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

District 3 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 3 case study school district is a small rural Title I district covering 100 square miles in the heart of Pennsylvania's coal mining region. The 867 students attend one of two schools, K-6 or 7-12, housed in the same building. When the current superintendent was appointed in 1997, computer technology consisted of one lab with 24 Apple IIe's. The district's mission statement says, "It is the mission of our dedicated staff and involved community to create a positive climate in which all students will develop the academic, technological and social skills to achieve their potential and to function successfully as citizens in an ever-changing global society."

Thanks to the grant writing efforts and expertise of the District Superintendent, this economically depressed district was already technology rich prior to their one-to-one student computing project. The building was wired with 1100 network connections, and 370 computers were located in classrooms, two high school labs and two elementary school labs for student use. This provided a low student/computer ratio of 2.3 to one and all teachers had computers.

During the 2002-2003 school year a pilot wireless network with 23 tablet computers was rolled out. These early version tablets proved somewhat unreliable and the consumer brand wireless access points were problematic.

The wireless network was upgraded to business level ceiling tile access points with the rollout of laptops for seventh grade honors students in the 2003-2004 school year.

High speed internet access was unknown in the area. Starting with a $360,000 grant and the help of a private communications company, the district installed wireless towers with a 72mps wireless backbone running to the nearest metropolitan area, nearly 20 miles away. Access is available to families in the area for $11 per month. This project has captured the attention of surrounding districts and communities, and the internet service is being expanded to include some of them. This network has opened subscription up to other area communities and actually generates revenue to this district.

Much of the student administrative processing, including student information, is performed as a remote service, which explains the relatively high External Application Providers cost of $118 per client computer. The high-speed access has made this approach a reasonable proposition for the district.

The district superintendent also serves as the technology director. Prior to the one-to-one project, two other staff provided support for the technology infrastructure.

Before One-to-one: Cost of Ownership Metrics

1. Overall Cost

Unit	Total Cost	Direct Cost	Indirect Labor Cost[*]
Overall District Cost	$1,105,201	$279,485	$825,716
District Cost per Client Computer	$2,387	$604	$1,783
District Cost per Student	$1,024	$258	$762

* Indirect Labor Cost was measured after the one-to-one project implementation

2. Direct Cost by Category

Unit	Hardware	Software	Direct Labor	External Application Providers
District Cost	$100,855	$26,877	$96,955	$54798
District Cost per Client Computer	$218	$58	$209	$118

3. Hardware Cost by Category

Unit	Client Computer	Server	Network	Printer & Supplies
District Cost	$84,123	$9,000	$4,000	$3,732
District Cost per Client Computer	$182	$19	$9	$8

4. Asset Metrics

Category of District Resource	Ratio
Students per Student Available Client Computer	2.34
Teachers per Teacher Dedicated Client Computer	1.06
Non-Classroom Personnel per Non-Classroom Client Computer	1.00
Total Users per Total Client Computers	2.10

5. Staffing Metrics

Direct Labor Category	Total Cost	Cost Per Client Computer ($ US)	Client Computers per Staff
Operations and Financial	$88,399	$191	226
Professional Development and Training	$4,278	$9	4,630
Curriculum Development and Support	$4,279	$9	4,630
Total Support	$96,955	$209	205

The One-to-one Project Vision and Goals

Having teachers trained on the use of technology, with a robust wired and wireless infrastructure inside the school plus state-of-the-art high-speed wireless area network, and pilot programs completed, this district was ready to pursue a Pennsylvania Accountability Block Grant for their proposed one-to-one student computing project. Without cost to the community or need to divert funds from other areas, this project was met with quick approval by the school board and community at large.

A major goal of this project and related Wireless WAN infrastructure is to provide equity with urban and suburban students and employment/college opportunity for students in this remote community which is losing jobs and population. A related goal is to provide the infrastructure and workforce to attract industry into the area.

The Grant was approved for this Title I district and the detailed requirements and project plan were developed. A Request for Quote was sent to major laptop computer vendors and the negotiations began.

Based on rounds of competitive responses to this bid for laptops, with office software, carrying bags and three-year warranty, Gateway was selected, and in October, 2005, 300 laptops were distributed to the ninth through twelfth grade students. With a parent signed consent form returned to the school, these students are responsible for their laptops and may take them home. All 150 seventh and eighth grade students are receiving their laptops in February, but will not be permitted to take them off school premises. All teachers (K-12) received laptops prior to the student rollout.

Former high school computers have been moved to the elementary school, and former elementary school computers with Waterford Reading have been placed in the local pre-school.

> **The process**:
> - LAN and WAN Infrastructure was built
> - Research, site visits were undertaken
> - Regular board updates were conducted; and the vision was shared with the community
> - Financing need was determined and grant request written
> - A general request for bid went to vendors for 500 laptops, carrying bags and warranty
> - Gateway was selected based on price and service.
> - All 36 high school and 30 elementary school teacher computers were replaced with laptops in September, 2005 – no formal training was provided
> - Ninth through twelfth grade students received laptops with return of parent signed consent form in October, 2005
> - Seventh and eighth grade students received laptops for in-school use in February, 2006

One-to-one Project Costs and Financing

Approach and Financing the One-to-one Project

The Accountability Block Grant provides funds in three annual payments of $142,383, $124,585 and $149,502 for a total of $416,470. These funds started flowing in 2004, one year before the laptop program was initiated, allowing the district to bank two annual payments before lease payments started. Based largely on price and support, the district selected Gateway M360 laptops with carrying case, Microsoft XP and Office, and a comprehensive three-year warranty and insurance. The total lease amount of $468,000 comes to $504,000 with interest and has a one dollar buyout. The monthly lease payments of about $1,400 started in August, 2005.

Other purchases associated with the one-to-one program include some switch upgrades for $5,000. An additional server was purchased for backup of student/teacher data and a contract was established with BitLeap for remote backup.

The following course software were purchased and loaded onto appropriate laptops: Encarta, A+ French, A+ Spanish, Human 3D, Physics 1 Plus, Math Complete, High School Math, and a limited number of AutoCAD licenses.

The plan to refresh the laptop systems after three or four years is to apply for another grant.

The Glendale foundation and STAR pre-school have received $36,000 this year from businesses and other donors to help support the laptop program and pre-school computer-based reading program.

Teacher Training

Other than a brief orientation, no special training was offered for teachers. 97% of the teachers were already considered to be technology literate. The district has a teacher training room where teachers can go to improve their skills in the use of any hardware/software technology that is available for classrooms. New teachers receive an orientation and continuation training for six levels of accomplishment is available. The district is willing to bring in substitutes to help teachers fulfill training needs.

Direct Labor – Support Staff

The district superintendent also serves as the technology director. Prior to the one-to-one project, two staff provided support for the technology infrastructure. The computer technology teacher also spends 25 percent of his allocated time managing and supporting the technology infrastructure. Prior to the laptop roll-out, this amounted to one computer services staff for 205 client computers.

One of the staff has since left the district and finding a replacement person is being considered. This replacement person may be financed in part by providing in-house warranty service. Network and other problem support is also provided by a "local" networking and computer integration firm. As a result of the laptop installation and reduced computer services staff, there are now 470 computers per computer services staff.

Remote management tools are being considered to provide better control and ease the support burden.

Indirect Labor Costs

Teachers and non-classroom staff were surveyed to estimate the time spent dealing with their own or other's system problems, time in training, and lost productivity when the network or their computer is not operational. This survey was taken just three months into the one-to-one program and reflects the entire environment, not just one-to-one.

Projected District TCO

The following costs are for this first year of the one-to-one project (2005-2006), assuming unanticipated costs will not be incurred.

6. Overall Cost

Unit	Total Cost	Direct Cost	Indirect Labor Cost*
Overall District Cost	$1,242,346	$416,630	$825,716
District Cost per Client Computer	$1,538	$516	$1,022
District Cost per Student	$1,240	$416	$824

7. Direct Cost by Category

Unit	Hardware	Software	Direct Labor	External Application Providers
District Cost	$235,175	$39,877	$62,780	$78,798
District Cost per Client Computer	$291	$49	$78	$98

8. Hardware Cost by Category

Unit	Client Computer	Server	Network
District Cost	$216,443	$11,000	$4000
District Cost per Client Computer	$268	$14	$5

9. Asset metrics

Category of District Resource	Ratio
Students per Student Available Client Computer	1.24
Teachers per Teacher Dedicated Client Computer	.86
Non-Classroom Personnel per Non-Classroom Client Computer	1.00
Total Users per Total Client Computers	1.20

Projected Benefits and Other Realized Benefits

Projected benefits

Providing students with **21st Century Skills** was mostly in place prior to the laptop program. However, this program has already generated some additional progress. Students are developing and maintaining websites for small businesses locally, in other states and even internationally. This free service is providing a valuable resume for the students doing this work, and there is discussion towards charging for this service. Fees charged will go to a foundation focused on sustainability of the laptop program and to fund teacher projects. The district is also experiencing an increase in the number of students entering two and four year colleges.

Providing 21st century skills and the development of a regional high-speed wireless infrastructure are important pieces of a plan to **enhance community development**. The goal is to off-set low paying coal mine related jobs with the emerging technology focus. This objective is beginning to show some early progress with the website development work and a couple of small technology companies moving into the area. While not measurable, there is a sense of improved community pride.

Providing **equity** for all students, despite socio-economic status was also a major goal. With all students receiving laptops and the availability of inexpensive high-speed internet access, all of the students have the opportunity to be technology rich. One impoverished parent made a point of catching up to the superintendent, telling him, "Thank you; you gave my child hope and a chance." Some older computers have been given to needy families. Courses available via distance education (e-learning) provide equity with larger schools that can offer a broader in-house curriculum.

> **Some Statistics**
> - Since a focus on classroom technology, 2 and 4 year college entry has gone from 10% to 64%. Goal with one-to-one is 90%
> - Driving technology based curriculum to elementary school with goal of 70% of students entering high school at or above proficient score in core subjects
> - Goal to reduce number of students entering first grade without literacy skills from 50% to 5% with pre-school Waterford Reading

Student motivation and achievement was another driver for the one-to-one program. Using 2005 as a baseline, the district objective is for 70% of students at or above proficient for PSSA (state) standardized test scores. The chart below shows some current scores (2005).

Grade 5			
Subject	District 2005	Objective 2008	State 2005
Reading	65%	70%	64%
Math	59%	70%	69%

| Grade 8 | | | |
Subject	District 2005	Objective 2008	State 2005
Reading	50%	70%	64%
Math	40%	70%	63%

| Grade 11 | | | |
Subject	District 2005	Objective 2008	State 2005
Reading	51%	70%	65%
Writing	60%	70%	69%
Math	39%	70%	51%

Leveraging the technology for experiential learning is an important strategy to meet these goals.

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. These include reduced printing and related supplies costs, as course guides, assignments and homework are handled electronically with Microsoft Class server. Increased student attendance results in increased student day revenues from the state. Online testing doesn't only provide students with immediate feedback, it also aids teacher productivity with less time spent grading tests.

Collaboration among students and teachers is being observed. The use of email among students, teachers and the superintendent has been an enabler for wider communications. Blogs and live chats have been set up between students and college students as well as professional, such as an architect and book author.

Student behavior in terms of reduced disruptions and attitude has been observed. The laptops were issued with little restriction on home use for ninth through twelfth graders, with the expectation that they treat the program as responsible citizens. On the whole, the students have respected this level of trust, as they know they can lose the privilege.

This remote district is also experiencing the additional benefits of good **teacher retention** and is better is able to attract new teachers. New teachers have a mentor to help them get up to speed with electronic whiteboards, email and productivity tools.

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 but-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, along with the district website, has helped to continue parent involvement and communications, and student laptop is available for parent use.

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

      District 2
      A mostly rural district with 1,800 students

      District 3
      A rural district with 867 students

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