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To: Members of the Policy Advisory Task Force, Wisconsin School Finance Adequacy Initiative

From: Allan Odden, Professor

Date: January 27, 2006

Re: Elaborations of Technology Costs

Following is a more detailed break out of technology costs, which will be inserted into the longer report for our April meeting.

Distribution of the Annual $250 per Student Technology Allocation

Federal Resources for Educational Technology

There are two federal sources of funding for educational technology that augment the above proposals for state support. The first is Title II D of the No Child Left Behind Act (NCLB), also known as the Enhancing Education Through Technology grant (EETT). These funds are distributed to state departments of education based on a formula which includes the number of disadvantaged students. Many states have used these funds for innovative technology programs, the fourth category below. Though the level of funding for this federal program fluctuates over time, it should be viewed as a strategic additional resource that states can deploy for whatever specific new technology needs that might arise.

The second federal support for educational technology is the E-Rate program that helps schools connect to the Internet and build internal networks within their buildings. This program is administered by the Schools and Library Division (SLD) of the Federal Communications Commission (FCC). Districts apply directly to the federal government to participate. The assistance this program provides can be significant to a district. Since funding is substantially based on the percentage of disadvantaged students within a district, this program mainly helps districts with concentrations of students from lower income backgrounds, and offers limited participation to other more economically advantaged districts. Nevertheless, this source of funding should b e viewed as a second strategic resource to augment the above core recommendations for funding for computer and related technologies.

Allocating the $250 per pupil.

Each district and school situation is unique, requiring that an individual technology plan be created at both the district and school levels. Most districts and schools already have technology plans because of the federal funding requirements in the E-Rate and EETT programs. These documents should be meaningful mechanisms used to distribute resources to the areas of most need within the school or district environment.

To assure that all technology needs are met, the recommended $250 per student figure has been assigned subcategories of spending. At the same time that these subcategories have firm dollar figures associated with them, they must be flexible enough to meet the changing needs of the organizations and the ebb-and-flow of technology purchases.

The four subcategories of need include:

1) Purchase, lease and maintenance of computers
2) Refresh of software including operating systems, productivity suites like Microsoft Office, and other essential software that give computers basic functionality
3) Purchase of networking equipment, printers, copiers, and their supplies
4) Purchase and refresh of instructional software (including one-time purchases and subscriptions) and additional hardware that enhances the instructional environment.

The allotted dollar figures are as follows:

- Computers (3-, 4-, or 5-year replacement cycle) $100
- Operating system, productivity and other non-instructional software $50
- Network equipment, printers, and copiers $50
- Instructional software & additional hardware $50

This distribution is based on what a typical school might need if that school had participated in the funding programs made available by the districts and states in the past. It assumes that campuses have been connected through Ethernet and/or fiber cabling and that Main and Intermediate Distribution Facilities (MDFs and IDFs) have been populated with the necessary active electronics (switches). It also assumes that schools own various computers between one and five years old which have a mixture of hardware, operating systems and miscellaneous iterations of instructional software.

1. Computer Purchase, Lease and Maintenance (3-, 4-, or 5-year replacement cycle) (3-to-1, or 2-to-1 student-to-computer ratio.

The formula for the expenditure of funds within the subcategory of *Computer Purchase* has multiple variants based on the distinct needs of the school and district. The $100 annual per student allocation for this subcategory was calculated using and average price of $1,200 per computer. This figure may seem high for the purchase of a common workstation, but it is based on the average price of computer within a group of machines that could include desktop workstations, laptops, high-end video editing stations, and/or wireless mobile carts (20 laptops and cart $60,000) depending on school site need.

All computers should be purchased with a 3-year on-site warranty. These warranties provide benefits to both large and small school districts. Larger districts typically enter into self-servicing agreements with manufacturers to generate funds for additional parts. Smaller districts, by

contrast, are served well by the "on site" technical help that warranty agreements provide because these districts lack the ability to hire highly specialized full time personnel.

When purchasing computers, districts should consider including computer monitors that are large enough to prevent eyestrain. LCD flat panel monitors generate less heat and should be considered to save energy costs in the spring and summer months. Each computer should come with the most up-to-date operating system and the latest office productivity suite pre-installed so that computers need only be reconfigured, not re-imaged, at installation.

Regarding computer replacement, for most applications in educational technology a four-year replacement cycle is adequate. There are exceptions. For example, for computers that are used for simple word processing and other such tasks, a five-year replacement cycle (especially with the software replacement outlined below) is appropriate. But, there are various cases in which a five-year replacement cycle is not sufficient. Many classrooms, most notably at the secondary level, demand the latest technology available and should be on a three-year replacement. Examples of courses that require ever-increasing computer power include higher mathematics, art, and other courses that heavily use multimedia or multimedia editing, which can include both biology and social studies. Further, because the student to computer ratio is meant also to provide computers for administrators, "power users" in the school office, such as the individual who processes student data, may require a three-year replacement.

If districts decide that it is important to have a two-to-one student-to-computer ratio, school officials can limit the number of higher-end computers they purchase to raise the overall number of computers and lower the student-to-computer ratio. Districts could also take three-year-old computers that are ready to be replaced from more demanding course environments and redeploy these units in less demanding environments thus gaining an additional two years of use.

Using a three-to-one student-to-computer ratio to generate a denominator of 3, and placing the $1,200 cost of the average computer as the numerator, the average cost, per student, per computer becomes $400. Spreading the $400 per student cost over the four year period that a computer would be in service creates a $100 cost, per year, per student figure. Thus, the annual cost per pupil to maintain a three-to-one student-to-computer ratio is approximately $100.

2. Refresh of operating system, productivity software, and other non-instructional software.

To compete well in the global economy, students should have access to the latest operating systems and productivity software. Additionally, new operating systems traditionally supply district personnel with more powerful features to secure the network and protect school and student data.

With educational discounts schools can buy the latest operating systems and productivity suites for approximately $55 each. Indispensable antivirus and anti-spyware software can be purchased on an annual basis (approximately $8 - $10 per workstation, per year for the most popular product). Software programs such as Altiris that allow teachers to monitor workstations or "push" their screens to students is expensive and should also be refreshed. Administrators or students may use the latest versions of FileMaker Pro or other databases to analyze data. Server

software must also be upgraded. The cost of these upgrades depends on what services are running (e-mail, database, network security, backup software). Larger campuses have at least two servers with various services running. After averaging in the number of servers provided at the district level, the formula for this category assumes three servers per school site.

Operating System (three years)	$ 57
Productivity Suite (three years)	$ 55
Server Software (every three years)	$ 1,500 (depending on services)
(based on 3 servers per site, average w/district)	
Database (FileMaker Pro, other) (three years)	$150
Antivirus/anti-spyware (annually)	$ 10
Other Network (Novell, Altiris, LanDesk)	$ 17

Providing for the three-year refresh cycle of the first four software items on this list and assuming a three-to-one computer ratio divided over the four-year life cycle of the computer, these software refreshes calculate to $51 per year per student. The figure of $50 will be used for ease of use.

(((((57+55+1,500+150)/3)+10+17)/3)/4)

This subcategory has some caveats. Depending on how often upgrades/refreshes become available and/or what functionality a new release of software holds, the annual allocation of $50 per student for software could be high or low. In years when the demand is not as heavy in this subcategory, the funds could be used in any of the other subcategories where there is a local need. School officials must be aware though that the price for these refreshes will cut into other subcategories when these upgrades for these software products become available.

Also, districts and schools will gain a year of operating system refresh if the life of a computer is four years. For example, the operating system would probably be refreshed once during the life of a computer, but a new replacement computer would come with a new operating system, effectively "giving" the school district a year of a more advanced operating system. This would also be true with the office productivity suite.

Not all districts and schools use all of the software listed above, but, they might have other software packages that they use to secure and regulate normal computing functions in the district. This formula assumes that these costs will average out.

3. Network Equipment, Printers, and Copiers

Assuming an average campus size of 400 students per site, the $50 per pupil figure for this technology subcategory provides $20,000 per year or $60,000 and $80,000 over three and four years, respectively. Since this subcategory has such diverse components, it is important that districts and schools set aside the funds necessary to meet that needs of each of these components: network equipment ($26), printers ($18), and copiers ($6).

3a. Network Equipment

To most district and school employees, the network equipment that provides connectivity to the district office, the Internet, and other specialized networks is invisible or transparent. Most networking equipment will have been purchased through facility funds or bond measures. Network equipment does not need to be refreshed as often as computers, but the larger more complex pieces of equipment should be on a maintenance contract with the manufacturer and/or a service contract with a third party vendor. In schools, most of this type of equipment will be used until it breaks or becomes obsolete. Taking this into consideration, the motivating factor for replacement usually is the speed of the product. The speed of networking equipment is measured in megabits per second. Common speeds of networking switches include 10 megabit, 100 megabit, and 1,000 megabit (commonly called gigabit). The current "standard" (or what most schools have) is 100 megabit to the desktop and 1,000 megabit on the backbone (main lines of the network). For almost any application, this is sufficient speed within a campus.

A cost of $2,200 has been assigned to replacing 10% of the school's network equipment annually. In this same school, if each piece of equipment was under a service contract, the service contract would have an approximate annual cost of $4,400 (20% of the original cost of the equipment). Most schools find it more cost effective to contract only for the most vital network pieces and not to maintain service contracts on the smaller switches in the network. Instead, districts purchase additional smaller switches as replacements if one of these pieces of equipment fails. Calculating these figures, the networking portion of this subcategory carries an annual per pupil expenditure of $17 per pupil.

The wide area network (WAN) that provides the gateway to the Internet is one of the main administrative and instructional resources for educators. The data lines that make up this network must remain uncongested for teachers and administrators to maximize their efficiency. Most elementary campuses have at least a T-1 line to their site; middle and high schools commonly have two T-1 lines to their site. The T-1 line has a capacity of only 1.5 megabits. Many times T-1 lines reach capacity at peak times on campuses frustrating users. It is imperative that administrators, teachers, and students understand that there is a limited amount of bandwidth and that it should be used for educational purposes.

Districts usually use E-Rate funds to offset the monthly cost of their T-1 lines which, before discounts, can cost approximately $250 a month, or $3000 a year. District then have to pay an access charge to an Internet provider to provide Internet service. This cost varies by service provider, but can be estimated at around $500 per school per year. So the total school cost of linking a 400-pupil school to the Internet is $ 3,500 per year, or $ 9 per pupil.

Calculating the per-pupil price of network related expenses based on the costs of a T-1 line per site, 10% replacement annually of network equipment, and maintaining service contracts on all networking equipment, the network portion of this subcategory approximates $26 dollars per pupil annually.

3b. Printers

Computer prices listed in the *Computer Purchase* subcategory do not include the initial costs for workstation printers, but each computer must have some method available to print. Some schools purchase higher-end laser printers for each classroom instead of attaching ink-jet printers to each individual work station (laser printers are more cost effective). In addition to classrooms, each school should have at least one mid-range color laser printer for communications that are sent to community members and parents. Since most small districts do not have the in-house expertise to repair printers, we suggest that they contract with an outside vendor and common practice around the county is to so contract.

The cost of an inkjet printer is a nominal $100. A high quality laser printer suitable for heavy classroom use is $1,200. Assuming that a 400-student school contains 16 classrooms with one laser printer, and at least two laser printers in the office, each with a life cycle of four years, the initial cost per student for the printing equipment would approximate $18,000 or $45 a student. Assuming a printer life cycle of four years, the annual cost for this element is $11 per pupil. The real costs of printing depend on the frequency of use and the volume of printing done (cost of paper, ink, and toner). Teachers, students and administrators will print as much the budget can support. Assigning a cost of $7 per student annually to a 400-student campus provides the campus with an annual budget of $2,800 for supplies such as paper, ink, toners, etc. Thus, printing per pupil annually would be $18.

Depending on size, each elementary school should have a high-speed copier that can meet the demands of its teachers. Depending on size, secondary schools will need additional copiers. Most districts maintain contracts with vendors for the repair and maintenance of these machines. Many sign lease agreements and pay for service on a “per click” basis (“per click” meaning printing per page). Whether a machine is bought or leased can play a factor in the final costs. Life cycle of specific machines and the volume of copying required by leasing companies determine whether one or the other method is more cost effective for any particular school or district. When paper, toner, service contracts, leases and other costs are factored, the average cost per copy approximates $.025 per copy. Assigning a $6 per pupil per year cost for photo copies allows each student 240 copies a year or 26 copies a month (9 month school year). This may not seem like a large number but when combined with the output of the printers listed in the previous paragraph, the overall number is more than adequate.

4. Instructional Software and Hardware

This subcategory could be termed the “innovation fund.” The $50 per pupil figure for this technology subcategory provides $20,000 per year for the 400-pupil school. Funds in this subcategory should be split evenly among components until sufficient hardware has been purchased (hardware $25, software $25).

Many districts only have the ability to provide the funds for the earlier three subcategories and have no funds left to purchase additional instructional hardware such as LCD projectors ($900 - $1,700), smart boards ($2,000 depending on features), document cameras ($1,500), digital cameras ($300), etc. This additional hardware allows teachers to bring multimedia resources

alive. It also gives students the opportunity to bring their own experience into the classroom through digital pictures and images.

Assuming $10,000 per year ($25 per student annually for a 400 student school) for this component in the 400-student, 16-classroom school, school officials might install three LCD projectors a year (there are some installation costs), buy 10 digital cameras that could be checked out by teachers and students, and setup one smart board. With some slight variations, within four years each classroom could have an LCD projector and various other items of innovative equipment.

As these pieces of equipment are installed, there will be more opportunity to use multimedia instructional software typified in student courseware and assessment packages. Reading packages such as Accelerated Reader, writing assessments like My Access, mathematics courseware represented by River Deep, and multimedia resources such as Discovery.Com, each present digital curricular solutions. Each of these products is based on an annual subscription costing from $5 - $15 per student for each individual package.

Administrative solutions that help administrators analyze test scores include products like Edusoft. Costs of a student administration system might also be considered a part of this component. Costs of these systems vary greatly ($5-$15 annually).

If the costs of all these instructional packages were totaled, the amount would exceed the $25 per student annually assigned to this component, but not every school will use all packages. Schools and districts must analyze their needs and then rank order those packages that target the needs of their population. Additionally, after all classrooms have been better equipped, funds from the hardware component of this subcategory can be shifted to instructional software component.