



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

**District 2 TCO/VOI Case Study**  
March 2006

Introduction..... 1  
Overview and General Setting..... 2  
Before One-to-one: Cost of Ownership Metrics..... 3  
The One-to-one Project Vision and Goals..... 4  
One-to-one Project Costs and Financing ..... 5  
    Approach and Financing the One-to-one Project..... 5  
    Teacher Training..... 6  
    Direct Labor – Support Staff..... 6  
    Projected High School TCO with the One-to-one program..... 6  
Projected Benefits and Other Realized Benefits..... 7  
    Projected benefits..... 8  
    Other Realized Benefits ..... 9  
Definitions..... 10  
Related Documents ..... 12  
Contact Information ..... 13



## ***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 2 case study school district is primarily a rural, small university town district located between two metropolitan areas in Pennsylvania and is experiencing a slow decline in student population. This district has 1,800 students, 134 teachers, 30 classroom aides and 69 non-classroom staff on six campuses, consisting of four elementary schools, one middle school and one high school. The school campus involved in the one-to-one program includes grades 9-12 in the high school, which has 640 students and 45 teachers. Although this is not a wealthy district, less than ten percent of the students qualify for free/reduced lunch. The local population consists primarily of land rich, moderate income farmers, university professors, and business and manufacturing employees.

The superintendent came on board in the fall of 1997, from a district that had more money and had been more able to afford technology. Feeling that a lower tax base was no excuse, the superintendent was determined to level the playing field when it came to providing technology. Using Title I funding available for one of the elementary schools, a pilot classroom project with computers and learning software was implemented. This project caused great excitement among the students and their families, while the other schools started insisting on equity. The enthusiasm spilled over to a summer camp, and various teacher and community training programs

Prior to their one-to-one implementation technology improvements were being made in the four elementary schools and the middle school, but there was a dearth of computers and networks in the high school, which became known as “the black hole of technology.” Of the computers installed in the high school, 75 percent were over four years old. The high school was built in the 1960’s and would require major refurbishing, including asbestos abatement, in order to implement the necessary network infrastructure for server-based management of student work, which must be available wherever the student logs in. This lack of computer technology in the high school was a real step down for the students coming from the middle school. The turning point came in 2003 when the middle school students won a history day competition, using technology to research and create their presentation. With little equipment in the high school, the students began to petition the school board.

By the 2003 -2004 school year, one computer services staff plus two aides supported the district. This was an increase from one person reporting to the librarian.



**Before One-to-one: Cost of Ownership Metrics**

For comparative reasons it was determined to perform a TCO analysis of the high school only (36 percent of district costs are allocated, in proportion to high school student population), both before and after the one-to-one implementation. The following tables reflect the results of the 2003-2004 school year, before the one-to-one implementation. Indirect labor costs (user time in training or dealing with system/network issues) were not surveyed. The district did not collect indirect labor: user time in training and self-support.

## 1. Direct Cost by Category

| Unit                                   | Total     | Hardware | Software | Direct Labor | External Application Providers |
|--|-----------|----------|----------|--------------|--------------------------------|
| High School Cost                       | \$132,600 | \$53,782 | \$15,873 | \$51,425     | \$11,520                       |
| High School Cost per Client Computer   | \$577     | \$234    | \$69     | \$224        | \$50                           |
| High School Cost per Student (HS only) | \$156     | \$63     | \$19     | \$61         | \$14                           |

## 2. Hardware Cost by Category

| Unit                                 | Client Computer | Server  | Network | Printer & Supplies |
|--------------------------------------|-----------------|---------|---------|--------------------|
| High School Cost                     | \$37,796        | \$5,992 | \$8,170 | \$1,824            |
| High School Cost per Client Computer | \$164           | \$26    | \$36    | \$8                |

## 3. Asset Metrics

| Category of District Resource                             | Ratio |
|---|-------|
| Students per Student Available Client Computer            | 3.7   |
| Teachers per Teacher Dedicated Client Computer            | 1.0   |
| Non-Classroom Personnel per Non-Classroom Client Computer | 1.0   |
| Total Users per Total Client Computers                    | 3.0   |

## 4. Staffing Metrics

| Direct Labor Category                 | Total Cost | Cost Per Client Computer (\$ US) | Client Computers per Staff |
|---------------------------------------|------------|----------------------------------|----------------------------|
| Operations and Financial              | \$34,875   | \$152                            | 307                        |
| Professional Development and Training | \$10,360   | \$45                             | 1,032                      |
| Curriculum Development and Support    | \$6,190    | \$27                             | 1,728                      |
| Total Support                         | \$51,425   | \$224                            | 208                        |



## ***The One-to-one Project Vision and Goals***

This district has had a proud history of academic excellence. It is highly rated in a county of 18 districts, based on state and standardized testing where for two consecutive years, the district had the highest percent proficient students in the county. It is important to this district to maintain an excellent rating while also focusing on equity of opportunity and 21<sup>st</sup> century skill development for its students. While supportive of the need to upgrade the high school technology infrastructure, the school board was concerned with potential costs.

With these goals in mind, and increasing pressure to upgrade the high school computing environment, two approaches to implementing technology into the high school curricula were evaluated: (1) Implementing updated labs and related robust network infrastructure that would allow students' work to follow the students, and (2) Providing a wireless network and laptops that the students could take with them. For equity reasons, the entire high school of 640 students needed to be included, including students at risk. When asking another district about their one-to-one program, the response was, "Find the student least likely to succeed, and that student will be your rising star."

Starting with the state contract for Apple iBook computers, the district worked directly with Apple to develop an affordable solution. The estimated cost for the traditional lab option, including upgrading the existing network infrastructure, replacing outdated lab, classroom and teacher computers, and without teacher training was \$721,800. The estimates for the one-to-one program for students and teachers, which included teacher training was a bit more at \$845,853 (17 percent more, after state grant). As the district is looking towards a new high school, or significant renovation, in the coming years, portability of the technology and related infrastructure was also a concern, as building refurbishing costs of \$170,000 for the traditional approach would be lost.

In spring of 2004 the school board made the difficult decision to move ahead with the one-to-one laptop program; thanks to a favorable lease arrangement At this point there was also an overall willingness of the community to accept a 1.7% increase in their property tax-rate

### **The process:**

- Research, site visits, and discussions with other districts were undertaken. Regular board updates were conducted; and the vision was shared with the community, including student presentations.
- Student/staff volunteers were recruited
- The district undertook an assessment of networking requirements.
- Hardware, software and training requirements were set for the traditional and one-to-one options.
- A capable person was assigned to address technical issues.



Consortium for School Networking

March 2006

[www.cosn.org](http://www.cosn.org) [www.classroomtco.org](http://www.classroomtco.org)

Page 4

- Pricing and financing was negotiated – See “Approach and Financing” below.
- State program improvement dollars and grants were secured and some existing funds were reallocated
- A majority board decision to move forward with the project took place in June, 2004.
- Initial teacher training took place over the summer of 2004, with student training in September/October. Laptops were handed out at these sessions.

## ***One-to-one Project Costs and Financing***

### **Approach and Financing the One-to-one Project**

The four-year lease consists of:

- 16 days of Teacher training by Apple Professional Development
- 700 Apple iBooks with four-year warranty
- Site assessment and 40 Airport wireless access ports
- Apple System Engineer support and other support/set-up services

The Pennsylvania grant paid for \$40,000 of the project and the lease covers the remaining \$845,853 as follows:

Year 1: \$126,000 (\$166,000 with the state grant of \$40,000 paid up-front)

Years 2 through 4: \$239,951

The lease is with Apple Financial at a rate of 5.2 percent and a \$1 buyout at the end. The district has not determined what to do with the laptops at the end of the lease. To put this in perspective, the annual lease payments amount to approximately one-half of the district technology budget (which includes technology and direct labor costs).

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

The insurance policy to cover loss or damage not covered in the four-year warranty is available for students/parents at \$53 per year, with a deductible of \$67. If the family with the ability to pay for the insurance chooses not to, the student does not receive a computer, but rather uses an in-school computer.

Technology costs not included in the lease but related to the one-to-one project include projectors, cameras, printers and other type of peripherals to help in the classroom end. The district also purchased a server to help with the increased network traffic.

Laptop carry bags were paid by the district’s internet provider, and insurance coverage for students unable to pay was covered by a local civic organization. The school’s education foundation provides additional program support through the state’s business tax credit program. The foundation provides between \$23,000 and \$31,000 each year to purchase additional cameras, projectors, scanners, and science probes.



## Teacher Training

Training is being provided in three tiers over two years, providing eight days of professional development for each teacher. The cost of the training was included with the lease. Most teachers attended unpaid preliminary training during the summer. Additional teacher training occurred during the seven professional development days throughout the school year. Weekly “quick hitter” sessions are offered before school on timely topics to help keep teachers up-to-speed and to keep ideas flowing.

Teachers are encouraged to leverage the student laptops in class and for homework where it makes sense. While training was required, it is up to the teachers whether the laptop program makes sense for their lesson plan.

The school librarian/media specialist has personally taken it upon herself to develop reliable online and other media resources and works closely with teachers to help them to integrate this wealth of information into their curriculum.

## Direct Labor – Support Staff

The district has added one technology aide to its three-member computer services staff, and some focus of original staff has shifted towards the high school. This original staff include the Technology Coordinator (all schools, now focusing more on the high school) a network administrator who also provides end user support in the high school, and a technology support person in the middle school. The added person designed and manages the district’s new web site and supports the newly added district-wide student data management system

At the time of this study, an Apple contract employee is on-site, full time, at no charge to the district to handle warranty repair.

Twenty students from different grades and social groups make up a student peer support team. These “Apple Corps” students provide technical help and support for their fellow students and the teachers during and between classes. They also make themselves available during their study hall time. They receive special training to help them in this task.

## Projected High School TCO with the One-to-one program

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 high school, including the one-to-one program, other equipment and proportioned district resources. This district elected not to survey for indirect labor, which includes user training time and user self/peer support. The total per-client computer direct cost (not including indirect labor cost) is \$542.



## 5. Direct Cost by Category

| Unit                                | Total     | Hardware  | Software | Direct Labor <sup>1</sup> | External Application Providers |
|-------------------------------------|-----------|-----------|----------|---------------------------|--------------------------------|
| District Cost                       | \$385,947 | \$193,124 | \$45,873 | \$132,550                 | \$14,400                       |
| District Cost per Client Computer   | \$542     | \$271     | \$64     | \$186                     | \$20                           |
| District Cost per Student (HS only) | \$603     | \$302     | \$72     | \$207                     | \$23                           |

1. Initial training has been amortized over four years
2. Per-student cost are total high school technology costs divided by the number of high school students

## 6. Hardware Cost by Category

| Unit                              | Client Computer | Server   | Network | Printer & Supplies |
|-----------------------------------|-----------------|----------|---------|--------------------|
| District Cost                     | \$171,692       | \$11,438 | \$8,170 | \$1,824            |
| District Cost per Client Computer | \$241           | \$16     | \$11    | \$3                |

## 7. Asset Metrics

| Category of District Resource                             | Ratio |
|---|-------|
| Students per Student Available Client Computer            | 1.0   |
| Teachers per Teacher Dedicated Client Computer            | 0.8   |
| Non-Classroom Personnel per Non-Classroom Client Computer | 1.0   |
| Total Users per Total Client Computers                    | 1.0   |

## 8. Staffing Metrics

| Direct Labor Category <sup>1</sup>    | Total Cost | Cost Per Client Computer (\$ US) | Client Computers per Staff |
|---------------------------------------|------------|----------------------------------|----------------------------|
| Operations and Financial              | \$58,150   | \$82                             | 310                        |
| Professional Development and Training | \$39,100   | \$55                             | 847                        |
| Curriculum Development and Support    | \$35,300   | \$50                             | 938                        |
| Total Support                         | \$132,550  | \$186                            | 183                        |

1. Initial training has been amortized over four years

**Projected Benefits and Other Realized Benefits**

Without actually walking the halls and talking to students and teachers, it is hard to visualize the energy and enthusiasm that this program has evoked. Now in its second year, the one-to-one program has really begun to work its way as an exciting tool into the curricula.



## Projected benefits

In mind from the beginning was a focus on the stated mission of the school district: “to provide an interactive educational environment, which encourages students to acquire the skills, knowledge, and attitudes necessary to become responsible members of society.”

The District Superintendent refers to the students’ 21<sup>st</sup> century bedroom and at best, a 20<sup>th</sup> century classroom. Providing students with **21<sup>st</sup> 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 aspects of teaching and learning is necessary to provide students with necessary skills for college or the workplace. The enGauge® 21<sup>st</sup> Century Skills document from NCREL and Metiri Group was used as a guideline. Major local industry has been very supportive of this project and the prospect of better-prepared applicants.

Providing **equity** for all students, despite socio-economic status was also a major goal. Following announcement of the one-to-one program, an alternate education student asked the superintendent, “but are **we** getting computers or do only the smart kids get to use them?” It took a few moments and questioning for the superintendent to realize what the student was asking as it hit to the core of providing equal opportunity for every student. Although 90 percent of the students now have internet at home, wireless access has been made available outside the school and software is provided to allow students to download internet content at school for viewing at home. 95 percent of the students take the laptop home every night and 95 percent say they use it for homework at home.

**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, along with the district website, has helped to continue parent involvement and communications, and the student laptop is available for parent use. A parent survey shows that they feel strongly about the value of the laptop program both as beneficial for their child’s education and for their success after high school. Community service organizations and local industry have been involved and supportive from the beginning.

### Some Statistics

- 95% of students take their laptop home every night
- 95% of students use their laptop for schoolwork at home (1-2 hours/night)
- 88% of students use their laptop for internet access at home (44% have a wireless router)
- 81% of students report being satisfied with the laptop program
- 88% of parents feel that the laptop initiative is beneficial or very beneficial for their child after high school
- 87% of parents feel that the laptop initiative is beneficial or very beneficial for their child’s high school education
- 68% of students prefer to take class notes using their computer



## Other Realized Benefits

**Cost savings**, although recognized, have not been quantified. One of the first savings to be recognized is the district's ability to reduce the number of required textbooks.

Teacher (and student) productivity and printer supplies savings are realized with an electronic homework hand-out, hand-in and hand-back system. Automated on-line testing and grading has saved teacher time and provided immediate feedback to students. Increased enrollment through a return of some home schooled students has been recognized and may be at least partially a result of the one-to-one laptop program.

The one-to-one program has lowered some of the special Ed costs since students with disabilities can use the laptop for enhanced audio and visual media. They can record teacher lectures and adaptive technology in individual education programs is often not needed since the laptop can be set up for those with special needs.

**Student motivation and continued achievement** was not a goal of the one-to-one project, but it is important to the district to maintain their high achievement rating. It is recognized that this can not be done by standing still. Students used to resent the fact that they had more technology in the middle school. Student time on task improvements and an increase of completed homework are indicative of continued achievement. Practice tests, automated testing with immediate results, and the automated homework submission and return not only help with productivity but are used to enhance learning. A recent parent survey indicated that the students' attitudes are very positive about school.

**Student organizational skills** have shown a noted improvement. The use of their laptop computers and mandatory use of course folders and sub-folders have helped students to organize their notes and assignments.

**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 leveraging student laptops in their instruction. The librarian/media specialist has been a galvanizing force in reinforcing use of lesson material in more than one class. For instance, a computer class exercise is to edit media clips containing subject matter the students are studying in their social studies class. Student/teacher communications has also improved with the automated homework submission system and increased use of email.

**Enhanced curricula**, including more in-depth lessons and labs have been made possible by the one-to-one project. Also, with the availability of the laptops, topics relating to current events are possible. This district has added courses such as Digital Photography, Radicals and Terrorists, Mathematica courses, Online Shakespeare, Music Composition and a Math Literature Circle as well as providing online access to all of the library sources.



## ***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](http://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



## **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](mailto:elizabeth@cosn.org)

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



Consortium for School Networking

March 2006

[www.cosn.org](http://www.cosn.org) [www.classroomtco.org](http://www.classroomtco.org)

Page 13