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ABSTRACT

Despite the potential of technology, it is clear that the benefits of computers, multimedia and telecommunications technology are not as widespread in schools as could be hoped. To ensure that all students and teachers have access to technology, the issue of comprehensive, statewide implementation must be addressed. This cost model for implementing technology statewide was developed in order to push beyond the level of mere discussion and to make the vision of ubiquitous technology a reality. This cost model defines a vision of technology capability and access for schools and students, and then outlines the expenditure required in New York state to fully implement the vision. The intent of this document is not to derive the exact cost for technology implementation, but rather to serve as a starting point for discussion. The three-stage cost model in this paper can give everyone--including local, state, and federal organizations--the ability to define the order of magnitude of cost involved in implementing statewide technology, and provides a firmer basis for discussing priorities and strategies for obtaining support from local, regional, state, and federal representatives. The cost model is built on the following sets of key assumptions, all of which are discussed in detail: educational assumptions, deployment/implementation assumptions, technology assumptions, and fiscal assumptions. Technology cost assumptions include workstation costs, network infrastructure costs, and salary, staff development, and equipment maintenance costs. The appendix provides the detailed cost components for each stage of the model, and includes copies of the spreadsheets used to calculate all costs. (MAS)

A COST MODEL

Implementing Technology in New York State Public Schools

A Paper for Discussion

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Albany, New York
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A COST MODEL

Implementing Technology in New York State Public Schools

Technology has tremendous potential to change the teaching and learning environment of our schools and to support the higher academic standards of *The New Compact for Learning* and other reform efforts at the local, state and national levels. As the National Educational Commission on Time and Learning pointed out in its report *Prisoners of Time*,

> Technology is a great unrealized hope in education reform. It can transform learning by improving both the effectiveness of existing time and making more time available through self-guided instruction, both in school and out. Technology has already changed much of the rest of American society--profit and non-profit, private sector and government alike--because it makes it possible to produce more with less.
>
> A similar revolution is possible in education. Effective learning technologies have already demonstrated their ability to pique student interest and increase motivation, encouraging students not only to spend more of their own time in learning, but also to be more deeply involved in what they are doing. (p. 37)

Despite the potential of technology, it is clear that the benefits of computer, multimedia and telecommunications technology are not as widespread in our schools as we would hope. While there are many factors at work preventing the extensive integration of technology into schools, including the lack of adequate training and support for teachers, one fundamental factor is the lack of ubiquitous access to technology.

If we are going to ensure that all students and teachers have access to technology, and use it as a regular, ongoing part of their learning, we must address the issue of comprehensive, statewide implementation of technology. We need to ensure that all students have equitable access to technology tools that allow them to become active, engaged learners, as well as producers (not just consumers) of information. All students must be experienced with the information tools which are part of our evolving information age. This is why computer, telecommunications and multimedia tools are so important. In order to insure access for all our students, we have to address the very real economic and educational issues that surround technology implementation.

As the report *Prisoners of Time* notes,

> The school revolution, however, depends both on a concerted investment strategy to help educators obtain these technologies and on educators confronting their reluctance to supplement the techniques of the 19th century (textbooks, chalk and blackboards) with the technologies of the 21st (CD-ROMs, modems and fiber optics). (p. 37)

In order to push beyond the level of mere discussion, and to make the vision of ubiquitous technology a reality, I have developed the following cost model for implementing technology statewide. This cost model is defined in an initial, draft form, for discussion purposes. This cost model defines a vision of technology capability and access for our schools and our students, and then outlines the expenditure it would take here in New York State to fully implement the vision. The cost model is built on a number of basic assumptions which are also outlined. The intent of this document is not to derive an exact, "to the dollar" cost for technology implementation, but rather to serve as a starting point for discussion. The paper does not necessarily represent the position of the State Education Department or the State of New York on this extremely complex issue. Rather, it surfaces a set of assumptions about technology implementation which allow us to more easily identify, clarify and plan for our real goals related to the implementation and use of technology support in schools.

The cost model in this paper can give everyone--including local, state and federal organizations--the ability to define the order of magnitude of cost involved in implementing a particular shared vision of technology. The cost model helps us not only to define what it is we really want with respect to technology (the vision, defined in practical, concrete terms), but also to identify, in concrete, hard dollar terms, the costs associated with making the vision a reality. Without a cost model, we have no basis for organizing and directing our efforts. With a cost model we have a firmer basis for discussing priorities and strategies for obtaining support from local, regional, state and federal representatives. By gaining consensus on a particular vision of technology (whether it is this particular model, or a variation), we can also develop the tactical approaches to bring it to every school, every classroom, and every student and teacher. Louis Perelman, in his book *School's Out: Hyperlearning , the New Technology, and the End of Education*, discusses a similar technology vision and demands that we look at the economic issues underlying technology and school reform. Only by combining a shared strategic vision of technology's role with a hard-nosed, practical, economically-driven perspective, can we hope to bring the vision of technology's power to reality.

The timing of this model is important, given the New York State Education Department's commitment (made in 1990) to revise the *Long Range Plan for Technology in Elementary and Secondary Education* in 1995, as well as New York's commitment, under the present Goals 2000 legislation, to develop a new state technology plan which supports the school improvement plan of Goals 2000. This cost model can serve as the focal point for statewide discussion about

technology, with the final result of special legislative and local initiatives to fund technology implementation in all New York State schools.

The Vision

The vision of technology-inspired school reform reflected in this model, is based on implementing a teaching and learning environment where a wide range of technology tools are available and continuously accessible to teachers and students. In this environment, technology would be integral to curriculum, instruction and assessment at all levels. The vision assumes that each school would have collaboratively developed a technology plan that complements and supports the school's school improvement plan. All staff in the school would have the opportunity for on-going staff development with a focus on integrating technology tools into the curriculum. Specifically, the technology-rich environment of the school would include 5-6 powerful workstations in every learning area. All resources would be networked in the school, and the school itself would be networked to the wide area network of the information superhighway. Ideally, the school network would allow for teacher and student access from home, as well as for parent and community access. In addition, classrooms would have the capability to present audio and visual materials in a wide variety of formats to the entire class, as well as small groups. The school library/media center would also provide access to instructional resources and information for the entire school community.

Assumptions

The cost model to implement this vision is built on the following key assumptions:

Educational Assumptions:

- Successful implementation and use of technology require that schools and districts complete a planning phase that addresses educational goals and the specific support roles that technology can play in achieving the educational goals. This cost model assumes that this planning has taken place, or will take place prior to any implementation of systems. The support component for this model includes funding for staff to assist in the planning.

- Technology is a powerful vehicle for reforming schools. To effect school change, students need access to powerful computer tools, multimedia and telecommunications resources as an integral part of their learning day. Therefore, computer and telecommunications access must be available in every classroom in the school. There are approximately 187,000 classroom teachers in the state. Therefore, this figure (187,000) will be used as the number of classrooms in public schools. Although there are over 230,000 computers in New York State public schools, the majority of those machines are not powerful enough to support the networked, multimedia applications which offer the most educational benefit to students. Therefore, no attempt will be made in this cost model to "back out" those machines which already are in schools. In reality, at most only 10% of existing machines could be considered in the category of "powerful, multimedia workstations."

- Effective technology implementations require planning, technical support and, most especially, ongoing staff development for teachers. Hardware is not enough. This cost model includes costs for staff to support planning, technical implementation and educational applications.

- There are 711 public school districts and 4,016 public schools in the State, with 187,000 classroom teachers. All schools, classrooms, teachers and students must be the target of our planning and implementation activities.

Deployment/Implementation Assumptions:

- The deployment of technology-based learning systems can be accomplished in a multitude of ways. For the purposes of this cost model, three stages of deployment will be examined, with the first two being intermediate stages, and the last stage being full implementation of the technology vision. Specifically, the first stage deployment would be 5 workstations with multimedia and network links in the library-media center of every one of the 4,016 public schools in the State. The second stage would extend workstations and connections beyond stage one, and include one workstation with network connection in each classroom in every school. The third, full blown model adds to the prior two stages four more workstations in each classroom.

Technology Assumptions:

- Technology tools are powerful vehicles for transforming schools. There are many technologies which can and should have a place in the school and in the classroom. Because of the convergence of all technologies under the umbrella of the digital capabilities of computers and telecommunications, those technologies will be the focus of this analysis. It can be demonstrated that other technologies such as television and videodisk can be encompassed within the technology designs projected here.

- Five (5) workstations per classroom provides a reasonable level of access for students and teachers. With an average class size of 25 students, 5 computers in the classroom means a ratio of 5 students to each computer. This level of access allows for small group and some individualized work as teachers work with clusters of students. For maximum flexibility, some of the workstations should be notebook size computers that can be moved easily within the school, as well as taken home by students and teachers. The school library is typically the best point for the initial deployment of computer, multimedia and networking technology into a school. School librarians typically are already using computers and networks, and are often working with all the teachers in a school to integrate technology into the curriculum. To create an effective "beachhead" for technology in a school building, the school library should have at least 5 workstations. Larger schools may need more workstations.

- The underlying assumption of technology use is that computers and other tools should be where students do the majority of their work--the classroom. The model discussed in this paper is not based on a "lab" philosophy that tries to maximize the efficient use of computers (as well as centralize their management and security). Technology should be ubiquitously available to students and teachers. Where labs exist in schools, they can be networked into the overall school network, and used for training and special presentations of software. Many schools, however, are re-deploying the computers in their labs back into classrooms to increase the integration and use of technology within curriculum, instruction and assessment. This trend is consistent with the philosophy of "in-classroom use" reflected in this vision.

- To obtain the real benefits of computer and other multimedia technology, all workstations should be networked. The network must include both local area networking and wide area network links to other networks and resources outside the building.

- One (1) laser printer per library media center or classroom is required.

- One (1) CD/ROM or equivalent networked CD-ROM per classroom is required.

- One (1) color LCD display panel with overhead projector per classroom is required.

- Building wiring will be fiber optic cable to all classrooms (building backbone connections), and copper from there to the desktops. This approach allows for later upgrades to allow fiber connections down to the workstation level. Every workstation should be networked to the internal LAN resources and out to the wide area network, including the Internet. Workstations must support Internet network protocols that insure interoperability (e.g. TCP/IP) at the workstation level, with full Internet capability including graphical user interfaces and client/server applications such as Mosaic and File Transfer Protocol (FTP) at the workstation level. Networking and network resource must be able to support high-bandwidth applications, including multimedia and interactive video from other sites. Included in the multimedia capability is videoconferencing at the workstation level.

- It is assumed that adequate electrical outlets are either available in each location where the technology is to be located, or can be added at very minimum cost. In some school sites, especially those constructed more than 30 years ago, this assumption may be invalid. Better information needs to be gathered on the specific physical facilities and their capacity to support technology implementations. It is also assumed that furniture for hardware is already available in the school.

- Networking to the wide area network/Internet requires a dedicated connection. Dial up connections are not adequate. The minimal connection for a school, given the increasingly demanding graphical applications on the Internet, is a broadband T-1 connection (1.544 megabit). Larger schools, and most particularly high schools will require higher bandwidths such as multiple T-1 connections (or T-3 which is 45 megabit or even higher broadband capacity such as ATM technologies). Note that in the first stage of the model, 56 kilobit (kb) links are proposed between the 5 workstations in the school library-media center. For sites involved with extensive 2 way, interactive video, the bandwidth requirements could be even greater. This cost model does not assume the need for this high bandwidth, 2 way interactive television via analog network connections. Rather, it assumes some form of digital, compressed video. The level of compression (and associated level of image quality) will need to be determined, depending on technologies available. The model assumes that existing broadband video technologies using analog television for two-way, interactive communications are prohibitively expensive for implementation in all schools, and particularly expensive for implementation in all classrooms in a school. Present models for interactive video involve a special classroom which is implemented in a school. This type of approach, which is effective for distance learning applications where specialized or low enrollment courses are involved, does not address the long-term educational need to transform teaching and learning by putting technology tools in the hands of students on a continual basis both in their classrooms and in their homes. In short, the interactive video models, particularly based on existing analog video transmission, do not scale well to the entire school building or inter-school connections. Developments in the cable television arena could change this over time as well.

Fiscal Assumptions:

- The cost model reflects an estimate of the total life-cycle costs, exclusive of consumable materials (e.g. printer toner and paper) for a five year period. All recurring costs in the model are calculated for 5 years.

- Basic list prices are considered in the cost model. Obviously, if funding and purchasing are consolidated, significantly lower unit pricing will be obtained. Since it was impossible to estimate any discounts which would be applied on such a large scale purchase , only basic list prices are used here. The degree of centralized purchasing (and related discounts) will be a function, in large measure, of the funding sources available to support any technology acquisition, and the ability of the purchasers to cooperate in consolidating their purchase requests.

- Existing hardware, software and networking in schools are ignored in the cost model. Based on the Department's most recent data (1993-94), there are 237,337 microcomputers in schools and 6,323 CD-ROM's. Clearly some percentage of the existing base of systems can be used. However, based on statistics already reported by the Department's Office of Instruction and Program Development (See *Technology Update--1994*) the number of high powered workstations in schools is fairly limited. Only 76,795 microcomputers can be classified as newer technology, and of these probably no more than 25,000 are in the category of powerful multimedia machines. No cost will be included in the model to address the connection or use of these existing machines. This will have to be addressed on a case-by-case basis.

- No assumptions are made about the source(s) or conditions of funding. In reality, existing funding sources often constrain the uses and targets of expenditures.

- Successful implementation of technology requires a life cycle cost analysis which examines the total system cost for technology over multiple years (typically 3-5). The life cycle cost analysis takes into account not only hardware and software, but also maintenance, technical support, training, networking and other "hidden" costs. This model attempts to address all the major components of system life cycle cost, except for the ongoing cost of supplies and materials. The model particularly emphasizes the staff development and technical support components of the successful technology implementations.

Technology Cost Assumptions:

- Workstation Costs

  A 486 (DX2) or Pentium or Macintosh Power PC 7100 with CD-ROM and color monitor. Notebook computers are an option. Basic operating system (Windows or System 7) is assumed to be bundled with each machine as part of the package.
  $3000

  Application Software/workstation (may include server versions and site licenses, as well as educational applications)
  $500

  Networking components(network board and cable to classroom hub)
  $500

CD-ROM Tower	$1,500
Color LCD projector unit	$8,000
Color LCD Display Panel w/overhead projector unit	$2,500

- Network Infrastructure Costs:

Building Server(s)	$15,000
Laser Printer	$1,250
56 kb Connection	$7,500
T-1 Connection	$25,000
Router / bridge (& CSU /DSU)	$5,000
Internal building wiring (20 classrooms @ $7,500 each)	$150,000

Note: Deriving exact, per building costs for networking is very difficult, given the wide variation in the age, type of construction and layout of each of the 4,016 school buildings across the State. The figures used here should provide a good "average" for computing a statewide cost. Individual building costs for networking will obviously vary. The cost to provide the wide-area networking connection will also vary depending on telecommunications provider, bandwidth requirements and geography. These figures are based on a number of school-wide networking projects implemented in New York State over the past few years, as well as on industry life cycle cost figures. (For information on life cycle costs, see *IS Budget*, May 1994; and *Information Week*--"Looking Beyond the Costs", January 1994.)

- Other Costs:

Technological/Educational Staff Support Persons--One per district in the first stage of deployment, and a person for each of the 4,016 buildings in the second stage of deployment . There are two sets of skills needed for success, one technical and the other educational. The technical skills involve providing technical support for teachers and student in the building, while the educational skills involve providing on-going support to teachers in integrating the technology into teaching and learning.

Total Salary with benefits per person	$75,000

Staff Development--ongoing/25 hours per teacher (over multiple years). It is assumed that half the cost and time would be used in the first year of implementation.

$5,000/teacher
over 5 years

Note: Staff will assist in the initial educational and technology planning within each building

Maintenance (all hardware and software) based on an estimate of 10% of hardware and software costs. It is assumed that there are no maintenance costs the first year because hardware is under warranty. The software maintenance costs reflect upgrade costs. The total maintenance costs in the cost model reflect 10% of the hardware and software costs for 4 years.

Note that all possible, life cycle costs are difficult to estimate. Generally, industry figures suggest 15-20% for hardware and software maintenance. However, a more conservative figure of 10% is used here to reflect the generally conservative approach of educational investments in maintenance. Basic supplies and materials, such as paper, toner for printers, and diskettes, are not included in the these cost figures, but will reflect a very real, and necessary on-going expense. Also not included anywhere in the model, as noted earlier, is furniture or electrical wiring.

Cost Models--Summary of Deployment--Stages One to Three

Cost Model Stage	Cost
Stage One: 5 Workstations in 4,016 Library Media Centers, with CD-ROM, laser printer, and Internet connection. Includes training and support	First Year Cost: **$371,593,000** Full Five Year Cost: **$808,584,200**
State Two: Extends Stage One to one workstation in each of 187,000 classrooms, with laser printer, CD-ROM and Internet connection.	First Year Cost: **$3,627,350,000** Full Five Year Cost: **$6,243,550,000**
Stage Three: Extends Stages One and Two to add 4 more workstations in each of 187,000 classrooms, all with Internet access.	First Year Cost: **$2,992,000,000** Full Five Year Cost: **$4,039,200,000**
Full Model--Implementing the Vision	**TOTALS** **First Year: $6,990,943,000** **Five Year: $11,091,334,200**

Discussion and Conclusions:

The Appendix of this discussion paper provides the detailed cost components for each stage of the model. The appendix also includes copies of the spreadsheets used to calculate all costs. At first glance the total cost for the full model is staggering. Even when seen as a percentage of the total expenditure for K-12 education (exceeding $22 billion per year), these cost are high. Despite this reality, it is important to consider the following:

First, no technology implementation could, or should be implemented in a single year. Investments in technology must be seen as on-going and integral to the overall school budget. As the New York State Business Council's Public Policy Institute of New York State detailed in its publication (*Technology in New York's Classrooms* 1991) schools spend less than 1% of their total budgets on technology. If schools doubled their technology expenditures from 1% of their budgets to 2% over 6 years, as the Policy Institute recommended, the requisite technology tools and infrastructure could begin to be implemented. It is also worth noting that in the corporate and business world, the percentage of total budget spent on technology is

generally above 3%. (See *IS Budget*, August, 1994.) Clearly, education lags far behind business and industry in its funding of the implementation and use of technology. Louis Perelman (in *School's Out*, as well as in other publications from the Hudson Institute) has also argued that schools need to dramatically increase their expenditure per student for technology, if the student "worker" is to benefit from the productivity and learning advantages of technology. If education were to increase its technology investment to 5% of its total budget of $22 billion, fully implementing this cost model would take approximately 10 years.

Second, the model has different stages of deployment, with the first stage reflecting the lowest total cost. This cost model reflects a comprehensive vision. It also provides a practical, first step with clearly identifiable targets and benefits. Obviously a portion of the model could be implemented without implementing it in its entirety. A few states (e.g. Kentucky and Massachusetts) have funded what they have called statewide technology/networking implementation plans. These are essentially "beachhead" strategies to get some minimum level of technology into each school. They are not "full-blown" implementations, but are comparable to the first stage of the cost model discussed here. A partial implementation can be used to leverage further implementation, based on its success.

Third, the models make no assumptions about funding sources or new funding, particularly from the State or the Federal government to support technology. There is increasing focus on technology at the federal level which may bring additional fiscal resources to schools.

Fourth, wealthy school districts are already implementing the vision in their schools, thereby advantaging their students. This growing inequity will create significant problems for education unless it is addressed. Technology tools should be available as an integral part of all student learning.

Fifth, the cost model in this discussion paper reflects a complete, life cycle view that includes all the critical components of technology planning and implementation. A large portion of the costs in the model are for training and support. Too often these components are ignored in the implementation of technology. Life cycle cost models from business and industry support the critical role of training and support. These models suggest that hardware and software reflect approximately 30% of the total system cost over the technology's life cycle. Too often funding initiatives ignore the entire set of funding components and focus on hardware and software. And yet, experience has shown that only by addressing the other components, as well as the hardware and software, will the technology expenditures be successful. This is most particularly true of the staff development cost component. Because of the need to restructure teaching and learning, using technology, teachers need extensive and on-going training not only in how to use technology, but how to fully integrate it into their curriculum, instruction and assessment practices. Teachers have to change their pedagogy, and will need help to do it. The cost model presented in this discussion paper addresses all these components. It does not define how these components will be funded, but only that they need to be addressed through an overall funding approach.

Sixth, the cost model is based on list prices, and assumes no discounting. It is likely that substantial discounts could be negotiated for most of the components of the model.

Schools need to develop clear educational plans, with technology in a strong support role. Schools also need to look at all their funding sources, local tax revenues, State and Federal funds, as well as corporate partnerships and foundation sources, concentrate their resources on implementing their vision over a multiple year time frame, consistent with their plan. This discussion paper illustrates the importance of a technology plan for effecting action.

Both the states and the Federal Government need to provide leadership in the planning and implementation of technology. Approaches that provide clear incentives for schools to use existing and new funding resources are very critical. The State of New York is directly providing over $150 million per year of State funding to schools for technology in a variety of programs and aid forms. In addition to this amount, schools spend more on technology from Federal program sources such as Title I, as well as from local tax levy funds. Based on the cost model in this discussion paper, it is clear that substantially more than $150 million must be spent to implement the technology vision in the model described in this paper. The State of New York needs to take steps to ensure that equitable access to technology resources is a part of all students' experience in school. Existing capital funding sources such as school building aid need to be focused on addressing the technology infrastructure requirements of schools. Innovative capital support such as proposals for the use of Dormitory Authority funding for technology infrastructure also need to be obtained. Many school districts also have had success recently with technology bond issues which local taxpayers have supported in order to bring necessary technology tools and staff development into schools. The establishment of state-level special funds, low or no-interest loans and large-scale state level purchasing also have to be examined as strategies for effecting this technology vision. New kinds of partnerships with business and industry, as well as increased community support for technology will also be needed. Finally federal resources need to be redirected in more flexible ways that allow technology to become an integral part of all learning programs sponsored by the Federal government. Only through such a concerted and coordinated effort will the vision of technology-inspirited transformation of schools take place

I welcome your thoughts and comments. I am interested most particularly in your thoughts about the technology vision, its costs, and specific strategies you have used to gain support within your own building, district or region to implement your technology vision.

Please respond to:

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Appendix

DETAILED COST COMPONENTS for Each Stage of the Model

Cost Model: Stage One

Stage one assumes that 5 networked workstations will be placed in every library media center in each of 4,016 public schools. No assumptions are made about the use of existing hardware, software or network connections.

Components/Quantities:

4,016 buildings x 5 workstations per building (typically in library-media centers)= 20,080 workstations.

4,016 buildings x 1 laser printer = 4,016 printers

4,016 buildings x 1 CD-ROM Tower = 4,016 CD-ROM's

4,016 buildings x 5 sets of software per building = 20,080 sets

4,016 Network connections to library media center and interconnection to 5 machines.

4,016 buildings x 56 kb link to Internet = 4,016 links.

4,016 LCD Color Display Projectors = 4,016 projectors

4 ,016 buildings x 1 router = 4,016 routers.

4,016 buildings x 1 server = 4,016 servers.

711 persons for technological support, one per district.

8,032 persons trained from all districts (2 per building).

Costs: First Year

20,080 workstations x. $3,000 =	$60,240,000
4,016 printers x $1,250=	$5,020,000
4,016 CD-ROM Towers x $5,000 =	$20,080,000
20,080 sets of software x $500 =	$10,040,000
4,016 Network connections to library media center and interconnection to 5 machines x $15,000	$60,240,000

4,016 56 kb links to Internet x $7,500 =	$30,120,000
4,016 color LCD projector units x $8,000 =	$32,128,000
4 ,206 routers x $5,000 =	$20,080,000
4,016 servers x $15,000 =	$60,240,000
711 district level people providing support x $75,000 =	$53,325,000
8,032 persons trained from all buildings, two per building x $5,000 =	$20,080,000
TOTAL for Stage 1 for first year	**$371,593,000**
TOTAL for Stage 1, including maintenance and other recurring costs, for full 5 years	**$808,584,200**

Cost Model: Stage Two

Stage two assumes, and builds on the infrastructure components in Stage One. The model, at this stage, assumes one workstation in each classroom, available for both students and teachers. The costs included below reflect only the additional, incremental costs to implement the full model. This total must be added to the total for stage one for the full model cost.

Components/Quantities:

187,000 classrooms x 1 workstation per classroom = 187,000 workstations

187,000 classrooms x 1 laser printer = 187,000 printers

187,000 classrooms x 1 set of software per classroom = 187,000 sets of software

187,000 network connections to internal LAN, including connection to workstation in each classroom

4,016 buildings x T-1 network links =4,016 T-1 Links

187,000 classroom x 1 color LCD display panel = 187,000 LCD panels

4,016 persons providing support--both technological and educational.

187,000 persons trained across 4,016 buildings.

Costs: First Year

187,000 workstations x $3,000=	$561,000,000
187,000 laser printers x $1,250 =	$233,750,000
187,000 sets of software x $500	$93,500,000
187,000 netconnections x $7,500 =	$1,402,500,000
4,016 T-1 Links x $25,000 first year cost =	$100,400,000
187,000 LCD panels x $2,500 =	$467,500,000
4,016 support persons (one per building) x $75,000 =	$301,200,000
187,000 persons x $2,500 training =	$467,500,000

Total for Stage 2 for first year **$3,627,350,000**

TOTAL for Stage 2, including maintenance and other recurring costs, for full 5 years

$6,243,500,000

Cost Model: Stage Three

Stage three adds four additional workstations to each classroom. The major cost for implementing the technology in the classroom is already covered under the costs for stage two. To derive the full cost for the model, stage 3 must be added to stages one and two.

Compunents/Quantities:

187,000 classrooms x 4 workstations =748,000 workstations

187,000 classrooms x 4 sets of software per classroom = 748,000 sets of software

187,000 network connections to internal LAN, including connection to 4 additional workstations in each classroom

Costs:

748,000 workstations x $3,000 =	$2,244,000,000
748,000 sets of software x $500 =	$374,000,000
Netconnections to 748,000 machines x $500 =	$374,000,000

TOTAL for Stage 3 for first year $2,992,000,000

TOTAL for Stage 3, including maintenance and other recurring costs, for full 5 years

$4,039,200,000

Grand Totals:

First Year	**$6,990,943,000**
Five Years	**$11,091,334,200**

	A	B	C	D	E	F
1	Cost Model for Implementing Technology in NYS					
2	Stage One					
3	Sites	Items	Total Quantity	Cost / (5 yr)	Total for 5 Years	First Year Cost
4	4016	5 workstations	20080	$3,000	$60,240,000	$60,240,000
5	4016	1 printer	4016	$1,250	$5,020,000	$5,020,000
6	4016	1 CD Tower	4016	$5,000	$20,080,000	$20,080,000
7	4016	5 sets software	20080	$500	$10,040,000	$10,040,000
8	4016	Network Conn	4016	$15,000	$60,240,000	$60,240,000
9	4016	56 Kb links	4016	$37,500	$150,600,000	$30,120,000
10	4016	LCD Projector	4016	$8,000	$32,128,000	$32,128,000
11	4016	1 router	4016	$5,000	$20,080,000	$20,080,000
12	4016	1 Server	4016	$15,000	$60,240,000	$60,240,000
13	711	1 Staff Support	711	$375,000	$266,625,000	$53,325,000
14	4016	2 People trained	8032	$5,000	$40,160,000	$20,080,000
15	4016	10% HW/SW Maint	4016	4 years	$83,131,200	$0
16						
17					$808,584,200	$371,593,000
18	Stage Two					
19	Sites	Items	Total Quantity	Cost/ (5 yrs)	Total for 5 Years	First Year Cost
20	187000	1 workstation	187000	$3,000	$561,000,000	$561,000,000
21	187000	1 laser printer	187000	$1,250	$233,750,000	$233,750,000
22	187000	1 set of software	187000	$500	$93,500,000	$93,500,000
23	187000	Netconnections	187000	$7,500	$1,402,500,000	$1,402,500,000
24	4016	1 T-1 Connection	4016	$125,000	$502,000,000	$100,400,000
25	187000	1 LCD Display	187000	$2,500	$467,500,000	$467,500,000
26	4016	1 Support Person	4016	$375,000	$1,506,000,000	$301,200,000
27	187000	Each Person Trained	187000	$5,000	$935,000,000	$467,500,000
28	187000	10% HW/SW Maint	187000	4 Years	$542,300,000	$0
29						
30					$6,243,550,000	$3,627,350,000

	A	B	C	D	E	F
31	Stage Three					
32	Sites	Items	Total Quantity	Cost / (5 yr)	Total for 5 Years	First Year Cost
33	187000	4 workstations	748000	$3,000	$2,244,000,000	$2,244,000,000
34	187000	4 sets of software	748000	$500	$374,000,000	$374,000,000
35	187000	4 netconnections	748000	$500	$374,000,000	$374,000,000
36	187000	10% HW/SW Maint	187000	4 Years	$1,047,200,000	$0
37						
38					$4,039,200,000	$2,992,000,000
39						
40				Grand Total	$11,091,334,200	$6,990,943,000
41						
42						
43	Note that costs for furniture		Note that the cost for network connections is			
44	and electrification of rooms		assumed to average $7,500 per classroom.			
45	is not included in model		The initial network connection to the library/media center			
46			is assumed to average $15,000			
47						
48	Note that the staff development					
49	cost is assumed to be					
50	$5,000 per teacher, with					
51	half of this amount expended in the					
52	first year of implementation.					