.org.

Rockman, S. (2003, Fall). *Learning from Laptops. Threshold.*

Rodriguez, G. & Knuth, R. (2000). *Critical issue: Providing professional development for effective technology use.* Retrieved December 8, 2003, from the North Central Regional Educational Laboratory, Pathways to School Improvement website: http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te1000.htm.

Salpeter, J. (2003, October 15). *21st Century Skills: Will our students be prepared?* [Electronic version]. *Tech Learning.* Retrieved December 2003, from http://www.techlearning.com/story/showArticle.jhtml?articleID=15202090.

Shepard, L. (2000, October). The role of assessment in a learning culture. *Educational Researcher* 29(7), 1-14.

Silvernail, D. & Lane, D. (2004). *The Impact of Maine's one-to-one laptop program on middle school teachers and students.* Maine Education Policy Research Institute, University of Southern Maine Office.

Solomon, G., Allen, N., & Resta, P., (Eds.). (2003). *Toward digital equity: Bridging the divide in education.* Boston: Pearson Group.

State of Maine. (2001). *Report by Task Force on the Maine Learning Endowment.* Retrieved December 8, 2003, from http://www.state.me.us/mlte/history/mlterpt.pdf.

Swain, C., & Pearson, T. (2001). Bridging the digital divide: A building block for teachers, *Learning and Leading with Technology* 28(8), 10.

Trombley, J. (n.d.) *Project Laptop: Achieving Equity and Access to Technology in a Public High School.* Retrieved December, 2003, from http://horizon.unc.edu/projects/monograph/K12/edited/Trombley.asp.

United States Department of Education. (1994, February 15). *Connecting families and schools to help our children succeed.* Retrieved December 8, 2003, from http://www.ed.gov/PressReleases/02-1994/parent.html.

Wheeler, S. & Bausch, L. (2003, March). *The wireless classroom and deployment process.* Retrieved December 8, 2003, from http://www.dell4k12.com/offers/article_290.pdf?DGVCode=EM.