



North Central Regional
Technology in Education
Consortium
at



A Report and Estimating Tool for
K-12 School Districts

Virginia District Case Study

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Consortium for School Networking

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Virginia District Case Study

Introduction

The four 2004 Total Cost of Ownership (TCO) case studies were developed by the Consortium for School Networking, thanks to a grant from the U.S. Department of Education and the cooperation of the case study school districts. These case studies are presented in the same format as the 2003 studies, but also have a focus on additional technologies beyond the base distributed computing model. These new technologies are voice/data integration, wireless networking, and e-learning.

From a technical perspective, the scope of the project included 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, and staff development and training were included as well.

Data from each district were used to develop a case study that reports pertinent TCO metrics, discusses how the district approached the TCO process, and provides background information on the district and its distributed computing environment. The metrics represent a baseline for the district; and from this baseline data, a trending analysis can be performed. In addition, the process for data collection should be refined, over time, as a first-time TCO analysis often requires a great deal of manual effort. It is difficult to compare one district's TCO study to another's because there are so many potential variables.

For the 2004 case studies, 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. Understandably, the indirect labor cost estimates for the 2004 studies are higher than the published 2003 case studies, because the 2003 projections were based on estimates by staff in the Information Technology department rather than a survey of users.

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. The third section includes an interpretation of key selected TCO metrics. The fourth section provides a review of the district's participation in the 2004 case study focus initiatives of wireless communications, voice/data integration, and e-learning technologies. The fifth and final section discusses each district's approach to performing the TCO analysis.



Overview and General Setting

The Virginia case study school district is primarily suburban and growing with 166,600 students on 241 campuses. The campuses are organized geographically into 8 clusters, each with three high schools and associated middle and elementary schools. Installed technology includes over 64,000 desktop computers which include client computers with Microsoft Windows and Apple Macintosh operating systems in classrooms, administrative offices, 517 shared computer facilities (including labs and libraries) and 110 wireless computer carts. The campuses are wired with category 5 Ethernet local area networks at mostly 100mbps connecting 96,000 access points to 1,100 Windows 2000 servers then via ATM wide area network to the district Windows and Unix application servers.

The information technology department regulates the administrative purchases for the district and provides standards and negotiates vendor contracts for the district. These standards are, for the most part, adhered to by the schools which have their own instructional technology budgets. Major client computer purchases are added to a 5-year leasing agreement in order to encourage system refresh and spread out the costs over a longer period of time.

The information technology department of about 388 district employees reports to an Assistant Superintendent/CIO who oversees four groups: Technology Planning and Assessment (financial management, technology consulting and assessment, and strategic technology architects), Customer Products and Services (technology support, multimedia/TV station services, teacher outreach services, library services, school/district project managers and decision support solutions), Information Technology Infrastructure (computer operations, network system services, and hardware support including warranty services), and Knowledge Asset Management (database and application support services).

First-level user support for a variety of versions of Macintosh- and Windows-based systems is provided by School Based Technology Support Specialists who report to their respective school. Second-level support is provided by Technology Support Specialists who report to the Department of Information Technology and are assigned to schools. From a support perspective, all electronic equipment, including audio-video, is supported by Field Service Technicians. Specific application support is provided by Functional Application Specialists who specialize in various applications such as library, student information, human resources, finance and procurement. These individuals report to the department responsible for their discipline.



Recent district technology initiatives include new help desk and dispatch software, application integration middleware, upgraded student information system with related school server upgrades, consolidation of two email systems to a single groupware and related email application, an upgraded web site using a student management system for teachers to post information for students and a process for the community to sign up to receive email notices based on interests, intranet services for use by school staff (includes HR benefits and personal information, forms, news, etc.), and an e-learning infrastructure set up as an online campus for students requiring individual or home-bound instruction.



Cost of Ownership Metrics

1. Overall Cost

Unit	Total Cost	Direct Cost	Indirect Labor Cost
Overall District Cost	\$233,059,569	\$88,923,705	\$144,135,864
District Cost per Client Computer	\$3,255	\$1,242	\$2,013

2. Direct Cost by Category

Unit	Hardware	Software	Direct Labor	External Application Providers
District Cost	\$13,441,774	\$15,664,322	\$58,613,663	\$1,203,946
District Cost per Client Computer	\$188	\$219	\$819	\$17

3. Hardware Cost by Category

Unit	Client Computer	Server	Network	Printer	Supplies
District Cost	\$7,924,025	\$3,088,647	\$2,429,102	N/A	N/A
District Cost per Client Computer	\$111	\$43	\$34	N/A	N/A

4. Asset Metrics

Category of District Resource	Ratio
Students per Student Dedicated Client Computer	2.92
Teachers per Teacher Dedicated Client Computer	1.39
Non-Classroom Personnel per Non-Classroom Client Computer	0.78
Total Users per Total Client Computers	2.61
Client Computers per Printer	N/A
Client Computers per Server	65.1

5. Staffing Metrics

Direct Labor Category	Total Cost	Cost Per Client Computer (\$ US)	Client Computers per Staff
Operations and Financial	\$44,603,683	\$623	129
Professional Development and Training	\$12,204,265	\$170	499
Curriculum Development and Support	\$1,805,715	\$25	3,193
Total Support	\$58,613,663	\$819	99



Interpretation of TCO Metrics

Hardware costs are relatively low at \$218 per client computer.

Over 55 percent of the client computers are 5 years old or older and fully depreciated. These devices were purchased prior to the district's computer leasing agreement and have, in many cases, been cascaded down to less demanding computer functions. With the lease in place, it is hoped that fewer old computers will remain in service over time. The older computers tend to drive up support costs in the form of direct and indirect labor.

Direct labor costs are higher than other case study districts at \$1,242 per client computer

The district has managed to accomplish a strong penetration of computers for student use at a 2.9 to one student-to-computer ratio, driving the need for a sizable support operation. The complexity of the environment by sheer size and deep functionality of the software environment also drives cost for support and new application implementation throughout the district. Major applications need dedicated support specialists to work with users and to keep the application updated and running smoothly.

The school district invests heavily in providing development and training of teachers, administrators and other staff members. This training, while using direct labor resources at 20% of the direct labor budget, goes a long way towards a satisfied user community and reducing the level of indirect labor. This district is located in the heart of a major metropolitan area with high cost of living, and pays the related higher wages. With the schools or clusters making decisions on student- and teacher-based applications, the district is allowing schools to suit their individual technology needs. However, this approach creates a variety of hardware and software products that must then be implemented and supported by direct labor personnel. Standardization of hardware and software products has enabled this district to keep this in check.

The technology groups are responsible for support of all electronic equipment in the district, including a local television broadcasting studio which provides instructional and community interest broadcasts. This is a broader direct labor responsibility than encountered at other case study districts.

The district is also authorized to perform its own warranty maintenance, which adds to direct labor costs, but generates offsetting warranty revenue from the vendor. This revenue is not recognized by the TCO tool as direct labor credits.



Software costs are higher than other case study districts at \$219 per client computer.

This higher software cost is explained by the range and complexity of the district's software environment. From client computer productivity aids to the comprehensive tools implemented for a sophisticated Internet and intranet application, which includes online grade reporting and attendance for teachers, add up in terms of cost, but also in terms of value and user productivity. This district would likely find that teachers were able to spend more time teaching because they had to spend less time on administrative tasks—an important consideration when evaluating the impact of a technology investment

Network costs at \$34 per client computer are in-line when compared to other districts studied.

Despite the size and complexity of the district's networks, the cost per client computer is right in line with some of the smaller case study districts. This network infrastructure has capacity for client computer growth, and consists of 96,000 wired network ports for the 64,000 desktop client computers plus numerous wireless "hot spots" for mobile wireless computer users.

Indirect labor costs at \$2,013 are in-line with other case study districts.

Despite the need to support the users of 71,600 client devices, including desktop, notebook and PDA devices and pretty much everything else electronic (most notably audio-visual equipment) the district has maintained minimal user productivity loss. Keeping in mind the higher salaries required by this metropolitan area, user time spent in training, performing system functions and providing or receiving technical support is quite reasonable and is the result of the district's investment in technology staff to train and support the users. This district far exceeds other case study districts in its investment in professional development and training for users.



2004 Focus Initiatives

e-Learning – “Online Campus”

During the 2001 – 2002 school year, the Virginia case study district conducted a pilot project exploring the usability, flexibility, and security of using an online course management system (CMS) to provide a full range of online instructional capabilities to students, faculty, staff, and parents. The initiative was named 24-7 Learning to provide a 24-hour a day online resource with capabilities ranging from educational enhancements for the traditional classroom, to complete online high school courses, to professional development opportunities for faculty and staff.

The initial pilot proved to be so successful, that the 24-7 Learning system was made available in the 2002-2003 school year to all 165,000 students and to 20,000 teachers and staff. Training for school-based technology specialists and central staff points of contact was critical to the success of both the data integration effort and the success of the fielding. A train-the-trainer model was used to establish a qualified training cadre to perform turn-around training for school-based specialists. Core trainers completed this turn-around training for over 150 school-based specialists in a two-month period.

The capabilities provided by 24-7 Learning are being embraced at a phenomenal rate. Since the beginning of the 2002 – 2003 school-year, weekly usage has soared to nearly 1,000,000 “hits” per week. The number of users grew from 12,000 to 85,000 in the first year of implementation with more than 53,000 students actively using the class sites of more than 2600 teachers for activities ranging from checking homework assignments to participating in full on-line classes, literally using the site around the clock.

A notable part of 24-7 Learning is the “Online Campus,” which is treated like a virtual high school. More than 350 students from 48 middle and high schools participate by taking one or more courses. The online courses are restricted to students that need access, either at school or from home, to Advanced Placement courses, students that require the completion of a course to fulfill their graduation requirements, and students with special needs. Students accessing courses from school do so in the library or another monitored facility. The curriculum consists of 17 core courses plus 14 Advanced Placement courses. Qualified teachers are available on a regular schedule, two times per week, to provide assistance via email and online chat sessions.

The course management system software that the district uses to develop and conduct these classes was selected because the district was already using it to help teachers create their own Web sites and to provide a mechanism for conducting online student assessments. As a part of the pilot installation the district used vendor-supplied courseware. After reviewing additional sources of courseware, the district concluded there was little available that matched the specifications of the district or the state. Moving ahead, the district chose to create courses from scratch rather than to acquire and



modify courseware. To create quality courses without infusing specific teacher individuality, a group of five teachers were brought together as a team and provided a stipend to create the content of each interactive course. The course content was then given to a web developer to publish it using HTML (HyperText Markup Language) for interactive web access.

The costs for creating and maintaining the Online Campus include the initial development and implementation costs and the ongoing costs of teachers and support.

Initial costs:

- Course development stipend for five teachers at 100 hours each course = \$10,500 per course.
- An outside web developer was hired to convert the course into HTML at a cost of \$11,000 per course.
- A course management server was purchased and a notebook computer was provided for each teacher that would be leading a course.

Ongoing costs and savings:

- Student management system software cost, used for course development and delivery, which in this case has been picked up by the district, because of its broader use throughout the district. For a TCO analysis, a portion of this cost should be attributed to e-learning TCO based on usage.
- Teaching personnel costs for support of each online course is required. This district felt that a ratio of one FTE teacher per 20 FTE students is appropriate, as opposed to the district average of 1:28 in traditional classes, plus the cost of supplies. The total online campus curriculum is broken into 23 sections, each with a teacher providing email and twice-weekly web chat student support at \$8400 per year each via additional time contract. The additional costs generated by a more favorable student-teacher ratio is offset by the costs saved by supporting fewer hours of teacher “face time” than in a traditional classroom.
- The administrative costs of a guidance director and a 70-percent-time principal for the project.
- The district recognizes that it saves some costs of facilities and transportation that are generally associated with educating students. Enrollment in these courses reduces the need for bus transportation and eliminates time away from the students’ base school.
- After initial development investment, approved online campus courses become the template for presentation of subject matter for the traditional setting. Minor modifications by central staff allow distribution and reuse of content by any teacher with minimal development effort.



From a technology TCO perspective, the following factors should be considered for this district:

- An additional server was purchased and should be amortized over five years.
- No dedicated student client computers were purchased. Available systems in labs, libraries and at home are used.
- No additional network costs were incurred, as the district's LAN and web access were already in place.
- Notebook computers were purchased for the teachers and should be amortized over five years.
- Courseware development of \$22,000 per course should be amortized over five years, assuming a course did not have to be updated during that time. Purchased courseware varies considerably in price averaging around \$300 per student per year. Some of the courses developed in-house generate revenue from use by other districts, effectively lowering their cost to the district.
- Host computer application support software costs should be allocated by the portion used specifically for the Online Campus.
- The cost of direct labor for application support is most likely to be somewhat higher per client computer than the overall district requirements.
- Other direct labor components, such as training and trouble-shooting may be somewhat higher for the teacher notebook computers, because the teachers may be using them more intensively than their counterparts in traditional classrooms.
- Indirect labor is most likely higher as Online Campus teachers and students are using computers more than their traditional classroom counterparts; hence, they are more likely to encounter system issues that require their intervention. They are also more dependent upon computer availability than some other computer users.

To do a meaningful TCO analysis of the e-learning environment, a district would have to do a base TCO analysis of the entire district to establish a TCO baseline, as was done for all case studies, followed by a specific TCO analysis of the e-learning environment, attributing the portions of district-wide technologies (servers, network, and district software) and direct labor supporting this environment. This specific TCO analysis of the e-learning environment has not yet been done.



TCO Processes

The TCO process has been integrated into this district's planning. The district has been involved and has used TCO management techniques for six years. Managers have participated with CoSN studies and presentations during this period. The TCO process has been used in formulating its Technology Plan which includes:

- structured planning/budgeting methodology with on-line systems support
- life-cycle costs included in major technology initiatives
- automated inventory system for computer hardware
- long-term contract vehicles with lease/purchase options
- three-year warranties on personal computers

The district has a very advanced ATM network with high bandwidth to all schools. The cost of this network is partially offset with E-rate funding.

Schools have wireless networks that have been installed based on the district's wireless policies and procedures.

The district has a sophisticated use of outsourcing. Some services have been outsourced successfully, while a number of services have been brought back in-house after a thorough review of the costs determined that this was the most cost effective and efficient way to provide the service.

Printers and the costs of related supplies within the school and cluster budgets are not tracked by the Information Technology department. This information was not available for the case study.

The district staff did not survey students for their input to the indirect labor portion of this analysis, based on concerns over privacy issues. As a result, student time spent dealing with system functions or problems is not recorded, but generally has minimal effect on indirect labor costs.

The direct labor costs per client computer are higher than other case study districts. However, considering the relative breadth, functionality, complexity and scale of its technology environment, plus the necessarily higher burdened salaries, this district is doing well at managing the environment, implementing new initiatives, and providing strong services to end users. The district was recently selected by CIO magazine as one of one hundred top IT organizations for its exceptional management of its IT resources and won the Virginia Governor's award for innovative development of its Education Decision Support Library (EDSL) in support of the No Child Left Behind legislation.

The Virginia case study district has an infrastructure in place for its e-learning environment. With its initial district-wide TCO analysis completed, the district could now



perform a similar analysis specifically on its Online Campus for comparison. It should be noted that a comparative TCO analysis covers only the technology-related costs, not all of the costs and savings of the Online Campus. Although the Online Campus is seen as a requirement for the district and is not viewed as a way to save money (it doesn't), understanding what the costs are, relative to the district as a whole, will provide support for future decisions concerning e-learning.



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 Include 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 Include all of the labor incurred by the user community for the study period. Indirect Labor includes the costs of users supporting one another, 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 administrative software and 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 and development 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.

Printer Cost per Client Computer

Measures the annualized cost printers 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, and 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 them.

Client Computers per Printer

Includes the total number of client computers divided by the total number of printers.

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, and 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 IT 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

Other 2004 Case Studies

Missouri District Case Study

A rural district with 450 students

Texas District Case Study

A suburban district with 35,500 students

Wisconsin District Case Study

An urban district with 21,500 students



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