

**REPORT TO THE
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**Best Practices in Using
Technology in Public Education**

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Technology Deployment and Use Varies by School

The Legislative Audit Subcommittee requested a review of how technology is being used to improve public education, whether there is sufficient training and support for teachers and students, and whether schools are maximizing the technology that has been purchased. Much has been accomplished to put technology into Utah's schools to improve the education of students. Most teachers have personal computers, all schools have some personal computers for student use, and most schools have some computers connected to the Internet. The amount, age, accessibility and use of computers varies greatly, however, by district and school. Although much has been accomplished, much remains to be done including upgrading and replacing outdated technology, providing the professional development needed to enable educators to use technology more effectively in the classroom and providing the technical support to maintain the systems.

Although questions still remain about how best to use technology to improve the education of students, many believe it plays an important role. While it is difficult to isolate the effects of technology alone, many administrators see positive academic effects of the use of computers, connections to the Internet, and various software programs in their schools.

Each school district determines how much to invest in technology to achieve its educational goals and how fast to deploy the technology infrastructure. School districts have local boards that have broad authority to set their education policies and differing funding capabilities to finance their technology programs. All districts benefitted from dedicated legislative funding under the Educational Technology Initiative (ETI) from 1991 to 2001. The end of the dedicated funding along with tight state budgets in the past few years have created funding concerns in some districts because they were not able to upgrade or replace outdated technology as planned, provide professional development opportunities for teachers or fund ongoing technical support.

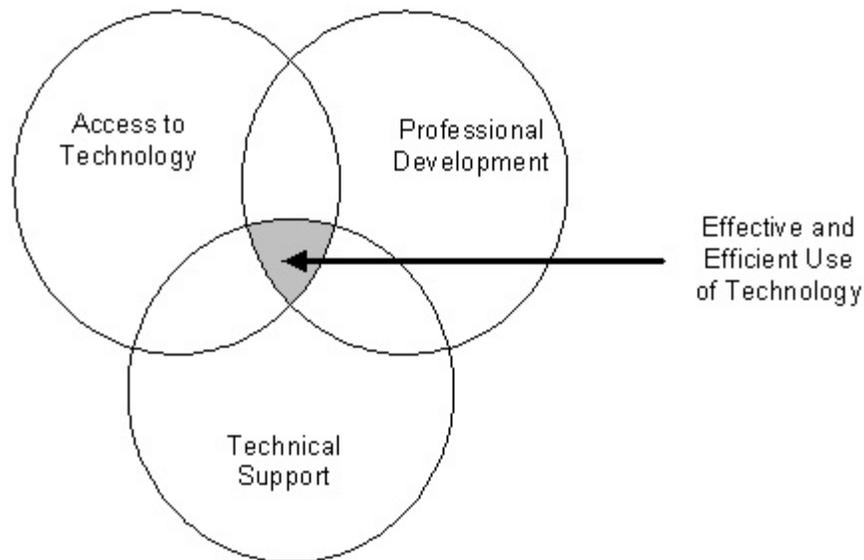
Technology Success Depends on Interrelated Components

For teachers and students to utilize technology in an efficient and effective manner and to fully take advantage of the benefits of using technology to improve the education of students, three components must be present. These are

- Access to technology, i.e., the hardware, software, and infrastructure
- Professional development opportunities for teachers in the use of the technology
- On-going technical support to maintain the systems.

The figure below provides a simplified diagram showing that all three components are necessary for technology to be used efficiently and effectively.

Figure 1. Three Basic Components of an Education Technology Program. The effective and efficient use of technology requires students and teachers to have access to technology, professional development training on its use and technical support to maintain the systems.



These three components must each be present, and they must each work together for technology in education to succeed. For example, if students have access to computers and sufficient technical support exists that keep the computers well maintained and operational, but teachers are not trained on how to effectively educate students with computers, then the computers become very expensive toys.

Or if professional development training is present, teachers have knowledge and ability to use computers to help increase the education of students, and the equipment is present for students to use, but adequate technical support does not exist to keep the computers consistently operational, then teachers may not count on the equipment and students will have difficulty benefitting from the technology.

The same scenario of students not being able to benefit from technology holds true if students do not have access to computer hardware, appropriate instructional software and Internet connections.

Indeed, it is vital that each of these three areas be given equal attention and sufficient resources for technology in education to succeed.

Where We are and How We Got Here

Much has been accomplished to put technology into Utah's schools. In 1990 few schools were connected to the Internet; today, 100 percent of public schools are connected. In 1990 there were very few teacher computers; today, almost all teachers have a teacher computer in their classroom. In 1990, very few students had access to computers in schools; today, all schools have some student computers.

All Utah school districts used Legislative funding and local resources to develop education technology programs, link most school computers to the Internet and begin to use computers for end-of-year testing. Legislative funding has also been used to create and maintain a statewide technology infrastructure, to create and operate EDNET for distance learning, and to start and operate a statewide electronic high school.

In 1990, Utah's legislature began a multi-year Educational Technology Initiative (ETI) to assist school districts and colleges of education to develop educational technology programs. From Fiscal Year 1991 through Fiscal Year 2001, a total of \$188 million was specifically appropriated by the legislature into four specific programs:

- \$86 million for public and higher education technology
- \$34 million for professional development for teachers
- \$29 million for EDNET, a closed circuit two-way video service for distance learning
- \$39 million for UtahLINK (now called UEN) for a statewide computer network infrastructure connecting Utah's school districts, State Office of Education, colleges and universities, the Electronic High School and the state's library system.

The mission of ETI was to enhance the teaching/learning process and to empower students to become literate, self-directed learners, problem-solvers, and productive members of a technology-oriented society. The enacting legislation stated the goals to be the following:

- Support and encourage the use of educational technology in the state's public schools
- Train teachers and prospective teachers to effectively use educational technology in the classroom
- Promote a strong technology partnership between public education and private enterprise
- Promote student performance in the basic curriculum areas of science, mathematics, reading, and language arts and encourage achievement in other curriculum areas identified by each local school board
- Focus public and private funding on critical educational areas that directly support student achievement and economic development
- Support the expansion of high technology industry in the state
- Make technology available to each school district so all students in the state have access.

The technology initiative ended on June 30, 2001. In Fiscal Year 2002, funding previously dedicated as ETI was rolled into block grants and technology became one of many school funding priorities for Utah's school districts. The following two years (Fiscal Years 2003 and 2004) were financially challenging years for the entire state, and block grants were cut in half which impacted the amount of funding that districts received. According to several technology directors and others in the education community, the loss of dedicated ETI funding and then cuts in the block grant created a hardship for some districts to continue to fund their technology programs.

Although education technology can include a wide range of tools such as distance learning and virtual high schools, our report focuses on computers, peripherals such as printers, and their connectivity to the Internet.

Reviewing How Technology is Used in Public Education

In order to respond to the Legislative Audit Subcommittee's request of how technology is being used to improve public education, we collected information from the Utah State Office of Education (USOE) and the Utah Education Network (UEN). We also interviewed some technology directors, superintendents, school technology personnel and teachers. We conducted a statewide written survey at 12 school districts – four large, four mid-sized and four small – to obtain feedback from teachers and administrators on the major issues being reviewed. We also examined national reports and literature written by professional groups.

To conduct the statewide survey, we designed two survey instruments – one for classroom teachers and one for administrators – to ask for information regarding technology use in their school. Both close-ended and open-ended questions were included. We randomly selected teachers at each school we reviewed which allowed us to survey all types of teachers in all disciplines and in all grade levels. Response rates were very high; 480 of 520 teachers responded for a response rate of 92 percent; 57 of 60 administrators responded for a response rate of 95 percent.

Identifying Best Practices in Districts

This review is a departure from a typical audit report where agency problem areas are highlighted and methods of improvement are addressed in auditor-generated recommendations. Instead, this report highlights best practices that appear to be working in various schools and districts that may be of benefit to others. Best practice reviews seek to build upon successful local efforts by identifying and publicizing efficient approaches to providing government services. Schools and districts may wish to pick and choose the best practices provided in this report as they continue to build their technology programs.

The best practices we highlight in the following sections are

1. Providing adequate technology resources
2. Providing professional development opportunities, support and time to implement the training
3. Providing sufficient technical support to keep the systems operational
4. Providing stable funding tied to short-term and long-term plans
5. Setting equipment standards
6. Managing computer and printer inventory
7. Conducting an annual Total Cost of Ownership (TCO) review

Provide Adequate Technology Resources

Providing teachers and students with up-to-date, useable technology is important.

All schools have computers for teachers and students, computers connected to the Internet and educational software; however, quantity, quality and accessibility vary greatly by school. Ensuring that all teachers and students have access to adequate technology resources is important to most schools.

Adequacy of Resources

- 98 percent of teachers have a computer dedicated to them.
- Instructional computers available range from 2.5 students per computer up to 23.0 students per computer depending on school.
- 68 percent of teachers do not believe that students have an adequate amount of time on classroom or lab computers.
- Classroom computers are aging. 47 percent are 4 or more years old.
- Lab computers are also aging. 45 percent are 4 or more years old.

Most Utah teachers have a computer in their classroom. 98 percent of all teachers surveyed have a dedicated computer and use the computer for administrative functions such as grading and attendance, which are state mandates.

Most Utah students have access to school computers, yet accessibility varies. One indicator of the amount of technology available to students in a school is the student per instructional computer ratio. The number of students per instructional computer varies from 2.5 students per computer up to 23.0 students per computer depending on the school. Elementary schools usually have the highest ratios meaning that more students

share each computer. According to *Education Week Technology Counts 2004*, Utah's state average of 5.2 students per instructional computer is one of the highest ratios in the country. The national average is 4.0 students per computer and ranges from 1.4 to 5.5 students per instructional computer.

The majority of student computers are in computer labs or media centers, and a few are in classrooms. Students have a variety of software programs to use. Administrators report that 100 percent of computers allow students to do word processing, 93 percent allow Internet searches, 93 percent allow presentations, 88 percent have spreadsheet software, 61 percent have simulation programs, and 51 percent have integrated learning systems. Administrators also report that in 80 percent of schools, students have complete access to the Internet after signing an acceptable use policy. In the other 20 percent of schools, Internet access is restricted to specific grades or to students enrolled in a computer course or a specific program.

Successful Practices:

- ✓ **Provide Laptop Computers for Teachers.** Most districts or schools provide desktop computers for teachers. In our survey many teachers stated they could be more effective with laptop computers. Some schools have found success in purchasing laptop computers for those teachers that want them and allowing the teachers to take the computers home. By using the computers at home, teachers become more knowledgeable and proficient with the hardware and software. Also, if they wish, teachers would be able to work from home on a variety of things such as lesson plans, grades, or curriculum and not be tied to their classroom desktop computers. Although laptops are somewhat more expensive than desktop computers, the benefits may outweigh the costs.
- ✓ **Place Computers in Classrooms for Student Use.** Computer labs allow students to share computers. However, if computer labs are not scheduled properly, the equipment is not used effectively. In our survey several comments indicated the ineffective use of computer labs. In our visits to schools we also observed that some labs were not being used effectively. Nationally, there is a trend to place computers at the point of instruction – in classrooms – instead of in computer labs.
- ✓ **Provide Software for Teachers and Students.** Students have access to computers with a variety of software intended to support their learning and future job needs. In the survey several teachers asked for more and better software that reinforces the skills and concepts they are teaching in the classroom as well as assistance in choosing appropriate software for their subject and grade level.
- ✓ **Institute a Systematic Computer Replacement Schedule.** Providing up-to-date hardware is a challenge for many schools since continuous improvements and advancements occur constantly in the computer industry. New educational software is continually being created that usually requires updated hardware to operate. Instituting a computer replacement schedule is important so that computers are consistently being upgraded. In our survey, 26 percent of administrators reported their district did not have a computer replacement schedule, and 32 percent did not think that their districts' replacement schedule was fair or effective.
- ✓ **Dispose of Old Equipment in a Timely Fashion.** Disposing of old computers that are not used and do not work is important. Spending limited resources trying to maintain old, out-of-date computers may not be a prudent use of funds. Worse yet, leaving computers to collect dust in classrooms, labs or storage rooms sends the wrong message to teachers and students about the value of technology.

Provide Professional Development Opportunities, Incentives, Support and Time to Implement the Training

The key to using technology successfully is the teacher. Only teachers can make technology happen effectively in the classroom.

98 percent of teachers surveyed have a computer in their classroom, and 80 percent report their assigned computer is sufficient for their needs. Teachers use computers to a great extent for administrative functions such as grades and attendance. Unfortunately, 36 percent of

Using Technology in the Curriculum

- 33 percent of teachers report that they have unused or underused technology in their classroom.
- Most teachers use computers for administrative functions.
- 29 percent of teachers report they rarely use computers or the Internet for instruction.
- 44 percent of administrators report that only half of their teachers are prepared to use computers for classroom instruction.

teachers report they are not prepared or only somewhat prepared to use computers for instruction. Many of these teachers report they need training and time to integrate that training into their instruction. Without training and adequate time to implement the training, teachers will let expensive hardware and software go unused or underused.

Many groups provide technology training for teachers. Districts, regional service centers, USOE and UEN all provide training on technology and how to integrate that technology into the curriculum. Some districts require technology training for teachers while others use incentives to encourage technology training. The majority

of districts leave it up to teachers to initiate participation. Many courses offered, however, are general, one-day workshop-type courses for teachers of varying abilities, grade levels and subjects, and many courses do not provide follow-up or support.

Although many professional development training opportunities are provided, teachers report the greatest barriers in using school computers for instruction to be insufficient time to learn about the technology, lack of a projection device in the classroom, and lack of adequate equipment. Teachers also reported that many courses offered were too general, not specific to grade level or subject and there was no support or follow-up after some courses. To make sure that the available technology is effectively used in the classroom, teachers need the opportunity, incentive, and support to experiment with it, master it, and learn to adopt it as a basic teaching tool.

Successful Practices:

- ✓ **Provide Follow-up and Support after Professional Development Courses.** One district has developed two training labs with instructors and a budget for substitutes. Teachers are trained during the day and then have a month's worth of follow-up and support for each of the classes. This model allows teachers to get support and follow-up so that they can actually put what they've learned into practice. Teachers in this district appeared more confident with their use of technology in teaching.
- ✓ **Provide Appropriate Professional Development Based on Feedback From School-based Staff.** Providing professional development opportunities for teachers based on their needs and aligning it with the district's technology plan will ensure that the appropriate training is provided at the appropriate time. In the survey some teachers commented the training they took would not be put to use because they did not have the software or hardware available. One teacher summed it up by saying, "If you go to the trouble and cost of training, make sure there is a way for teachers to get the software that will run on their computers."
- ✓ **Provide a Variety of Opportunities in Terms of Time, Location, and Delivery Mode for Technology Training.** Our survey results show that teachers have different training needs and want a variety of opportunities to meet their individual needs. Teachers also want one place where they can view all available training opportunities both within and outside their district. Providing training opportunities in a variety of times, locations and delivery modes would ensure teachers receive the training they need when they can use it.
- ✓ **Provide Professional Development on Integrating Technology Into the Curriculum.** 30 percent of teachers surveyed noted they were unable to use the technology available to them because of a lack of training, especially in integrating the technology they currently have into the curriculum. The surveyed teachers noted that they wanted training by educators who have been successful using technology in his/her own classroom and know what works. Also, they wanted training specific to their grade, subject and level of technical expertise.
- ✓ **Consider Adopting the ISTE National Education Technology Standards (NETS) for teachers and administrators.** Several administrators noted that technology training should be mandatory for teachers. Other states address technology skills through the adoption of teacher and administrator standards. 40 states and the District of Columbia have adopted these standards for teachers and administrators. All candidates seeking certification or endorsements in teacher preparation should meet these educational technology standards. It is the responsibility of the faculty across the university and at cooperating schools to provide opportunities for teacher candidates to meet these standards.

Provide Sufficient Technical Support to Keep the Systems Operational

Technical support is like the key to a car; without it the car can't move.

The majority of teachers are waiting at least two days, and in some cases a month or more, to receive technical support for their computers. Computers that are not working cannot be used to advance the education of students. By not providing enough support for the existing equipment, schools are letting expensive hardware and software go unused.

Sufficiency of Technical Support

- 25 percent of teachers reported getting hardware problems fixed by the end of the day.
- 37 percent of teachers reported getting their hardware problems fixed in two to five days.
- 38 percent of teachers reported they waited a week or longer to get hardware problems fixed.
- 33 percent of teachers report that the amount of down time is unreasonable.

Districts use a variety of approaches to maintain their computer network and fix computer problems. Districts use a combination of the district technical staff, school technology staff and classroom teachers to repair and maintain the hardware and software at each school. Districts appear dedicated in providing technical service to their schools the best way they can. Indeed technical support personnel are putting in long hours and working as efficiently as they know how. However, they do face many obstacles. Some practices work much better in alleviating some of the burden from district technicians.

Successful Practices:

- ✓ **Use District Level Technical Staff for System Wide Issues.** All districts use skilled technical staff to manage the network systems issues and other general complex technical problems that schools encounter. However, in some districts these technicians are also required to troubleshoot minor problems in individual schools. Since there are so few district level technical staff, they cannot correct all problems in individual schools in a timely manner leaving many teachers without useable technology.

- ✓ **Use On-site Technology Specialists.** To resolve technical problems in individual schools in a timely manner, some districts provide technology specialists at the schools. These specialists troubleshoot minor technical problems, help resolve computer viruses and help teachers integrate technology into the curriculum. If the on-site technology specialists need assistance, they can get assistance from the district level technical staff.
- ✓ **Use Computer Technicians not Classroom Teachers as Technical Support.** Some districts assign a classroom teacher as the primary technical support person. However, classroom teachers generally do not have sufficient time and may not have the expertise to fix technical problems. The teacher is often called away from teaching and puts in many hours after school. We have heard of instances where teachers have transferred schools just to get away from their technical support responsibilities.
- ✓ **Use Students as Technicians.** To provide more timely technical support in schools, some districts use students as technicians. Some rural districts use a program called Cybercorps, based on a national model, where students are trained to take over some of the technical needs of equipment maintenance and troubleshooting. Districts using this program have seen great success with it. Additional benefits of this program include (1) students receive quality training and learn valuable technical skills, and (2) teachers and administrators get fast, if not immediate, help with technical problems.
- ✓ **Utilize as Many “Easy Fixes” as Possible.** Diagnosing and resolving software problems can be time consuming. In one district, technicians will only spend 20 minutes trying to diagnose a problem. If the problem cannot be solved within that time, then the computer is wiped cleaned and the software is reinstalled. This process can be done from a remote location, which saves a technician valuable time. Districts that use this process find that they can resolve their software problems more efficiently.

Provide Stable Funding Tied to Short-term and Long-term Plans

Provide a stable source of revenue for technology to ensure success.

All districts received dedicated technology funding from 1991 to 2001 under the Educational Technology Initiative (ETI) and were able to create or expand technology programs in their schools. When the initiative ended in 2001, some districts continued to provide dedicated funding for technology, but other districts did not. Funding for technology has decreased in many schools because of the tight state budget in the past few years. By not supporting the existing equipment and users and providing professional development for teachers, some schools are not maximizing the existing technology.

In addition to the up-front costs of purchasing technology there are annual costs to maintain it and then to eventually upgrade and replace it. In addition to funding for the equipment itself, funding is important for professional development needed to enable educators to use technology more effectively as well as providing support for the systems.

Budget Concerns

- 16 percent of administrators report that they do not have a formal technology plan.
- 43 percent of administrators report that their technology budget has been cut in the past year.
- 84 percent of administrators report there is not adequate funding for classroom-based technology resources.
- 89 percent of administrators report there is not adequate budgeting for hardware and software replacements and upgrades.
- Teachers that have taught in various districts report disparity in available technology.

Successful Practices:

- ✓ **Have an Overall Technology Vision.** Some districts have strong visionary leadership and have been able to maintain and expand their technology programs even during tight budgeting times. These districts have an overall vision for technology in education that is well supported by district leadership. Also, planning for technology is a joint effort with input from the board, administration, teachers, and community business leaders.

- ✓ **Have an Effective Technology Plan to Drive Decisions.** Because of the lack of dedicated technology funding, some districts and schools have not taken the time to make plans or to keep their plans up-to-date claiming that planning is irrelevant if there is no funding. It is important not to abandon a plan because funding is not currently available. School districts that have technology plans and fund their plans appear to be doing better than those districts that do not have well-established plans. Effective technology plans include clear concise goals, objectives and action plans for technology projects; specific assignments to individuals responsible for implementing goals and objectives; firm deadlines; and budgets tied to the plan's deadlines.
- ✓ **Provide a Stable Funding Source.** Utah's districts have local boards with broad authority to set their own education policies and differing funding capabilities to finance their technology programs. Schools and districts use a variety of funding sources to fund their technology programs. Federal funds and grants, E-rate, state funds, state trust lands, student fees, grants from corporations and foundations and corporate donations are used to build technology programs. In addition, districts have used bonding and voted leeways to build technology programs. While investigating each of these funding sources takes time, it is a good way to augment the technology funding at schools.

Technology is one of the top five funding priorities in some districts. However, in other districts, technology is not as high a priority. In those districts where technology was a high priority, there appeared to be more technology for students, more working computers and fewer maintenance backlogs.

E-rate is an example of a federal funding source that some districts have not taken full advantage of. In a previous report our office found that some districts were not getting all possible E-rate funds.

Set Equipment Standards

There may be a price to pay in the costs of long-term maintenance and support if individual schools are permitted to make their own decisions on how technology will be deployed.

Many schools have a wide variety of brands and models of computers with different hardware configurations. Also, schools have a wide variety of second-hand computers. Providing technical support to keep these different systems operational is extremely time consuming, costly and creates support backlogs. When additional computers are purchased or when old computers are replaced, districts should consider buying only one, or at the most two, brands of computers and keeping similar hardware standards for every computer.

Purchase and Maintenance Responsibilities

- 45 percent of schools have complete autonomy to purchase, replace and upgrade computers, software, and peripherals.
- 60 percent of districts are responsible for maintaining the computers, software and peripherals at individual schools.

Some districts give individual schools complete autonomy to purchase computers, software and peripherals. As a result schools have a wide variety of brands and models of computers with varying hardware configurations that need to be maintained and repaired. Some district do not impose a standard on the schools' purchases because they feel that schools should have autonomy over their purchases. It is true that by not imposing a standard on schools these schools have more autonomy and can select the equipment they feel is best for them. However,

often technical expertise does not exist at the school level and this lack often results in schools selecting inferior equipment, which ultimately creates problems district technicians are required to fix. In addition, district technicians have to continually retrain themselves in the different makes and models purchased by the schools.

Administrators must recognize there may be a price to pay in the costs of long-term maintenance and support if individual schools are permitted to make their own decisions on how technology will be deployed.

Successful Practices:

- ✓ **Set Equipment Standards.** Some districts have standardized computer equipment and only allow schools to choose from one or two computer manufacturers. In other words, schools can purchase one brand of Windows-based and/or OS X-based Macintosh personal computers. But schools are allowed to choose from several models of the chosen manufacturers, and these choices give the school flexibility. By standardizing equipment purchases, technical support and repairs are streamlined. Uniform computers also create a seamless transition when teachers or students transfer schools within the district.
- ✓ **Purchase Equipment at the District Level.** Some districts purchase all computers at the district level and are therefore able to take advantage of quantity discounts from manufacturers. In fact, some districts purchase all computers, install the software and deliver the computers to the schools. Districts that purchase from one or two computer manufactures and set in policy standards for hardware and software have experienced multiple benefits. Some districts reported to us that giving schools dollars to purchase their own equipment created “haves” and “have-nots” between schools. In addition, ownership issues with equipment have been eliminated and equipment can be moved among schools as student enrollment changes.
- ✓ **Insure that Donated Computers Meet District Standards.** Donated computers vary widely in quality and performance, but they almost always create technical support issues for districts. Often, well-meaning local businesses and private citizens may offer to donate older computers to schools, and schools that need technology often agree to accept them. While the computers may be free, usually substantial costs occur to upgrade them to the standards of the district’s network.

Some districts have policies specifying the minimum computer standards they will accept for a donation. A minimum standard is important for a district to enforce. Accepting computers that are below an acceptable standard increase district costs. Savings are soon eroded by the support costs associated with keeping inferior computers up-to-date.

We have been told by some districts that they will accept any computer donation even if it is below their acceptable standard so they do not create public relations problems. Computers that are below standard are typically not used heavily and are often thrown away. Consequently, the district can become a dumping ground for unuseable computers. The district also becomes responsible for disposing of the computers. One possible alternative is for districts to channel donated computers into low-income homes that might not otherwise have a computer.

Manage Computer and Printer Inventory

Districts should be wise in how they conduct inventory and purchase printers.

A few districts conduct an annual inventory of equipment, but others do not. In addition, few districts track their donated computers. An annual inventory of all computer devices will help districts know the location of all the equipment for which they are to provide technical support. It is good management practice for districts to know how many computers and printers are in the district and the location of each. Having accessible, reliable, cost-effective printers is also important for teachers and students.

Inventory and Printer Issues

- Some districts do not track their donated computers.
- Some schools give teachers the choice of printer but then require teachers to purchase ink for inkjet printers.
- Some teachers were angry at having to purchase their own ink for the inkjet printers.

An annual inventory of computers and printers allows the district to know how many devices are in the schools that district technicians are likely responsible for supporting. Also, keeping track of the district's inventory can help prevent the possibility of misuse. The district technology coordinator cannot effectively plan for repairs when he/she does not know all equipment that is in the schools. Knowing the age of the district's inventory can also help determine the replacement schedule of the computers.

Some districts give teachers the choice of printers, and sometimes if teachers choose to have an inkjet printer, the school requires these teachers to purchase their own ink. Our survey showed that some teachers were angry at having to purchase their own ink.

Successful Practices:

- ✓ **Conduct an Annual Inventory of Equipment.** Conducting an annual equipment inventory will enable districts to have a better knowledge of the age of their technology and provide them with needed data when planning to replace equipment. Keeping records of the equipment will also benefit districts when they complete an annual Total Cost of Ownership.

- ✓ **Use Printers That Are Cost Effective.** Networked laser printers provide lower cost per page than inkjet printers and school districts should consider using networked laser printers. Laser printers cost more to buy but much less to use. With all costs figured in, each page printed from a laser printer costs from two cents to five cents. The cost to print from an inkjet printer ranges from 10 cents to 15 cents per page, depending on the model. Printers can be expensive to operate, and they often pose technical support problems. Unfortunately, it maybe cost prohibitive to have a printer in every teacher's classroom.

- ✓ **Strategically Place Printers Where They Will Get the Most Use.** Savings could be increased drastically if more planning takes place in how printers are allocated so that a group of employees shares one laser printer connected to the network instead of having a printer for each user. Districts analyzing their printer needs with the goal of obtaining the lowest cost in ownership will help them to determine what kind of printer to buy for their users. Laser printer technology is well suited for heavy printing and is an economical choice.

Conduct an Annual Total Cost of Ownership (TCO) Review

“School districts need to be aware that they cannot manage what they cannot measure” ...Gartner Group

Four districts have recently gone through a Total Cost of Ownership (TCO) analysis that was created to help organizations understand all costs, benefits and value associated with procuring, owning, and using information technology components over time. As schools become more dependent on technology and as budgets become more scrutinized and with increasing student enrollment, school districts need to do everything they can to stretch their technology dollars further than ever before. Going through an annual TCO analysis will provide benefits to all school districts.

TCO Reviews Completed by Districts

- Four districts have completed TCO reviews.
- Three districts have nearly completed TCO reviews.

The Total Cost of Ownership (TCO) process was created by the Consortium for School Networking with support from the U.S. Department of Education. TCO captures the entire cost of acquisition and maintenance of technology. TCO has become the standard by which organizations evaluate and measure the value of technology products and services.

Completing an annual TCO will enable districts to understand better their direct and indirect costs of operating and maintaining their computer network. The TCO tool is most useful for measuring districts' costs over time.

Successful Practice:

- ✓ **Implement an Annual Total Cost of Ownership (TCO).** By implementing an annual TCO, districts can better follow their costs and see the effects of their short- and long-range goals for technology in their districts. Once total costs are understood, districts can analyze efforts and begin to measure technology effectiveness.

Completing an annual TCO will provide data needed to help administrators and boards understand the impact as well as the costs of technology initiatives. The TCO process identifies and documents direct and indirect costs. Understanding and

consolidating both types of costs tend to lead to lower overall spending. Consequently, determining the costs involved may also lead to increased efficiency in meeting district goals. At first it may be difficult to discover the sources of various costs, but as districts complete this report over time, the task will become easier.

By completing a TCO, districts will be able to perform what-if scenarios because they will know the direct and indirect costs. This data will help them see if there is a more cost effective approach for a technology solution. For example, a district may want to look at the costs of centralized repair and maintenance of computers as compared to the costs of having individual schools performing the maintenance. Different scenarios can be created based on changing the ratio of centralized to local effort, or by outsourcing some or all of the maintenance and repairs of computers. Districts could then understand the costs of each scenario while considering the effects and their impact on instructional programs.

By using the TCO method, districts can use the data collected from this process to help develop and document the real cost of using their technology. Using the data collected from the TCO can help administrators develop budget guidelines that can withstand critical review.

Conclusion

This report has described some important best practices that occur within school districts in their efforts to provide technology for their students, teachers and administrators. It is our hope that schools and districts will choose the practices that will help them improve their technology programs.

This report further stresses there are three components for efficient and effective technology use - student access, technical support, and professional development - each requiring stable funding. Where funding, policy review, and leadership are in place, schools and students benefit from the investment in educational technology.