A Report and Estimating Tool for
K-12 School Districts
One-to one Student Computing
Total Cost of Ownership
Value of Investment

District 1 TCO/VOI Case Study
March 2006

Consortium for School Networking

Introduction

The three 2006 one-to-one student computing Value of Investment (VOI) case studies were developed by CoSN with thanks to the generous support of corporate sponsors and cooperation of the case study school districts. These case studies are presented in a format similar to the previous eight CoSN TCO case studies, but focus on project costs and benefits of one-to-one student computing projects at these districts.

Process: For comparative purposes, a Total Cost of Ownership (TCO) analysis has been performed for the district's or school's computing and network environment prior to the implementation of their one-to-one project. The CoSN-Gartner TCO tool was used for this TCO analysis. Following this baseline TCO analysis, the one-to-one project has been evaluated in terms of projected costs, savings and anticipated benefits. While it is too soon to verify the costs and benefits of these one-to-one projects, it is CoSN's intent to revisit these districts and measure the results.

From a technical perspective, the scope of the studies includes costs for end-user computing devices, network servers, local area network hardware, and the labor costs associated with each of these components. Software, application service providers, content and curriculum development, staff development and training, and indirect labor were included as well.

Value of Investment: Each district entered into their one-to-one project with project goals relating to their respective district mission and goals. With the project already under way, use of measurable anticipated benefits as prescribed by CoSN's VOI process was not adhered to. As a result, most of the anticipated benefits have not been stated in measurable terms. Where possible, anticipated and other realized benefits have been measured.

The reports: Data from each district was used to develop a case study that reports pertinent background leading up to the one-to-one implementation including baseline background information on the district, baseline TCO metrics, and an overview of the distributed computing environment. The inspiration leading to the one-to-one implementation, costs and projected benefits are then discussed. As these one-to-one projects are already under way, actual costs have been collected and reported, along with some additional benefits. Indirect labor (i.e. the time users spend in performing routine system functions, dealing with system problems and receiving training) was based on user survey data.

There are five sections to each case study. The first is an overview of the district and the general setting of the distributed computing environment. The second section contains the TCO metrics prior to the one-to-one project implementation. The third section focuses on the vision and approval process. The fourth section provides a review of the costs and financing of the one-to-one project. The fifth and final section discusses the projected and realized benefits to-date for the one-to-one project as related to the district.

Overview and General Setting

The District 1 case study school district is a growing, primarily rural and small town district with 10,200 students, 733 teachers and 418 non-classroom staff on 20 campuses, plus a district building and an annex. The school campuses involved in the one-to-one program include three high schools, a Career Technology Center and an alternative school. More than 54% of the district's students qualify for free/ reduce lunch with eight of eleven elementary schools qualifying for Title One grants.

While there was some technology and network implementation in the late 1990's, a severe budget crunch eliminated technology from the budget in the 2000 to 2002 timeframe. The networking infrastructure included LAN implementation along with South Carolina Budget and Control Board provided T1 Internet connections.

With minimal focus on the use of technology and lack of any computer technology budget, site-based management of any school-based computers and networks prevailed. With no additional computer services staff to support this uncontrolled environment, the client computer base evolved to 536 client computers per computer support staff person; twice the number of computers per support person than the highest for the eight CoSN TCO case studies. Further complicated with the need to support aging computers, the indirect labor costs (cost of time spent by end users dealing with computer and network issues) were very high.

By the 2003 -2004 school year, five computer services staff plus one other person supported everything from project management and training to end user support for 4401 client computers and 40 servers located in 699 classrooms and 56 shared facilities.

The TCO analysis numbers indicate the classic K-12 growth of computer networks without related investment in support staff. The result of insufficient support staff and this district's historically mixed computer technologies is increased indirect labor; that is users spending time dealing with system issues.

Before One-to-one: Cost of Ownership Metrics

1. Overall Cost

Unit	Total Cost	Direct Cost	Indirect Labor Cost
Overall District Cost	$13,274,073	$1,153,642	$12,120,431
District Cost per Client Computer	$3,016	$262	$2,754
District Cost per Student	$1,029	$89	$940

2. Direct Cost by Category

Unit	Hardware	Software	Direct Labor	External Application Providers
District Cost	$472,580	$293,782	$345,640	$41,640
District Cost per Client Computer	$107	$67	$79	$9

3. Hardware Cost by Category

Unit	Client Computer	Server	Network
District Cost	$382,200	$29,600	$60,780
District Cost per Client Computer	$87	$7	$14

4. Asset Metrics

Category of District Resource	Ratio
Students per Student Available Client Computer	2.93
Teachers per Teacher Dedicated Client Computer	1.04
Non-Classroom Personnel per Non-Classroom Client Computer	1.79
Total Users per Total Client Computers	2.60

5. Staffing Metrics

Direct Labor Category	Total Cost	Cost Per Client Computer ($ US)	Client Computers per Staff
Operations and Financial	$323,058	$73	600
Professional Development and Training	$12,582	$3	17,604
Curriculum Development and Support	$10,000	$2	17,604
Total Support	$345,640	$79	561

The One-to-one Project Vision and Goals

In 2003, the current tech-savvy superintendent was hired by the district. Without a budget line item for computer technology, no one could tell him what the per-student spend on technology was. Further investigation revealed that the district was spending a mere four dollars per student per year for computer technology. This amount was in contrast to the state recommended annual $250 per student.

The District Superintendent was intent upon leveraging technology as a tool to drive progress towards certain district goals; to find the biggest impact of implementing technology closer to the state recommended level of over $2 million. The major goals to be addressed were:

- "Put all District 1 County students at a distinct advantage in the 21st century workplace"
- Provide digital age equity for all students

Significant investment in the district networks, mobile computer carts, teacher computers and computer labs was evaluated along with the one-to-one student computing concept. The superintendent determined that the biggest impact on achieving these goals and greatest potential impact on student learning would be to provide every high school student with a laptop computer – at a projected cost close to the $2 million annual expenditure goal.

The one-to-one project was named i-CAN, as students can now say "I can" when they face the necessary tasks of the future.

The process:

- Research, site visits were undertaken with staff involvement to promote buy-in.
- Regular board updates were conducted; and the vision was shared with the community.
- Financing was strategized – See "Approach and Financing" below.
- A general request for bid went to vendors, asking them to present a complete solution, with a emphasis on teacher training.
- The district undertook an assessment of wireless networking requirements.
- Hardware and software standards were set along with a directive to centralize control for computer management and support.
- Technical issues were addressed.
- Hewlett-Packard was selected as the designated vendor based primarily on training offerings and flexible financing.
- A unanimous board decision to move forward with the i-CAN project took place in September, 2004.

- Initial teacher training took place in October, 2004. A Laptop, extra battery, projector, camera, mini electronic whiteboard and some printers were given out to teachers at the initial training session. Training has included over four days per teacher plus refresher and extra mentor training.
- A parent meeting and ninth grade student deployment took place in January 2005.
- The following year's ninth grade deployment took place in August, 2005.

One-to-one Project Costs and Financing

Approach and Financing the One-to-one Project

The first year of this major technology initiative had no budget. Through some creative refinancing of debt, the district managed to free up $500,000. The project, which includes over 4500 student/laptop computers, intensive training, seven servers, wireless networks with 380 access points, portable electronic white board interface devices, digital cameras, projectors, and printers is valued at $8 million.

The approach with this comparatively small "down payment" was to provide laptops to each ninth grade student each year for four years via four-year lease. While holding all other district expenses constant, a budget for classroom technology could be implemented and grow through normal inflation based growth in per-student revenue and growth of the student population.

With the additional first-year expenses for teacher laptops, teacher training, wireless network infrastructure, servers and other items, a flexible back-end loaded lease for the $3.3 million first year rollout needed to be negotiated. This first lease includes 1,284 ninth grade student and teacher HP nx5000 laptop computers with Microsoft Office, antivirus, configuration management tools, and a four-year warranty. A $50 buy-out at end of lease will be available to students who would like to keep their laptop following graduation.

An insurance policy to cover loss or damage not covered in the four-year warranty is available for students/parents at $50. Help is provided for families who can't afford the insurance. Families who opt out of the insurance are liable for replacing a lost or destroyed laptop per signed parent agreement.

The lease payment schedule follows, with a new four-year lease added each year:
Year 1 - $.5 million (Unbudgeted - refinanced debt) – ninth grade only
Year 2 - $1.2 (Second year of first lease plus first year of second lease)
Year 3 - $2.3 (Third year of first lease, plus second year of second lease plus first year of third lease)
Year 4 - smaller dollar increase expected (four active leases) - ninth through twelfth grade

Years 5 on – Expected to be around the year 4 amount as a new lease replaces a completed one

This approach, while helping reduce initial expenses, also provides for sustainability of the project through a four-year budgeted replacement cycle.

It should be noted that other district areas where budgets have been frozen will likely incur hardships.

Teacher Training

The first year lease essentially paid for the $500,000 (est.) training program. Intensive hands-on staff development started with an assessment of computer skills, followed by appropriate training based on individual performance. Teachers identified as "high-flyers" serve as mentors at each school, including periodical classroom observation to help with implementation and deal with potential issues. Every teacher also received instruction on how to manage a classroom in a laptop environment. "There's now a constant dialogue in the classroom," the Assistant District Superintendent for Instruction says. "It's more interactive, rigorous, more like the real world."

After the initial training, teachers developed lesson plans in their content areas and received assistance in finding online resources to bolster the curriculum. The training mentioned above will be continually implemented with teachers on all grade levels, 9-12, including new teachers.

Instructional Technology Specialists were hired at each high school and the Career Technology Center campus and are available to help teachers with the continued integration of technology into instruction in the classroom.

Direct Labor – Support Staff

Four contracted computer support technicians, one at each high school and Career Technology Center, have been included as a part of the lease. No other support staff has been added. While these additional staff members provide primary support for the i-CAN laptops, with an average of 401 computers per support staff for the first year and closer to 700 computers per support staff for the second year, the already stretched district computer support staff have picked up the additional wireless network support responsibilities. In year two, three instructional technology specialists were added to support technology integration in the schools where they were assigned.

Indirect Labor Costs

Indirect labor, while not measured specifically for the one-to-one project is probably lower than for the district as a whole. With the upfront teacher training, low cost of students in terms of indirect labor costs, and the availability of spare laptops, it is likely to be somewhat lower than the indirect labor costs for the rest of the district.

Projected Project TCO

The following costs are for the first year of the one-to-one project (2004-2005), and represent TCO (total costs amortized over the four-year refresh cycle) for the i-CAN project. The total per-laptop direct cost is: $780.

6. Laptop Direct Cost by Category

Unit	Hardware	Software	Direct Labor[1]	External Application Providers[2]
District Cost	$594,224	$39,519	$380,188	$38,808
District Cost per Laptop	$436	$33	$279	$32

1. Direct Labor consists of the four onsite contractors at the high schools and Career Technology Center plus three Instructional Technology Specialists at the three high schools. Each is approximately $50,000 yearly and are paid from the general funding. Also, $30,000 training is allocated ($500,000 amortized over four years and based on anticipated total number of one-to-one laptops over the four-year project)
2. External Service Providers represents Budget and Control Board charges for increased bandwidth.

7. Hardware Cost by Category

Unit	Client Computer	Server[1]	Network[2]
District Cost	$478,193	$11,178	$104,853
District Cost per Client Computer	$398	$9	$29

1. New servers; does not include increased use of existing servers
2. Network costs include wireless access points and wired LAN upgrades (amortized over four years and based on anticipated total number of one-to-one laptops over the four-year project)

Projected Benefits and Other Realized Benefits

Projected benefits

Providing students with **21st Century Skills** beyond what is offered elsewhere was a main driver for the one-to-one initiative. Providing students with exposure to some of the more popular productivity tools is adequate for some districts, but this district superintendent insisted that the infusion of technology in all aspects of teaching and learning is necessary to provide students with an edge. The Career Technology Center staff acquired real life software used by auto mechanics and nurses. Microsoft IC3 (Internet and computing core certification) is also offered as a part of the curricula. Starting with year three, existing high school labs and some wireless networking are being pushed down to the middle schools with computer curricula changed to prepare middle school students for effective use of their laptops when they reach high school. A web-based and CD career search application is an additional tool available to students.

The district is tracking student progress in obtaining these skills via survey. A survey was given to teachers prior to the i-CAN project asking about frequency of computer use in various aspects of course work (25 questions) and a self-evaluation of competencies in operating system, general computing, peripherals, word processing, spreadsheets, presentation software, and email (75 questions). A more general survey has been taken by students concerning usage and skills prior to the i-CAN project. Students and teachers will again be surveyed in April, 2006 as a way to check progress concerning infusion of technology in the curricula and to measure increase of 21st century skills.

Providing **equity** for all students, despite socio-economic status was also a major goal. It was decided to start with all ninth grade students at the three high schools, Career Technology Center and the alternative school adding the incoming ninth graders each year. For students without internet access at home, a commons area with wireless access is located outside of each high school, providing 24/7 access. Local retail businesses have been encouraged to provide wireless communications access and the major town within the district is providing town-wide wireless access.

Students have been surveyed concerning availability and use of a computer at home prior to i-CAN and again in January, 2006.

Weekly Computer Use Away from School

Weekly Computer Use at School
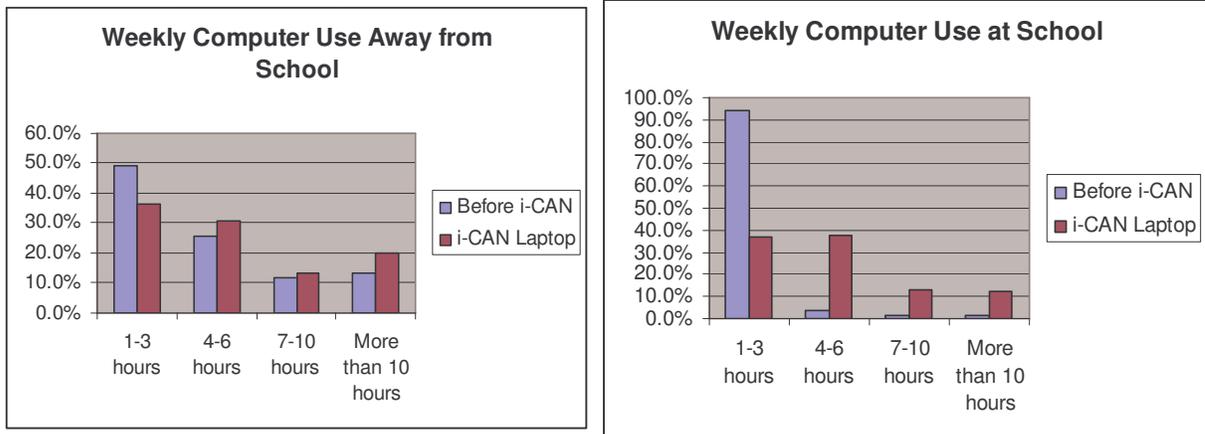
Student motivation and achievement was another expected outcome for the one-to-one program. The ninth grade is a pivotal year for the success of many students. Providing the i-CAN initiative for the freshman class along with the Ninth Grade Academy is intended to increase the number of students for promotion into tenth grade with the further goal of increasing the percentage that go on to graduate. This district has specific annual achievement goals with interim goals each year through 2014, driven in part by NCLB mandates. These goals include using the laptop program to change the teaching/learning process (how you teach and learn) to improve student performance. They have a goal to be in top 10 districts within SC, backed by specific course/grade standard test scores, and measured goals such as "At least 90% of all HS students will pass the state end-of-course

Algebra I, Math Tech II tests by 2010" (Currently at 83.9%). Similar measurable goals include percent of students taking Advanced Placement courses and resulting exam scores; SAT and ACT scores; graduates with LIFE scholarship qualification; and graduation rate.

Another stated goal is to increase **teacher satisfaction.** The district is also experiencing the additional benefits of improved teacher retention and is better able to attract new teachers.
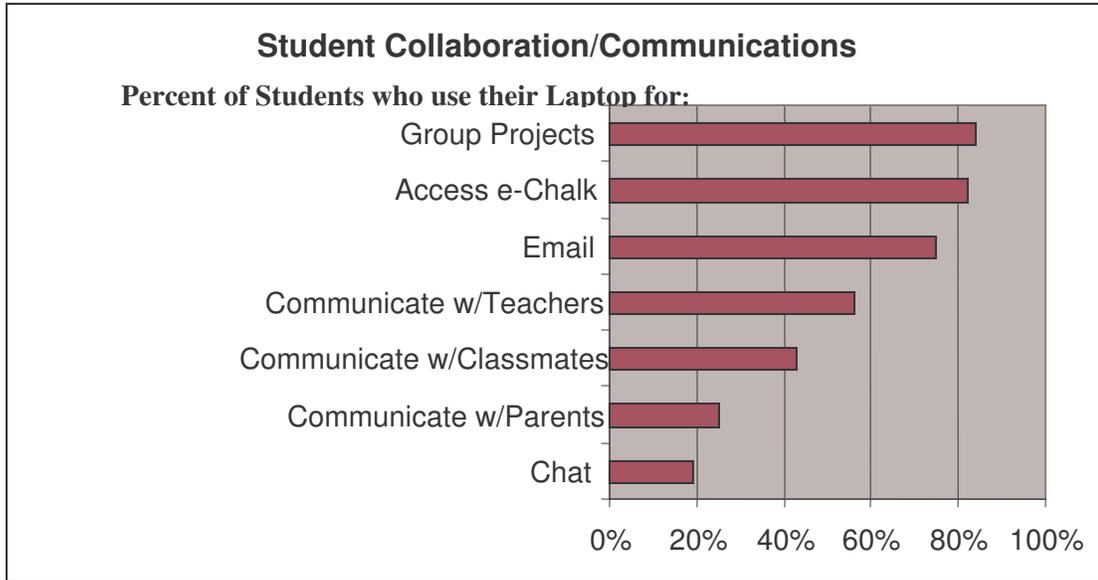
Improved parent communications was another stated goal for the one-to-one project. Parents and the community were involved early in the decision process, generating interest and buy-in. Parents were required to attend a training meeting concerning the use of the laptops and needed to sign use and insurance agreements. Access to student performance and assignments through e-Chalk, along with the district website, has helped to continue parent involvement and communications, and student laptop is available for parent use.

Other Realized Benefits

Cost savings, productivity enhancements and increased revenue were not part of the projected benefits of the one-to-one program. However, some financial benefits are being realized. Increased student attendance results in increased student day revenues from the state, and there is evidence of students coming back from area private schools. Cost savings include reduced printing and related supplies costs, as course guides, assignments and homework are handled electronically. Many parent letters are also now online. This project also helped drive the quest for centralized control of the district's computer infrastructure and included reorganizing the server room with rack mounted servers, providing enhanced computer support efficiencies.

Collaboration among students and teachers is being observed and measured via survey. Student participation on-line in small group class projects is promoting increased collaboration. It has also been observed that teachers are collaborating on approaches to increase and integrate technology into their instruction.

Student Collaboration/Communications

Percent of Students who use their Laptop for:

Group Projects	
Access e-Chalk	
Email	
Communicate w/Teachers	
Communicate w/Classmates	
Communicate w/Parents	
Chat	

0%   20%   40%   60%   80%   100%

Student behavior in terms of reduced disruptions in certain areas and improved attitude has been observed. The laptops were issued with little restriction on home use, with the expectation that the students treat the laptop program including the equipment and software as responsible citizens. On the whole, the students have respected this level of trust.

Definitions

Total Cost Includes all costs within the model. It is a balanced look at what it truly takes to support a computer for the district. The metric includes both Direct and Indirect costs.

Direct Costs Includes all technology and direct labor costs incurred by the school district during the study period (hardware, software, external application providers, and direct labor).

Indirect Costs Includes all of the labor incurred by the user community for the study period. Indirect Labor includes the costs of users supporting one another, time spent in training classes, casual learning, self support, user applications development and downtime costs.

Hardware Includes the annual costs for client computers, peripherals, servers, network equipment, and printers.

Software Includes the annual costs for all software running on client computers and servers. This would include infrastructure software, educational and administrative software, personal productivity software, as well as content and curriculum specific software.

Direct Labor Includes burdened salaries from personnel whose job role includes operations and financial support, professional training, or curriculum development.

External Application Provider
Includes all costs associated with organizations that provide the use of applications, and associated services to customers.

Client Cost per Client Computer
Measures the annualized cost of personal computers, and peripherals divided by the total number of client computers.

Server Cost per Client Computer
Measures the annualized cost of servers divided by the total number of client computers.

Network Cost per Client Computer
Measures the annualized cost of network equipment (hubs/routers/switches, etc.) divided by the total number of client computers.

Students per Available Client Computer
Includes the total number of students divided by the total number of client computers located in classrooms, libraries, media centers, labs, etc., along with the total number of student dedicated client computers, not including student owned equipment.

Teachers per Teacher Dedicated Client Computer
Includes the total number of classroom teachers divided by the total number of client computers dedicated for use by these individuals.

Non Classroom Personnel per Non Classroom Personnel Client Computer
Includes the total number of non-classroom personnel divided by the number of client computers dedicated for use by these individuals.

Client Computers per Server
Includes the total number of client computers divided by the total number of servers.

Operations and Financial Cost
Measures the total personnel costs, vendor costs associated with "hands-on" labor, and help
desk support around client computers, servers, printers, and network equipment. It also
includes any costs around planning and process management, finance and administration
(budgeting, procurement, asset management etc.), and physical database administration.

Professional Development and Training costs
Includes training of personnel to provide familiarization, and proficiency with the operation
of equipment and software to carry out school tasks whether instructional or administrative.

Curriculum Development and Support costs includes
Labor involved in integrating technology into the teaching and learning process.

Client Computers per Staff Metrics
The number of Operations and Financial, Professional Development and Training, and
Curriculum Development and Support personnel are divided by the total number of client
computers to create client computers per staff metrics. Looking at the data this way tends to
normalize for high or low salaries when making comparisons.

Related Documents

Please refer to these documents (available at the www.classroomtco.org Web site) for additional information regarding TCO in the K-12 environment.

Why Total Cost of Ownership (TCO) Matters
Necessary reading before getting started

Preparing for TCO Analysis
Input fields required for the Web-based TCO Tool and extensions for further evaluations

The Web-based TCO Tool
A review of the Web-based TCO Tool

2003 Case Studies

    California District Case Study
    An urban district with 140,000 students

    Minnesota District Case Study
    A rural district with 4,000 students

    Pennsylvania District case Study
    A rural district with 2,500 students

    Utah District Case Study
    A suburban district with 49,000 students

2004 TCO Case Studies

    Missouri District Case Study
    A rural district with 450 students

    Texas District Case Study
    A Suburban District with 35,500 students

    Virginia District Case Study
    A suburban/urban district with 166,000 students

    Wisconsin District Case Study
    An urban district with 21,500 students

One-to-one TCO/VOI Case Studies

    District 1
    A rural and small town district with 10,200 students (SC)

    District 2
    A mostly rural district with 1,800 students (PA)

    District 3
    A rural district with 867 students (PA)

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Contact Information

The Consortium for School Networking

Name: Elizabeth Weaver Engel, CAE
Vice President, Marketing
Telephone: 202.861.2676 x120
E-mail: elizabeth@cosn.org

Name: Rich Kaestner
Editor/TCO/VOI Project Director
Telephone: +1-541-929-4589
E-mail: richk@alyrica.net