The Florida Senate

LAPTOP COMPUTERS IN THE CLASSROOM

SUMMARY

The objective of this project is to examine specific examples where mobile computing is being integrated into K-12 education to determine what the experience has been in terms of costs and benefits.

During the past three years, the number of schools conducting pilot projects implementing one-to-one student use of laptops has increased rapidly throughout Florida and other states. Pilot projects are using a variety of approaches: a single classroom; an entire grade level; middle school only; etc.. Some projects use mobile labs and some allow students to take laptops home.

All of the pilot programs are very new and little data is available to measure their benefits. The available evaluation data consists primarily of the responses of students and teachers to interviews. Overall the responses have been positive and support continuation of the pilots. Among the concerns were: a lack of technical support required for one-to-one student use of computers; a lack of professional support required for integrating technology with curriculum, teaching, and learning; and a lack of financial resources to sustain the effort beyond the pilot programs.

The Florida Department of Education and all school districts in Florida use National Education Technology Standards. Almost 100% of Florida's school districts have a published technology plan and more than 65% of schools report that their school technology plan is actively supported by the faculty and staff. Over 97% of Florida schools, 87% of classrooms, and 50% of student homes have Internet access. Based on the Florida School Technology Readiness chart at least 20 school districts are ready to begin introducing one-to-one student use of computers.

The cost of laptops with sufficient capacity for classroom use has recently declined to approximately $1,000 each. With more than 2,500,000 students enrolled in K-12 education in Florida, the cost of providing a laptop for each student at today's cost would be $2.5 billion. The current annual expenditure of Florida's school districts for educational technology is approximately 20% of that amount. Education technology professionals have reason to believe that machines are currently in development that will soon be available for one-fourth to one-half the price of today's laptop.

The development of a digital computer that is wireless, mobile, durable, Internet capable, and financially feasible for use in K-12 education makes it possible to integrate technology with curriculum, teaching, and learning, and to have 21st Century classrooms where students are active engaged (instead of passive) learners, and teachers are mentors and facilitators of learning.

BACKGROUND

The ability to use information technology is increasing in importance for enhancing teaching and learning and has become a basic skill in many fields of employment. Due to economic barriers, many individuals are not afforded opportunities to become proficient in the use of technology.

More than 2,500,000 students are enrolled in K-12 public education in Florida. In response to the Department of Education 2003 Florida Technology Resource Survey, school districts reported that almost 475,000 modern (internet capable) and 138,000 non-modern (not internet or multimedia capable) computers are located in instructional areas in the schools. The four primary locations of the modern computers are: classrooms -265,000; computer labs -149,000; media centers -14,000; and mobile labs -14,000. Most of these computers require the use of wired technology and tend to remain in a stationary location and are

available for student use only at pre-scheduled times during the regular school day.

In Florida an enormous amount of attention and effort has been given to providing teachers and students access to technology for instruction and learning. Almost 100 percent of the school districts have a published technology plan and more than 65 percent of schools report their school technology plan is actively supported by the faculty and staff. Over 97 percent of schools, 87 percent of classrooms, and 50 percent of student homes have Internet access.

Yet, there is considerable concern that many students are not learning the information technology skills required to participate in today's technological economy in which officers of 70 percent of employers report their companies are concerned about the lack of information technology talent needed to support the U. S. economy.

A combination of factors inherent in the technology initially used in education limits the ability of schools to assist all students to become proficient in the use of information technology. Some of these factors are: 1) stationary location of computers; 2) cost per computer; 3) lack of student access for hands on use; 4) limited interactive curriculum; 5) lack of technology training for teachers; and 6) lack of technical support. These and other factors lead to the notion that the computer could be used only as a resource, such as the library shared by multiple users, and therefore was not available for teachers to be used in planning and delivering classroom instruction and as a primary tool used in student learning. The 2002 Florida Study of Educational Technology reported that 89 percent of respondents believe that the future use of the computer will continue to be supplemental, while 11 percent believe that in the future the information in printed textbooks can be accessed online as interactive text for use by teachers and students.

One of the early applications of computers in K-12 education was the creation of the school "computer lab" in which computers were located in a single room for shared use by the entire student body. This meant that for students to use the computers they had to leave their regular classrooms to go to the "computer lab." Because there were many more students in the school than computers it was difficult to integrate computer technology into each student's curriculum. As schools were able to purchase additional computers, rather than setting up additional stationary "computer labs" they created "mobile computer labs." This made it possible

for computers to be taken to the classroom where the students were located, instead of the students leaving the classroom to go to where the computers were located. Schools could have more than one "mobile lab." This change provided greater access to computers for instruction, but still required pre-scheduling and the lab set-up and take-down time reduced the amount of time allotted for classroom instruction. A third change was to install one or more computers directly in classrooms. This gave the teacher and students access to a computer for any class on any day. However, the other limiting factors had not been overcome.

The development of a laptop computer that is wireless, mobile, durable, and less costly, overcomes some of the factors that limited the integration of technology with curriculum, teaching and learning. Introduction of the laptop computer to K-12 education makes it possible to provide teachers and students one-to-one, 24 hour, 7 day access to the computer for the entire curriculum. The laptop can be carried home for students to continue their school work outside the hours of the regular school day. The laptop has the added advantage of providing opportunities for increased parental involvement in their children's education producing benefits to both parents and students.

METHODOLOGY

The following methodology was used. Published literature including reports by external evaluators about the use of laptops in the classroom in the United States and in other nations was reviewed. Information from technology providers was reviewed to determine availability of laptop hardware and software. Information about the use of laptops in the classroom in Florida public schools was obtained from publications and interviews with technology professionals currently active in K-12 education in Florida.

FINDINGS

Today's students are called the "Millennial Generation" identified as those born between 1976 and 2000. Almost 100 million young people born during this period (36% of the total population) will come to adulthood having grown up with the Internet and the use of technology such as digital music player, video game console, cell phone, digital camera, satellite TV, digital cable TV, and the computer.

Children and teenagers use computers and the Internet more than any other age group. According to the U. S.

Department of Education 90% of children between the ages of 5 and 17 use computers and more than 90% of students in the 12-18 age group use the Internet.

Since the early 1990's, laptop computers have repeatedly been suggested as a tool to improve instruction and student learning. Since 1996 the use of mobile computers has spread worldwide.

Laptop Projects

Listed below are some of the schools where laptop computers have been provided (or will be provided in 2004-2005) in sufficient numbers to provide teachers and students one-to-one access for regular classroom instruction. Some schools have pilot programs that allow students to take their laptops home. Table 1 lists Schools by Name/Location, and when available, the number of laptops/students, grade level, and cost.

Table 1 – Laptop Projects

Locations other than Florida
Henrico County, Virginia
23,000 Laptops
High school students
Apple "One-to-One Initiative"
4-year lease--$37.2 million

State of Maine
33,000 Laptops
7th and 8th graders
Apple "i-Books"
3-year lease--$30 million State Appropriation
plus Private Donations

State of Michigan
Freedom to Learn Project
132,000 Laptops
All 6th graders in the state
Lease --$39 million ($22 State and $17 Federal)

Quaker Valley School District, Pennsylvania
Demonstration Project
1,300 Laptops all students in grades 3-12
$4.1 million State and District Funds—
Paying for wireless internet for 700 student homes

Oklahoma City Public Schools, Oklahoma
10,000 Laptops and wireless carts
Dell--$25 million contract

Deer Valley Unified School District, Arizona
200 Laptops
5th graders in 2 low income schools

Gwinnett County, Georgia
Laptops for all teachers, instructional personnel, and administrators
150 Laptops with wireless carts for high schools and 15 Laptops with wireless carts for elementary schools
Dell--$7.9 million

Locations in Florida
Howard Middle School, Jefferson County
450 Laptops –Apple "i-Book"
All 5th graders
$600,000 Federal Grant— Enhancing Education Through Technology (EETT)

Manatee County School District
Technology integrated with standard curriculum "Project Based Learning"
22 Elementary and Secondary Schools
Apple i-Book –Approximately $1,000 each EETT

Haile Middle School, Manatee County
200 Laptops
5th grade and 7th grade
$500,000 Federal Grant (EETT)

Bayshore High School, Manatee County
Students in selected classrooms
Apple "i-Book" –
$986 per student Laptop--$1,100 per teacher laptop
$1.9 million and $200,000 for High Speed Wireless Network for the school

Palmer Trinity School
Interactive texts—trying to eliminate books
IBM ThinkPad –anytime, anywhere wireless access

Pine Crest School
Project based technology immersion
900 computers for grades 7-12
Anytime, anywhere access extends student learning experience beyond the classroom

Carrollton School of the Sacred Heart, Miami
241 Laptops for students in grades 7-12

North Broward Preparatory School, Coral Springs
1,500 Laptops for use on campus

Moton Elementary School, Hernando County
60 Apple i-Books
Internet-based interactive curriculum—Destination Reading

St. Johns County
700 Laptops
Middle School and Elementary School
At least one class in each elementary school
Apple "i-Book" Federal Grant (EETT)

St. Lucie County
Laptop Academy (school within a school) uses the laptop as the principle tool through which instruction is delivered. The Laptop Academy uses integrated instruction among science, math, English, and social studies. Each student in the academy is given a laptop computer to keep for the duration of the school year.

Ocoee Middle School, Orange County
150 Compaq Tablet Computers equipped with a year's worth of interactive learning materials---$2,000/ Laptop
7th graders
$1 million—Donation by Microsoft, Hewlett Packard, and Harcourt Education

Booker Middle School, Sarasota County
Apple "One-to-One Initiative"

Okaloosa/Walton Charter School
Students in grades 9-12
Laptops are checked out for the year

Florida Virtual School
Statewide
Grades 9-12 – All subjects
2,000 FTE
$8.4 million state funds plus revenue from non-Florida users

Many of the early one-to-one laptop pilot programs have involved students from low income families. This is to make sure that all students have access to information technology and the opportunity to become skilled in its use. Another reason may be the availability of funding from Federal Title I in which 25% of funds must be used for instructional technology for students.

Evaluation of Projects
Only a small number of the schools listed in Table 1 reported experience of two years or more of providing mobile computers for the teacher and each student in a classroom; therefore, third party evaluation or other evaluation data is limited. The evaluation data that is available consists primarily of the responses of students and teachers to interviews.

The Maine Learning Technology Initiative

In March 2003, the Maine Education Policy Research Institute reported student, teacher, and school perspectives in a Mid-Year Evaluation for year one of the Maine Learning Technology Initiative (MLTI). The Mid-Year Evaluation focused on these three questions:
1. How are the laptops being used?

2. What are the impacts of the laptops on teachers, students, and schools?
3. Are there obstacles to full implementation of the Maine Learning Technology Initiative?

Liverpool Central School District

In the Evaluation Report of the High School Laptop Computer Program for the 2000-2001 school year, the second year of this program, the evaluator concluded the following: "Within subjects, and across grade levels, it appeared that the more experience and enthusiasm the teacher had for the Program, the better the experience for the student in Year 2. Within the same grade and/or same subject, two laptop students could and did have very different experiences – depending on which teacher's class they were assigned."

Manatee County School District, Florida

A current program in Manatee County involves 22 classrooms ranging from elementary through high school. After one year of implementation, observers report the following: 1) Teachers are teaching differently and students are more engaged in their school work; 2) Student school work has improved in quality; 3) Student absences have declined nearly 40% among students with laptops; and 4) Classroom space has been increased by removing old desk top computers.

Summary of Evaluation

How are laptops being used by students?
Students used laptops to: 1) research information; 2) complete assignments; 3) create projects; and 4) communicate with teachers and other students.

The effect on students has been:
1. Increased interest in their school work and an increase in the amount of work they are doing in and out of school.
2. They made more interesting presentations, made more revisions in their papers, stored information in electronic folders making it easier to maintain, locate, and use.
3. Increased the amount of time spent learning.(The nature of student learning in classrooms may be changing because students have the tools more readily at hand to pursue, organize, analyze, and present information.)
4. Less school absence.
5. Less discipline referrals.

How are laptops being used by teachers?

Teachers used laptops to: 1) locate more up-to-date information; 2) locate more resources; 3) explore knowledge and information in more depth; 4) plan lessons; 5) prepare multimedia and graphical presentations and simulations; 6) correspond with parents, students, school personnel, and subject area experts; 7) maintain student grades and attendance; and 8) evaluate student progress.

Education Technology Standards

The Florida Department of Education and all school districts in Florida use nationally recognized education technology standards.

Consistent with National Educational Technology Standards (NETS), the Florida Department of Education has published the Florida School Technology and Readiness (STaR) chart. The STaR chart contains four levels: 1) Entry; 2) Intermediate; 3) Advanced; and 4) Target.

Specific standards are provided for each of the following areas: 1) Technology Administration and Support; 2) Technology Capacity; 3) Educator Competency and Professional Development; 4) Learners and Learning; and 5) Accountability. Table 2 list the standards for three sub areas:

Table 2 - Education Technology Standards

Student use of Technology

Entry Level – Infrequent use by students as a basic tool for drill and practice, and/or integrated learning labs.

Intermediate Level – Frequent individual use by students to access information resources for communication and presentation projects.

Advanced Level -- 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 Level – Students regularly use technology for working collaboratively in communities of inquiry to propose, assess, and implement solutions to real work problems, and for evaluating and analyzing their own assessment information to improve learning. Students communicate effectively with a variety of audiences.

21st Century classroom

Entry Level –Teacher-centered learning. Teachers allow students to use technology to work on individual projects.

Intermediate Level – Teacher-directed learning. Teachers encourage students to use technology for cooperative projects in their classrooms. Teachers support student use of technology to accomplish curriculum goals.

Advanced Level – Teacher-facilitated learning. Teachers establish communities of inquiry for students to collaborate with community members. Technology is embedded in core curriculum areas.

Target Level – 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..

Student computer access

Entry Level – One modern computer per instructional area, or 10 or more students per computer with no refresh cycle.

Intermediate Level – Fewer than 10 students per one modern computer with refresh cycle every 5 years.

Advanced Level – Fewer than 5 students per one modern computer with refresh cycle every 4 years.

Target Level – One modern computer per student with refresh cycle every 3 years or less.

Based on data from the 2003 Florida School Technology and Readiness Survey of the 67 Florida school districts, the following 20 districts appear to have the greatest degree of readiness to implement one-to-one laptops in the classroom: Monroe, Baker, Union, Sarasota, Lafayette, Bay, Franklin, Indian River, Collier, Jefferson, Manatee, Broward, Lee, Levy, Santa Rosa, Citrus, Dixie, Osceola, Pinellas, Hardee.

Integrating Technology with Curriculum, Teaching, and Learning

Most schools and computer companies discuss the use of computers, including laptops (notebooks), as a tool to supplement the information in the textbook for teacher-centered instruction and to assist students in locating information and preparing class assignments.

Only three of the laptop schools reviewed for this project considered an online interactive curriculum as an alternative for the traditional print textbook.

Henrico County, Virginia is working with "Beyond Books" to develop online textbooks in four curriculum areas – math, science, social studies, and literature and language arts to largely eliminate regular textbooks in

grades 6-12. It was expected that teachers and students could begin using the online textbooks by the fall of 2003.

Ocoee Middle School, Orange County, Florida is participating in a national computer pilot venture in which 150 7th graders have traded their traditional textbooks for a Laptop computer. Each student is provided a "tablet-sized notebook" that will replace traditional textbooks for science, social studies, language arts, and eventually, math. Each notebook is equipped with a year's worth of interactive learning material. These notebooks aren't exactly laptops. Equipped with wireless Internet access, students can move the display screens in any direction pop them off and even use them as keyboards. Students are supposed to keep up with their $2,000 machines, taking them home every night and doing all of their homework and projects on them.

Florida Virtual School –Statewide provides online all courses for grades 9-12. These courses are taken for high school credit by students enrolled in a public, private, or home school in Florida. All grade 9-12 online courses are also available to be used by any school district in the state through a franchise agreement with the Florida Virtual School. Non-Florida students may take the online courses by paying a user fee. The curriculum was developed with state funds.

Beyond The Laptop

The wireless, light weight, mobile, and less expensive laptop has increased optimism that progress can be made to eliminate the "digital divide"---the gap between those who have access to Information Age tools and the skills to use them and those who don't. However, with more than 2,500,000 students enrolled in K-12 education in Florida, providing a laptop for each student at today's price of approximately $1,000 per Laptop would cost $2. 5 billion. This is five times greater than current $500 million annual school district expenditure for technology.

Published information providing details about the next generation of mobile personal computers for use in K-12 education was not available for review for this project. However, education technology professionals report they have reason to believe that computer companies are currently developing and in the very near future will bring to market wireless Internet capable machines that are smaller, lighter and priced at half or less the cost of today's laptops.

Some Issues and Cautions Learned From Early Laptop Pilot Projects

1. How should a one-to-one laptop program be implemented? Early pilots provided Laptops to all students in a single grade, such as all 5th graders or all 7th graders. When the pilot program did not provide laptops for these students the following year for the next grade level teachers and students were disappointed and expressed frustration about having to go through another transition back to the old way of school.

2. How to sustain a one-to-one laptop program? Some schools acquired the use of laptops through "leases." Some of the programs used "one time nonrecurring revenue sources." When subsequent year funding was reduced or eliminated teachers, students, and parents were very upset and felt they were being denied the support that had been promised.

3. How to help teachers become comfortable and proficient with integrating technology with the curriculum, teaching, and learning? Lack of support for teachers was identified as a major problem. Just providing hardware alone does not result in technology being used to improve teaching and learning.

4. How can the increased technical support required for one-to-one use of laptops in the classroom be provided? 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. Failure to plan for and provide adequate technical support was one of the most frequently mentioned problems by students and teachers. Technical support is one of the more expensive elements of providing technology in K-12 education.

5. Who should be responsible in the event a laptop taken home by a student is lost, stolen, or damaged; the student or the school? Most schools decided to arrange for insurance sufficient to protect taxpayer assets. Who should pay for the insurance; parents or the school? The cost of insurance ranged from $35 to $50 per laptop. Some schools purchased the insurance and those that asked parents to pay used private funds for students who couldn't pay.

6. Who should provide the cost for home Internet access for students who don't have it and can't pay for it? Some schools arranged through local Internet providers for discounts for economically needy students, some used private funds, and some used public funds.

7. To use wireless technology in the classroom requires the addition of wireless access capability for

each classroom and throughout the school. What to do about <u>wireless access in student homes</u>?

8.   What arrangements should be made for appropriate filtering capability to avoid student access to <u>inappropriate or objectionable web-based information</u> when Laptops are taken home and use non-school Internet access?

9.   How to provide adequate <u>technical support</u> when each student in the class is using the Laptop in real time learning in all classes?

10. How to provide adequate <u>professional support</u> for teachers as they learn how to modify their teaching style from "teacher-centered," to "teacher-facilitated" and "student-centered" learning?

Availability and Cost of Mobile Computers

Notebook computers (the new name for laptop) have traditionally cost several hundred dollars more than comparably featured desktop PCs, but as prices for computer parts have fallen and the volume of computer sales has shifted to notebooks, companies have slashed prices. A notebook with a sufficient-sized hard drive, adequate memory, and a speedy microprocessor so that students can surf the Web, download information, prepare classroom assignments, and multi-media presentations can now be purchased for around $1,000.

The following is a sample of systems that are available:

eMachines Inc. --- $1,199 ---6.5 pounds
Gateway Inc. ---$999---6.2 pounds
Hewlett-Packard Inc. ---$1,099.99 ---7.5 pounds
Dell Computer Corp. ---$999---7.2 pounds
Toshiba Corp. ---$999
IBM ---$1,099 ---8.49 pounds
Apple Computer Inc. ---$999 ---4.9 pound

The Apple i-Book project approved for the Bayshore High School in Manatee County beginning in 2004-05 cost $986 for student notebooks and $1,100 for teacher notebooks.

With more than 2,500,000 students enrolled in K-12 education in Florida the cost of providing a laptop for each student at today's cost of $1,000 each is $2. 5 billion. Not covered by the cost of laptops for each student is cost of the following: 1) laptops for teachers; 2) a substantial increase in the amount of technical support required for one-to-one student use of computers (historically technical support has been expensive and difficult to fund); 3) increased professional development for teachers which is essential for successful integration of technology with curriculum, teaching, and learning; 4) internet access

for students who can't pay for it; 4) internet content filtering; and 5) insurance to cover lost, stolen, and damaged computers.   Department of Education Standards for one-to-one student use of computers provides for a 3-year refresh cycle to sustain the target level of a fully implemented program.

The current annual expenditure for computers and related technology, not including new schools, by Florida school districts is estimated to be approximately $500 million. The source of these funds is; 60% local, 29% state, and 11% Federal.

Education technology professionals have reason to believe that machines are currently in development that will soon be available for one-fourth to one-half the price of today's laptop.

RECOMMENDATIONS

It appears that Laptop technology has tremendous potential for changing K-12 education from an environment in which students are primarily passive learners, to one in which students are active, engaged learners who continue school assignments and learning beyond the classroom and standard school day. The response from teachers and students in the early one-to-one pilot laptop projects has been positive with a decline in student absences, less discipline referrals, increased student interest in school work, more time spent on school work in and out of school and more interesting presentations. However, at this time, none of the pilots have identified an increase in student test scores as an outcome. Obviously it is too early to determine the full benefits; however, without evidence of an increase in student test scores it will be difficult for schools to justify adding this cost to the existing expenditure base for K-12 education. Florida school districts are rapidly implementing one-to-one student use of laptops. To assist schools currently conducting pilot projects and also schools planning to implement one-to-one student use of laptops in the classroom, the Department of Education should:

1.   Encourage schools implementing one-to-one pilot laptop programs to include provisions for an independent, valid evaluation to document the benefits of the program including the effect on student test scores.

2.   Provide the results of these evaluations to all school districts.

3.   Provide school districts information learned from pilot laptop projects (in state and out-of-state) that is useful when planning for successful implementation of new laptop projects and avoiding barriers experienced in the earlier projects.

4.   Seek new ways to make laptops in the classroom more financially feasible.

5.   Seek affordable ways of providing the increased technical support required for one-to-one student use of laptops.

6.   Assist schools with locating and accessing appropriate and adequate training required for teachers to be successful with integrating technology with curriculum, teaching, and learning so that student's use of the computer is not limited to just "pulling information in" but also includes "creating and pushing information out."

7.   Seek ways to increase the amount and affordability of interactive curriculum content.

8.   Encourage schools to plan for sustainability of one-to-one student use of computers as pilot programs are expanded.

9.   Help schools to be aware that a one-to-one laptop program is successful only when adequate technical support for students and adequate professional support for teachers is provided.