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ABSTRACT

This document is designed for education, government, and community leaders as they collaborate to provide information access for students by establishing a technology infrastructure within schools. Overviews of issues, appropriate questions to consider, and lists of recommendations seek to put the non-technology literate end-user, who might now be expected to make decisions relating to information technology, in a better position to do so. Topics include: (1) networking and connectivity; (2) the environment for the technology, including asbestos removal or abatement, lighting, acoustics, climate control, space, electrical connections, and security; (3) training, including general technology skills and integration of technology within the curriculum; (4) maintenance and technical support; (5) dealing with contracts, consultants, and vendors to obtain the needed technologies; (6) funding strategies; and (7) resources for further information. (SWC)

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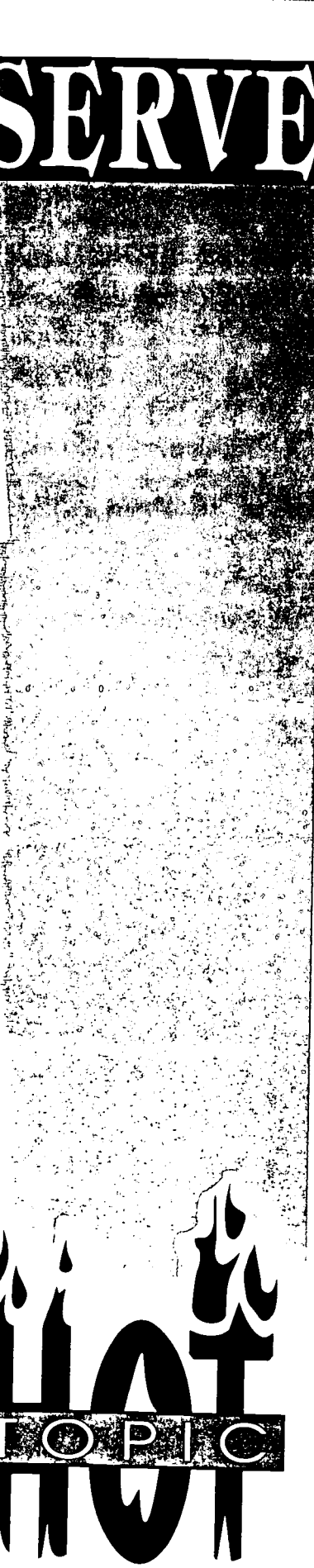
Technology Infrastructure in Schools



SouthEastern Regional Vision for Education

TECHNO

IN SCHOOLS

February 1996

SERVE
SouthEastern Regional Vision for Education

associated with the School of Education
University of North Carolina at Greensboro

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ABOUT SERVE

SERVE, the SouthEastern Regional Vision for Education, is a consortium of educational organizations whose mission is to promote and support the continuous improvement of educational opportunities for all learners in the Southeast. Formed by a coalition of business leaders, governors, policymakers, and educators seeking systemic, lasting improvement in education, the organization is governed and guided by a Board of Directors that includes the chief state school officers, governors, and legislative representatives from Alabama, Florida, Georgia, Mississippi, North Carolina, and South Carolina. Committed to creating a shared vision of the future of education in the Southeast, the consortium impacts educational change by addressing critical educational issues in the region, acting as a catalyst for positive change, and serving as a resource to individuals and groups striving for comprehensive school improvement.

SERVE's core component is a regional educational laboratory funded since 1990 by the Office of Education Research and Improvement (OERI). Building from this core, SERVE has developed a system of programs and initiatives that provides a spectrum of resources, services, and products for responding effectively to national, regional, state and local needs. SERVE is a dynamic force, transforming national education reform strategies into progressive policies and viable initiatives at all levels. SERVE Laboratory programs and key activities are centered around

- applying research and development related to improving teaching, learning and organizational management;
- serving the educational needs of young children and their families more effectively;
- providing field and information services to promote and assist local implementation of research-based practices and programs;
- offering policy services, information, and assistance to decision makers concerned with developing pogressive educational policy;
- connecting educators to a regional computerized communication system, so that they may search for and share information, and network; and
- developing and disseminating publications and products designed to give educators practical information and the latest research on common issues and problems.

The Eisenhower Mathematics and Science Consortium at SERVE is part of the national infrastructure for the improvement of mathematics and science education sponsored by OERI. The consortium coordinates resources, disseminates exemplary instructional materials, and provides technical assistance for implementing teaching methods and assessment tools.

The SouthEast and Islands Regional Technology in Education Consortium (SEIRTEC) serves 14 states and territories. A seven-member partnership led by SERVE, the consortium offers a variety of services to foster the infusion of technology into K-12 classrooms. The Region IV Comprehensive Assistance Center provides a coordinated, comprehensive approach to technical assistance through its partnership with SERVE.

A set of special purpose institutes completes the system of SERVE resources. These institutes provide education stakeholders extended site-based access to high quality professional development programs; evaluation and assessment services; training and policy development to improve school safety; and subject area or project-specific planning and implementation assistance to support clients school improvement goals.

Following the distributive approach to responding and providing services to its customers, SERVE has ten offices in the region. The North Carolina office at the

University of North Carolina at Greensboro is headquarters for the Laboratory's executive services and operations. Policy offices are located in the departments of education in Alabama, Georgia, Mississippi, North Carolina, South Carolina, and in the Florida office in Tallahassee. This document includes contact information for SERVE programs, services, and institutes.

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TECHNO

IN SCHOOLS

TECHNOLOGY INFRASTRUCTURE IN SCHOOLS

> "If you are preparing for the Information Age, you have missed it! We are entering a new age - the Communication Age."

The issue is not technology; the issue is access to information. Global market, local economic development, the "net", and "downsizing" herald this new era and technology is the tool that is driving this transformation at a pace unheard of in history. It is no wonder, then, that governmental, educational, and community leaders are unsure of their emerging roles as they relate to each other and find it difficult to keep up with the changes in the technology arena. It is also not surprising that educators, community leaders, and businesses are seeking technology solutions to prepare their students/community for this new society. It is clear that this new technology-driven age is a community issue, not only an educational issue, and collaboration is the vehicle that will lead to the successful harnessing of information technology.

Signs of the Time

- It has been said that technology changes every six months.
- AARP (American Association of Retired Persons) counts 2 million computer users among its 33 million members.
- In the time it will take you to read this document, one more node will be added to the Internet.
- E-mail is everywhere in society, from the President to classrooms across the world.
- United States has over 19 million computer users on-line.
- Electronic communities connect government, education, and business.

This document is designed for education, government, and community leaders as they collaborate to provide information access for students by establishing a technology infrastructure within schools. It is not intended to be a manual for wiring, but a "roadmap" with recommendations and questions for multi-stakeholders as they design the infrastructure facilitating information exchange.

It is vital that one recognizes that technology is constantly changing in size and function at an incredible rate. Consider the emergence of the personal computer in the mid '80s which entered the market at a premium price as a means to accomplish mainly accounting and word processing functions. Today, for half the price, one is able to purchase significantly advanced technology which is less than one quarter of the size, small enough to carry in a briefcase. This technology is also capable of transmitting and receiving information on land, sea, or air. As we watch this convergence of technologies, it is clear that we must plan for present and future needs. A "roadmap" that simultaneously is able to adapt to the changing environment could prevent costly diversions and ensure that the technology infrastructure provides short- and long-term solutions by doing what we want it to do – provide access to information.

A COLLABORATIVE PLAN

As a school district prepares students for a work place that is vastly different from the one today, superintendents, school board members, principals, teachers, parents, and community members need to collaborate to design a system that will provide access to information. This collaboration requires "joint planning, joint implementation, and joint evaluation" (Hord, 1986) to be successful. Based on the five step collaborative process (Melaville, Blank, & Asayesh, 1993) and effective technology planning (Building the Foundation, 1994), there are four essential phases for a collaborative infrastructure program:

Phase One:
Getting Started

- Clearly define what is critical to your success: student achievement, mastering skills and concepts, broadening horizons, administrative productivity, etc.
- Decide if and where technology can help in this process.
- The "ends" must drive the process. The goal is to prepare students for their world of work.
- Let those established needs determine your technology infrastructure, keeping future needs and applications in mind.
- Commit to action. Don't just talk about it.
- Involve the right players at the table - include school board members, the superintendent, principals, teachers, parents, businesses, higher education, and community members. No project will be successful unless appropriate "sponsors" have been identified and their buy-in clearly established.
- Identify your champion – technology projects often appear "abstract" to community members. A champion can demonstrate successful applications and demonstrate and ensure long-term commitment.
- Begin considering a fiscal strategy.

Phase Two:
Developing a Plan

- Develop a knowledge base of infrastructure issues.
- Assess the technology, personnel, and funding resources.
- Develop a comprehensive technology plan with shared goals and objectives.
- Establish a technology committee.

Phase Three:
Technology Infrastructure Action Plan

- Define desired student outcomes.
- Establish timeline of activities and implementation.
- Identify evaluation process.
- Build community constituency.
- Visit other sites.

Phase Four:
Economies of Scale

- Identify ways to share resources.
- Design a fiscal strategy.
- Deepen collaborative culture.

HOW TO USE

The purpose of this document is to raise questions and make recommendations that will put the non-technology literate end-user, who is now expected to make decisions relating to information technology, in a better position to do so. It is not intended for nor should it be used as a blue print for establishing a technology infrastructure. Technology is changing nearly overnight; it is dynamic; it holds tremendous potential for all segments of society. The challenge before all of us is to use it as a means to move forward.

The following are areas that deal with technology infrastructure-related issues. Each section includes an overview of the issue, questions to be asked relating to that issue, and recommendations that should help establish a better understanding of the issues and decisions that need to be made. One final caution – this is a resource to start conversations, not to end them.

NETWORKING & CONNECTIVITY

making the connection

TELECOMMUNICATIONS

Earlier this century, the creation of the interstate highway system formed a mechanism to connect towns, cities, states, and regions. These highway systems facilitated the connection of people to people, people to places, businesses to businesses, allowing the flow of traffic, trade, and commerce. Today's road is the electronic network. The late '80s and early '90s witnessed a tremendous growth in personal computers (PC's). The PC provided a powerful mechanism to accommodate applications such as word-processing, graphics, spreadsheets, databases, and others. However, the information that resided at the specific PC was not accessible by others, nor could PC's share common devices such as printers. It became apparent that the ability to share documents, spreadsheets, and information from one PC to another would be a great advantage. This sharing of resources and information is made possible by computer networks.

> "The technology should be approached as a tool for achieving your goals."

Networks can range in magnitude, and type. A local area network, commonly referred to as a LAN, describes the connection between two or more computers that can occur in the same room, different rooms, the wing of a building, or the entire complex. This is commonly the first network to be established within a school.

A wide area network, commonly referred to as a WAN, describes the connection between two or more computers at two or more separate sites, such as one or more school(s) to another school(s); school(s) to central office (a district wide area network); district to state capital, or to businesses globally, universities, community colleges, county agencies, health departments, etc.

NETWORKING...IS IT FOR YOU?

The benefits of networking are establishing an economy of scale (sharing costly equipment such as laser printers, software, file servers, modems); creating additional methods of communication (e-mail, curriculum software); enhancing classroom management (time saver by storing data files and assignments); and gaining the ability to interact with the global community.

The downside of networking is that it can be expensive to implement. Costs include implementation, cabling, and improvements to physical environment (asbestos removal, additions, increasing electrical capacities, ventilation space, etc.).

However, retrofit networking costs are much greater than networking planned in initial construction phases.

NETWORK REQUIREMENTS

- Wiring
- Network cards (may come attached to the individual computers)
- Networking software
- Network consultant(s) (highly recommended due to the technical requirements of the system)

OBJECTIVES & APPLICATIONS

Student and school objectives:
- Develop skills to access and manipulate data
- Foster the ability to interact with the global community
- Teach cooperative/team building skills
- Improve verbal and written communication
- Enhance interaction with the school community
- Present information within a context drawing from various sources and references

Possible technology applications:
- On-line services such as Internet access
- E-mail
- LAN interconnectivity
- Parent/community access
- Distance learning for "have not" schools
- Desktop video for collaborative projects
- Voice mail
- On-line maintenance and accounting
- Video conference meeting
- High speed image and graphic transfer
- Intercom
- Word processing and publishing
- File, text, and/or still image transfer
- Multimedia (CD-ROM)

... FOR ALL STAKEHOLDERS

- Is the plan based on educational goals?
- Are end users involved in this planning?
- Does the plan provide for easy expansion?
- How are we gaining widespread community support for this plan?
- Is someone researching vendor/consultants for this plan? Do we know their "track records?"
- Is the media center first to be networked? Why/why not?
- Who is designing the Request for Proposal/Information (RFP/RFI)?
- Do we have support from community members who could help in this project? (i.e., contractors, architects, etc.)
- Have we identified community members who can spearhead the project and find people who have experience/knowledge in:
  - installing and replacing boards and adapter cards in computers
  - setting dip switches and moving jumpers on cards
  - cabling of telephone, computer cable, and fiber-optic wires
  - installing connectors on telephones and TV cables
  - routing telephone or computer cable through existing ceilings, walls, or floors
  - understanding what a TSR program is and how it works (TSR - terminate and stay resident)
  - installing large programs on hard drives
  - sectoring hard disks, organizing the sectors in logical sub directories, and arranging the program and data files
  - understanding what a "path" is and how to change it
  - having time, patience, knowledge, and skill to help on all hardware and software installation
  - reading and understanding all the associated technical manuals
  - establishing operating and maintenance procedures, a back up schedule, a disaster recovery plan, and providing training in the use of the system

... FOR TECHNOLOGY COMMITTEE

- What are the goals and objectives of the network?
- Who is keeping track of each system to be attached to the network? inventory control?
- What are the configurations of each new system to be ordered for the network?
- Who is sketching (to scale) the facility where the network is to be installed?
- Where is the location of each network component?
- What is the best location for the server?
- Who is working on the cable?
- Who is checking the building codes?
- When are we visiting a site that is using a similar network?
- Who will lay out the network components?
- Who will install the hardware?
- Who will install the software?
- What structural modifications need to be done to the facility? Who will do them?
- What is the timetable for each phase of the installation process?

Recommendations

- See that instructional and administrative applications drive the selection of the network-related technology.
- See that one vendor/consultant is responsible for installing the network and making sure it meets all performance specifications.
- Make sure the vendor/consultant has had a successful experience with similar network installations.
- Stress the need for all involved in the project to communicate clearly with each other. Criteria for clear communication:
  - State your present educational objectives.
  - Project your future educational objectives.
  - Determine which objectives (present/future) require information sharing.
  - Research which technology applications enable successful sharing of information to achieve your objectives.

> "I recommend setting up a mini-network for a server and 3 to 5 work stations; spend time determining hardware and software capability."

- Plan for future applications of the network.
- Schedule for minimum of classroom disruption.
- Integrate local networking plan with existing system-wide, regional, and state networking plans.
- Be aware of existing system-wide, regional or state standards.
- Communicate with the contractor the timetable for each phase of the installation process. Include this in your contract.
- Provide a blueprint of the facility to help the contractor locate wires, etc.
- Consult with an architect to assess what structural modifications need to be done to the facility before installation starts.
- Detail vendor's responsibilities in the contract (i.e. hauling off all trash, cleaning floors/carpets, etc.).
- Request that the project be tested on a small scale, or build a proof-of-concept lab where the technology can be tested before being implemented system wide. Include this in the contract.

responsibilities

...OF SUPERINTENDENT, PRINCIPAL

- Recognize existing system-wide, regional, and state standards.
- Ensure references have been checked and sites have been visited before signing off on a contractor.
- Plan for future applications of the network.

...OF TECHNOLOGY COMMITTEE

- Work with officials, inspectors, and contractors.
- Plan work flow.
- Supervise the collaboration of contractors and school maintenance personnel.
- Assure receipt of the correct materials and equipment at the correct time and location.
- Manage scheduling changes.
- Inspect/approve cable/connector installation.
- Complete documentation of the installation process.
- Recognize existing system-wide, regional or state standards.
- Plan for future applications of the network.

WIRING & CABLING

overview

The issue of wiring and cabling is complex and intimidating due to the broad array of choices, decision points and cost. Networks provide the backbone for connectivity and instant communications, and users must decide what kind of network will meet their needs. Wiring and cabling issues include: current needs, bandwidths, cost-effective alternatives, hidden costs, and potential future applications. As with other technology decisions, needs should drive the process. However, due to the cost of installing conduit, wiring trays, cable, phone lines, and other items, any decision must also encompass current and future applications.

- Have you first decided what applications you will be using?
- Have the architectural specifications been reviewed?
- Is there existing conduit?
- If hardware is to be installed on walls, is cabling accessible in an area sufficient to physically support the hardware?
- Are there blue prints showing current configuration?
- Could the installation of conduit or wiring breach an asbestos-neutralized environment?
- Will installation require breaching physical barriers such as fire walls?
- Have you explored alternatives to conduit such as wiring trays, raised floors, movable tile?
- Can the conduit and cable accommodate future expansion and applications?

> "If you are going to cut costs, avoid cutting wiring and cabling costs; 95% of the problems encountered with a network are wiring-related."

- With new construction, have architects been working with technology coordinators or specialists?
- Have existing state wiring standards been reviewed?
- Have you considered spending more today that will reap benefits in the future?
- Have safety and fire code regulations been considered?
- Are there a sufficient number of drops provided per classroom to meet current and future needs?
- Is there sufficient termination space for the type of wiring?
- Have you explored the benefits of installing fiber, especially as your network back-bone?

- Let your needs drive your decisions in this area as in others. Remember, you want to purchase a window of opportunity with the existing network that will provide you with future opportunities and expansion.
- Consider wireless if:
  - the lower transmission speeds suit present and future applications.
  - the needed retrofitting wiring and cabling is too costly.
- Discuss the installation of conduit and wiring while planning the construction of new buildings or capital projects. The addition of conduit and wiring at a later date will result in far greater expenses.
- Check existing district and state standards.
- Closely tie the selection of wiring and cabling to the selected network and applications.
- Consider purchasing more cable than you think you need (actual length and bandwidth).
- Standardize the selection of wiring and cabling at the district level.
- Consider moveable tiles and raised floors that will provide easy access to the cable.
- Be sure that you have the advice and assistance of qualified cabling personnel.
- Locate and review the building blueprints or architectural drawings.
- Do not run cable distances exceeding cable specifications.
- Do not run cable in conduits with electrical lines or directly over lighting boxes in the ceiling.
- Label every cable as to its location/destination.
- Ensure that wiring standards are consistent with the network.
- Currently, star wired unshielded twisted pair (UTP) is the standard recommendation for LANs and is being used in about 95% of installations.
- Beware of ground loops.
- Involve students.

...Huntsville, Alabama
AT&T sponsored a project at Ridgecrest Elementary School that connects fifth graders with students in eight other schools studying the same curriculum. The project is designed to develop higher order thinking and technological skills needed for the future workforce.

TELECOMMUNICATIONS

Fundamental to the communication era in which we have entered is the ability to share data and information through a connected medium. This sharing of information can take place between two locations (school to school), many locations (between all the schools in a district and the central office), or thousands of locations (all the schools in a state/nation/world). Common applications possible via telecommunications include the exchange of electronic mail, documents, video, and audio.

> "As with any use of technology, the needs must drive the process. It will do little good to invest in an on-line service if it will not be used to meet an identified education-related goal or objective."

...Union City, New Jersey
Providing information access was the focus of a project that supplied a personal computer at home and school for all 7th-grade students and teachers at Christopher Columbus Middle School. Bell Atlantic supplied the technology which allowed participants to exchange e-mail, data, and graphics. Test results show students in the program outscored their middle school peers both locally and statewide.

The use of information technology in education is largely determined by the creativity and ingenuity of the end-user. Currently, science classes are consulting with renowned scientists and researchers at top universities across the country and the world. Students across the U.S. are working jointly on projects with their peers in Europe to solve related problems. Art classes take a tour of the Louvre in Paris within the confines of their rural school in western North Carolina. Principals and administrators are increasing their productivity while saving time by simply using electronic mail for routine staff messages and responses. Regardless of what others are doing, it is important to let your needs drive the process. It will do little good to invest in an installing or subscribing to an on-line service if it will not be used to meet an identified education-related goal or objective.

The amount of bandwidth or the speed at which one is able to exchange information is an issue that needs to be addressed when planning for technology. The transmission speed will depend upon at least three factors:

- The communication speed of the device attached to your computer or network.
- The amount of bandwidth available through the line.
- The speed of the receiving device.

One is limited to the speed of the least common denominator of these three factors. The selection of the amount of bandwidth and the transmitting device itself (both of which will increase in price at higher speeds) should be driven by present and future needs.

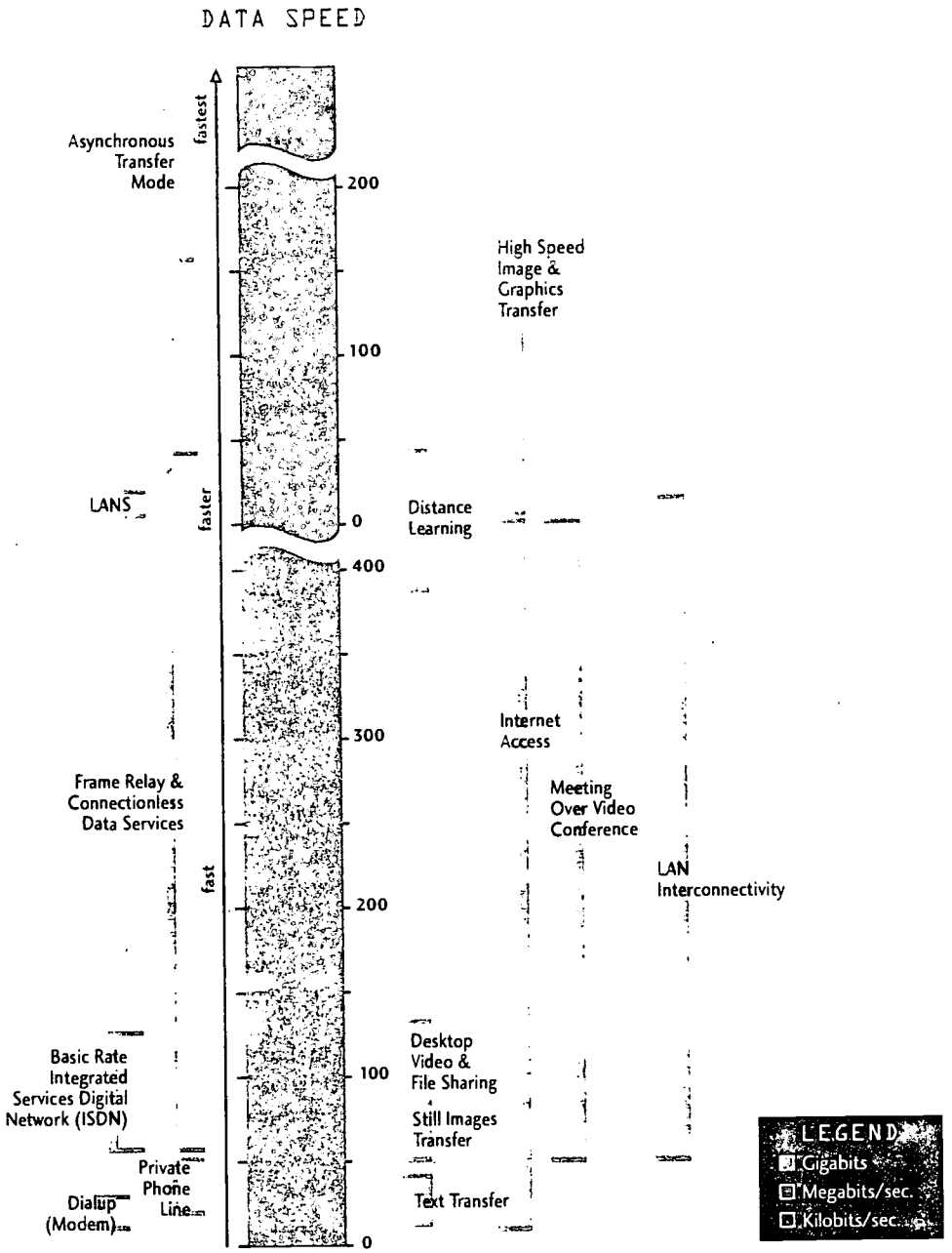
Remember, the installation of additional lines and the subscription to on-line sources will result in additional monthly charges, charges that need to be budgeted and identified from the outset.

Telecommunications and network connectivity are closely associated. An overall networking strategy will combine applications needs, local area networking requirements, and anticipated voice, video, and data communications both within and outside the school campus.

Local networks allow many users to use the same device in establishing an outside connection creating somewhat of an economy of scale. However, with more users intent upon connecting at the same time, one may have to move towards adding more lines or increasing the bandwidth on the existing line. The chart to the left references some telecommunications services and bandwidth requirements. Common applications have been listed with indications as to which services and bandwidth requirements might be necessary to support these.

Due to the complexity of this issue, many firms, schools, agencies, etc. are exploring alternatives that don't require establishing a modem pool or telecommunications hub on-site. In making such decisions, one should ask:

- What services do we need?
- Where can they be housed?
- Do we have the expertise to support such services locally?
- What are other school districts/systems doing?



- Do you anticipate using on-line services from outside the building?
- How many end-users intend to use this line simultaneously?
- For multiple users, have you considered alternatives such as increasing the bandwidth versus adding more telephone lines?
- Are any individual classrooms networked together through a local area network? What are the specific communication requirements needed to address identified applications?
- Will the current in-house cable support your necessary application(s)?

- Is cable required in each classroom for intercom and voice mail purposes or access to the Internet?
- Have you answered:
  - how much information needs to be sent or received out of the school (administrative and instructional)?
  - when does it need to be sent (time of day)?
  - where does it need to be sent (local or long-distance)?
  - how quickly must it be sent (amount of necessary bandwidth)?
  - how often does it need to be sent?

Planning Considerations

- Consider future applications and needs in making present decisions.
- Recognize and budget for costs associated with line charges, installing separate lines, increasing bandwidth, etc.
- Let the applications drive the selection of hardware, number of lines, etc.
- Explore the out-sourcing of services based upon local resources (expertise, hardware, infrastructure, etc.).

ENVIRONMENT

A unifying theme for technology

ENVIRONMENT

One of the most overlooked areas in the installation of technology is that of the environment for technology, including asbestos removal or abatement, lighting, acoustics, and climate control (humidity and temperature). Information technology is sensitive to many conditions that are often over-looked or unheeded. Though the federal government has established asbestos removal and neutralization standards, many schools find this to be a problem when installing wiring, upgrading electrical capacity, etc. Many schools in the Southeast still lack air-conditioning and adequate air flow beyond the front offices.

> "Ventilation is critical, even if air-conditioning is not needed or available in your school."

High temperatures can result in malfunctioning or inoperable technology, especially in technology "rich" environments (labs, wiring closets, file server locations, etc.) Such areas may require additional ventilation and individual temperature control year-round. This is an issue relevant to old and new buildings alike. Adequate air-conditioning, ventilation, and wiring closets, should be discussed with architects for new schools. (Perhaps most frustrating are new buildings not being equipped to handle the needs of the technology.) One should especially guard against new buildings not equipped to handle current and future technology.

- Are the designated areas for the technology well-suited for its use (lighting, temperature)?
- Will asbestos-neutralized environments be breached if a wiring infrastructure is installed?
- Have you considered the potential damage caused by static electricity – a result of certain carpeting in rooms containing computers?
- Are technology environments that require additional ventilation and air-conditioning equipped with individual temperature controls?
- Are technology storage or use areas free from water, pipes, etc.?
- Have acoustics and sound proofing been considered, especially in the areas of distance learning and audio visual production?
- How much thermal output will be the result of the students combined with that of the technology? Can the air-conditioning and ventilation adequately support that output?

- Match the environmental needs with the nature of the technology.
- Guard against electromagnetic interferences as well as less obvious causes of damage such as static electricity.
- Require facility personnel, architects, principals, parents, and teachers to work together in establishing a well-suited environment.
- Avoid hazardous monitor emissions by using glare control filters and screens on the front of monitors and purchasing monitors with metal shields on the back. Place monitors back to back so students do not face the back of a monitor. Demand energy efficient monitors.

TEMPERATURE CONTROL

- Install an independent temperature control unit in 'technology rich' environments.
- Make sure air conditioning and ventilation accommodate the heat load produced by technology hardware, not just human bodies.
- Check that humidity levels are appropriate for the amount of technology.
- Maintain climate control throughout the night hours when the communications equipment cannot be shut down, (for instance, telecommunications for communicating with parents or distance learning).

- Remember that equipment and wiring closets need adequate air-conditioning and circulation.

LIGHTING

- Install zone lighting to have the ability to change the lighting levels in different areas of the room.
- Install dimmers.
- Research which type of lighting will best suit your needs. Incandescent fixtures are more suitable for projected images as well as other specific lighting tasks where directional control and limited illumination fields are critical. However, incandescent lights generate more heat than fluorescent lights, resulting in greater air-conditioning needs.
- Fluorescent tubes should be a minimum of 40 watts per tube, standard white so that the base light in the room is at least 50 foot candles as measured with an incidental light meter.
- Consider using:
  - blinds/curtains over all windows to block light.
  - low gloss wall finishes and matte desks to reduce glare.
  - movable lights to avoid glare on screens or in eyes.
  - recessed light fixtures or indirect lighting.

ACOUSTIC

- Use headphones when voice software is used.
- Place noisy printers, fax and copy machines away from student work areas. Use sound suppression devices for noisy printers.
- Consider the use of carrels.
- Use ceiling and floor treatments to absorb sound, such as acoustic tiles or carpeting if needed.
- Place microphones where students' and teachers' voices will be paramount with distance learning applications. Distance learning classrooms may require limits on outside noise, requiring sound proofing.

...FOR SUPERINTENDENT, SCHOOL BOARD

- Meet with facility planners within/outside district.
- Establish widespread community support for capital requirements.

...FOR TECHNOLOGY COMMITTEE

- Involve representatives from the school building in planning for the appropriate environment, including teachers, principals, janitors, facility personnel, etc.
- Develop a cost analysis for a variety of approaches.
- Update staff on plans and installation process.
- Visit other sites.
- Consider requiring an environmental audit which includes technology.

According to the NC State Dept. of School Facilities and Planning standards, if you:

- Add five computers per classroom, you will need no additional space, but you will need 25% additional air-conditioning capacity.
- Add ten computers per classroom, you will need 10-15% more space and 50% additional air-conditioning capacity.
- Add twenty computers per classroom, you will need 100% additional air-conditioning capacity.

SPACE

It is important to make the best use of classroom space due to the fact that technology takes up valuable room. Classroom space issues include flexible room arrangements to allow for different types of instruction; comfortable, adjustable furniture for students; and adjustable classroom space standards. Kindergarten students have different space requirements than high school students, and "one size does not fit all." This is also true of classrooms. A science classroom needs more space for labs, science-related technology, and hardware than does a social studies classroom. In addition to these classroom needs, one must provide enough space for the equipment as well as wiring closets and equipment rooms throughout the school facility.

> "Supporting student achievement is critical to space design. Look at designs that allow students to work in cooperative groups."

- Does the equipment configuration promote the necessary type of instruction (team teaching, interdisciplinary instruction and "traditional")?
- Is the furniture appropriate for students' use?
- Are teacher workstations planned as the technical control and large-group presentation centers of the classroom?
- Is there an appropriate amount of space not only for the technology but for electrical and wiring closets, equipment rooms and labs?
- Are there state requirements that need to be met?

- Isolate audio-visual equipment from noise and electromagnetic interference.
- Do not place audio-visual equipment near air handlers, telephone rooms or file server closets.
- Do not use wiring and equipment closets as storage closets.
- See that furniture is age appropriate – computer monitors should not block eye contact between teacher and student.
- Plan space around computers for textbooks, notepads, and other materials.
- Budget for necessary furniture.
- Plan for the science room to be larger than a standard classroom.
- Complete a sight-line study to determine the visibility from each row of seats to the teaching focus area and display screen in an auditorium.
- Plan enough room for equipment in the media center, and include an area for small group instruction.
- Ensure that the teacher workstation is easily accessible.
- Provide sufficient space for a camera in the first row of the distance learning room.

...OF SUPERINTENDENT, SCHOOL BOARD

- Collaborate with community members on space related issues (i.e. local builders association to monitor furniture construction. electricians to complete electrical drops for teacher workstations).
- Determine who is responsible for compiling information relating to selecting desks and tables for use with computers, obtaining guidelines for projection screens, wall mountings, marker boards, teacher workstations. reduction of negative impact of monitor emissions. and equipment mobility.
- Prepare RFP/RFI for consultant team which includes an architect. computer hardware specialist, network specialist. and software specialist.

...OF TECHNOLOGY COMMITTEE

- Research effective use of space.

...OF TEACHERS

- Rethink student activities to make the most efficient use of space.

ELECTRICAL

Many classrooms in the Southeast are ill equipped to handle power requirements of information technology. Filtered power, ample outlets, and adequate grounding are just three examples of common problems encountered in both old and new buildings. Information technology not only requires a steady electrical current but. depending on the sensitivity of the hardware, must guard against surges and fluctuations. Schools that have inadequate power and require electrical retrofitting quickly realize the magnitude of this problem in extra expenditures and limitations placed upon the technology.

> "Only after buying hardware and software did we recognize our electrical capacity was insufficient."

- Can the existing electrical capacity support the technology?
- Is the power supply un-interruptable?
- Are there enough outlets in the room?
- Is there room for expansion to handle future applications?
- Are there existing devices, systems, motors. etc. within the building that could cause network interference?
- Is the technology guarded against surges? If yes, can the power suppresser provide real protection in the event of a serious power line disturbance?
- Are there any state standards regarding electrical lines?
- Does the grounding meet current specifications? (Insist on "yes" answers).

- Check the power specifications of the school.
- Filtered power and a steady current are essential.
- Involve planners in establishing adequate electrical capabilities for technology in the new contruction phase.
- Be wary of using discounted surge protectors as a means to meet the above requirements. They typically provide little or no real protection in the event of a serious power line disturbance.
- Check local, regional, and state electrical guidelines and recommendations. All equipment purchased should be UL-FCC approved.
- Be aware that additional measures may need to be taken with mobile units.
- Explain potential uses and demands of the technology to provide assistance for individuals upgrading electrical capacity.
- Separate power circuits are necessary in schools where the air-conditioning is intermittent, causing power failure.
- Check on electrical capacity to handle additional hardware (computers, copiers, etc.) once equipment is in place.

> "Our students learned the detrimental effects of water when the technology was placed next to the sink."

- Be sure outlets are not installed near sinks.
- Provide a sufficient number of outlets per room to handle current capacity and provide room for expansion. Fourplex (quad) outlets should be provided in designated workstations at six to eight foot intervals.
- Be aware of not only where you put the technology, but what you put near it (water, magnetics, interference, etc.).
- Discuss with teachers where they would like the technology located in order to determine the location of the outlets.
- List the volt and amp readings on the outside of the cases on all equipment.
- Label clearly all breakers and disconnects to prevent accidental disconnects.
- Label outlets as to panel location.
- Provide power outlets at all locations where a communications outlet is placed.
- Make sure ground that once was sufficient remains sufficient and has integrity all the way to the building ground.

...OF SUPERINTENDENT

- Be aware of high costs associated with upgrading electrical capacity in older buildings.
- Assign committee/staff to work with architects to ensure that new structures have sufficient outlets and capacity for current and future needs/applications.

...OF PRINCIPAL & TECHNOLOGY COMMITTEE

- Focus on safety issues.
- Communicate the educational objectives clearly so that the electrician can tailor the electrical configuration to meet those needs.
- Work with architect to ensure that electrical specifications are in alignment with educational needs and applications.
- Check state electrical guidelines and resources.
- Get input from individual teachers on outlet location and applications used in the classroom.

SECURITY

Crime in the information age has found a new focus, often worth more than gold – computer chips. With the gradual introduction of technology, more of our schools are becoming home to thousands of dollars worth of information technology, often within one central area such as a computer lab. Schools cannot afford to overlook protecting this environment. In the same manner, as the emphasis upon connectivity and communication links more and more individuals, the issue of data security and privacy becomes a serious concern. Security is a necessary part of a technology plan to ensure that the technology infrastructure is safeguarded properly. This section includes guidelines for protecting expensive hardware/software and maintaining authorized use of the system. Additional guidelines for protection can be provided by insurance companies.

> Only after the theft of many computers did we learn the value of security for our schools.

PRINCIPAL & TECHNOLOGY SPECIALIST

- Does the inventory control include the location of equipment at all times?
- Is there a check-out system for:
  - faculty and/or students to take equipment home?
  - equipment movement from room to room?
- Who is responsible for equipment inventory and records?
- How often are these records reviewed?
- How will the equipment be marked for easy identification?
- Who is legally liable for information content or actions within the context of on-line services
- Are users and administrators trained in how to care for the equipment?
- Who is responsible for installing and updating virus protective software?
- How are on-line, shared files protected from unauthorized access?
- Who is responsible for auditing use of the system (user ID, workstation ID, time)?
- What is the process for protecting passwords?
- What are the procedures to protect against piracy?
- Is it a policy to virus check all information gathered from on-line sources?
- Are there established policies for hacking and misuse?
- Does each room have locks?
- Are there established "fire-walls" (privacy safeguards) for information-sensitive material (grades, student information, etc.)?
- Is there an established policy for back-up and keeping copies in secure locations off-site in the event of a system failure, tampering, or loss of data?
- Who is responsible for making sure that software copies are in accordance with federal copyright laws and licensing agreements?
- Is it appropriate for students to load their personal software on the machines?
- Is security considered in the design of all new buildings?
- Has the district considered security in their long-range plan?
- Is the alarm system adequate?
- Who controls after-hours access?
- How is the equipment secured?
- Has the fire department approved the type of fire suppression products to be used in technology areas?
- Who is periodically checking wires/cable for cuts and frays?
- Are you aware that adult content material is accessible through some on-line services?
- Have you considered establishing an appropriate use contract with parents and students?
- Is there a policy specifying who is to install, upgrade, and discard hardware and software?
- Do corporate/business partners have insight, suggestions, or resources to share?

...OF SUPERINTENDENT

- Establish and publicize a district policy on information technology security-related issues such as ethics, privacy, copyrights, and appropriate use. Involve community stakeholders and have the Board attorney review related documents.
- Ensure that the policy addresses enforcement of consequences associated with the misuse of information technology.
- Assign someone to carry out these responsibilities.
- Safeguard technology investments.
- Stay current with federal IT (information technology) policy and guidelines.

...OF PRINCIPAL & TECHNOLOGY COMMITTEE

- Contact other sites that have completed this process.
- Discuss security issues with school personnel.
- Develop building security policy and routines with staff.
- Ensure that the physical integrity of the system is intact.
- Test data backup procedures to ensure that data is properly saved and can be properly restored.

...OF TEACHERS

- Inform students in a formal classroom content section as to proper information technology use and school policy. Invite a visitor from the business world to talk about what might happen if a system is "hacked."
- Discuss information ethics and privacy with students and parents.
- Involve students in policy making concerning security. Allow them to be a part of enforcing the rules.

HARDWARE

- Mark equipment clearly (bar-codes work well)
- Keep an inventory record in another location.
- Secure equipment.
- Install locks on closets where access should be restricted.

SOFTWARE

- Assign unique ID passwords and change passwords periodically.
- Corporate resources on data security are available from corporate sponsors and other school systems.
- Train users on telecommunications etiquette.
- Have students sign a responsibility contract.
- Install virus protectors on all servers.
- Establish a policy restricting personal software use.
- Back up files and keep a copy off site.
- Attempt to restore select files to ensure backup is effective.
- Set network application software to "Execute."
- Program files should be "READ ONLY."
- Recognize and establish a policy about adult content.

FACILITY

- To protect technology rooms, install:
  - break-in resistant doors/windows
  - dead bolt locks
  - hidden cameras
  - motion detectors
- Interior connecting labs should have windows for supervision of both rooms.
- Check-out points should be visible. Assign an individual to monitor equipment.
- Consider installing time-sensitive locks on all computer lab exit doors.
- Secure all outside windows.
- Secure equipment.

TRAINING

critical to the equation

TRAINING

...In Monterey, California This "supersub program" at Monterey Model Technology School (MMTS) releases teachers during the day for technology training and provides students with a technology-based lesson. These expert "supersubs" are retired teachers or administrators using technology as an effective instructional support tool. While teachers are being trained, the "substitutes" conduct a lesson.

Much of the attention with information technology tends to focus upon the hardware and the software. However, studies have shown that without the proper training and support, technology will in all probability be underutilized. Some private firms have actually documented their technology-related expenditures, including hardware, software, training, and technical support costs, and have demonstrated that the costs associated with ensuring the technology is used properly and fully (training) and those associated with keeping it up and running (technical support) account for upwards of 50% to 70% of all expenditures.

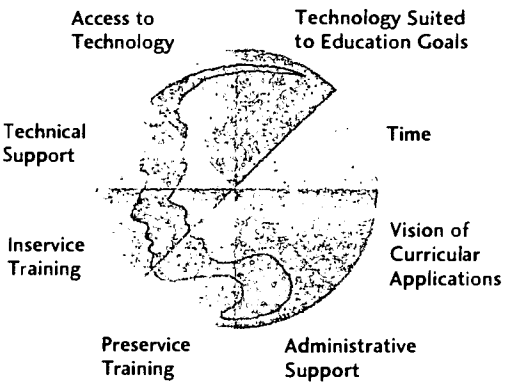
> "Training and support for technology make up 30% - 50% of all technology expenditures."

Using technology changes the way teachers teach. According to the Office of Technology Assessment (OTA), "to use new technologies well, teachers not only need access to them, but they also need opportunities to discover what the technologies can do, learn how to operate them, and experiment with ways to apply them." In the OTA's 1995 document, *Teachers & Technology – Making the Connection*, the barriers to effective use of technology are: teacher time, access and costs, vision or rationale for technology use, training and support, and, current assessment practices.

Technology training does not just include training teachers how to use computers, but also includes telecommunications, video, long-distance learning, hypermedia, multi-media, and other applications. Thus, educational technology training occurs on two levels:

- General technology skills: basic knowledge of technology including word processing, databases, spreadsheets, and other applications
- Integration of technology within the curriculum: changing the delivery method of instruction using technology as an innovative tool for instruction

REQUIREMENTS FOR EFFECTIVE USE OF TECHNOLOGY



Another critical component of effective train-ing is that it is ongoing. The rapid changes in hardware, software and applications call for continuous and ongoing user training.

[illegible]

- Does the training provide "hands-on" activities for teachers?
- Are individual needs of teachers met?
- How is time made for training?
- Where should the training take place?
- How is follow-up support and coaching after the initial training being provided?
- Are all staff development activities in the district linked?
- Who gets trained first?
- Have options such as training a trainer been explored, where one individual receives training, after which, he or she provides training to his or her peers?
- What are the levels of training required by staff members? Remember, needs will differ and one size does not fit all.
- Is the local university/college/community college being used as a resource?
- Is instructional integration a focus of the

training, as well as technology use?
- Is the central office staff trained?
- How will the program be sustained (money, facilities, access, etc.)?
- What incentives are there to encourage teachers to use technology after the training?
- When should training be provided - during school hours or after school?
- How will the teachers be compensated?
- Is time budgeted for training?
- What percent of the technology budget should be for training?
- How can we gain community support and understanding of technology training?
- Is there a formal needs evaluation done yearly?
- Is there a system for evaluating the training program for its overall effectiveness? Is accountability a part of this evaluation?

- Make effective use of in-school training.
- Provide on-site support.
- Develop cooperative training classes.
- Utilize local expertise.
- Allow for training to take place at home.
- Ensure that access and training are simultaneous.

> "If I had it to do over again, I would spend more time up front communicating to teachers how teaching with technology would change the way they teach."

- Provide models showing the value of technology for professional use.
- Consider technology as a means to increase productivity and support curriculum.
- Combine communicated mandates with constructive coaching to overcome inevitable resistance to change.
- Mandate initial training.
- Clearly communicate the rationale for technology use, and keep the staff focused on the vision throughout the training process and beyond.
- Create a mission statement and live by it.
- Budget for on-going training.
- Train to individual needs so that each teacher gets the most out of the training.
- Design all training to be on-going.
- Move toward "growing" and hiring teachers as trainers and technology experts.
- Concentrate on risk takers. Identify a champion, or someone to serve as an example for others. Train the teachers and other staff members who want it "first."
- Trainers must be trusted by teachers.
- Use lead peer concept where teachers are trained to train their colleagues in "train the trainer" models.
- Vary format of training – video, distance-learning courses, teleconferences, etc.
- Consider including a small group of students in the formal training alongside teachers to provide assistance to other students and teachers afterwards.
- Allow district facilities to be used by local organizations.
- Provide opportunities for cost sharing. Personnel positions may be shared among schools, local government, and other organizations.
- Consider distance learning as a delivery mechanism.
- Consider the allocation of 30% to 50% of all technology costs to training.
- Compensate the staff for their training whenever possible. This can be done with stipends for hours spent training, career ladder credit, release time, and special offers from vendors. These methods can also be used as incentives to encourage teachers to continue using the technology.
- Include accountability in all training sessions.
- Allow for experimentation time as teachers change their approach to teaching.
- Establish an evaluation system.
- Communicate with the end user to see if the type and amount of training is adequate.
- Collect quarterly information on how the technology is being used, as well as both the students' and teachers' perceptions of the benefits and drawbacks of computer mediated communication.

...In Bellevue, Washington Based on the concept that a teacher who has interest and is successful in using technology will disseminate teaching strategies to colleagues if given the appropriate tools, this program provides a variety of technologies to an individual teacher. In 1987, the district started a program that concentrated technology in a classroom with a "risk taking" teacher, who disseminated teaching strategies to colleagues. The program has grown from two to sixty classrooms each in different schools with the teacher modeling successful practices.

- Collaborate with other community organizations to share facilities.
- Enlist aid of local experts to train in general technology skills.
- Ensure that professional development money is available in the budget.
- Secure widespread support for new forms of staff development.
- Share staff development success stories.
- Provide teachers with time to learn.
- Establish a means of compensating teachers for training time and the innovative use of technology.
- Budget for on-going training.
- Consider mandating training before, during, and after the delivery of the hardware and/or software.
- Make full use of local resources such as community colleges and/or universities for the possible collaborative delivery of training.
- Evaluate training.
- Explain to the community why 30% to 50% of all technology costs are allocated to training.
- Encourage area businesses to endorse volunteering in public schools. Send interest inventory forms to businesses for employers to return to schools or the school system.

...OF TECHNOLOGY COORDINATOR

- Establish a training needs assessment system.
- Establish an evaluation mechanism for training.
- Provide varied, hands-on and individualized training.
- Train both to the general technology skills and the integration of technology within the curriculum.
- Ensure that the staff has ready access to the technology on which to practice and develop skills.
- Provide and publicize a variety of resources, information and opportunities for professional growth.
- Manage maintenance of technical-based systems and resources.
- Coordinate technology support services.
- Design technology-related staff development plans that include support and follow up activities.
- Coordinate personnel and technology resources to improve teaching and learning.

...OF TEACHERS

- Take advantage of the technology and training, communicate your training needs, and share your successes with others.
- Communicate with students as to the care and responsible use of the equipment.
- Encourage all students, regardless of socio-economic status, sex, and ethnicity to make full use of the technology.

...OF PARENTS

- Support teachers as they change the way they teach.
- Offer technology expertise as a resource for classrooms.
- Provide flexible scheduling for training.
- Encourage the widespread support of training and staff development.
- Advocate equal access to and use of technology.

MAINTENANCE & TECHNICAL SUPPORT

supporting your investment

MAINTENANCE & TECHNICAL SUPPORT

As teachers and administrators begin to rely more upon information technology, the need for technology to function effectively becomes even greater. Due to problems with technology, schools often find themselves in a situation where labs, computer stations, networks, etc. are inoperable not merely a day or two at a time, but for weeks. This forces the question, "How is a teacher to prepare for and instruct a class when the fundamental tools for teaching that class are not available?" It is essential that schools and districts consider the need for technical support and maintenance at the outset.

> "We have had trouble attracting technical assistants due to the competitive market for these highly skilled personnel."

There are three levels of technical support:

- Fundamental troubleshooting, is covered under training.
- Basic front-end support, including on-line troubleshooting and minor hardware and software repair.
- In-depth troubleshooting, including network repair and more technical problems.

- Have you considered the need for maintenance and repair of the information technology?
- Do you have anyone on staff with information technology expertise who has the time and resources to provide support? What are their skills?
- What is an acceptable amount of down-time?
- Is there an agreed-upon mechanism for first level troubleshooting (identifying the potential problem) which could save time and resources of all parties involved? Did the vendor have any suggestions for this?
- Is an agreement for outside support in a written contract?
- Do vendors have a proven track record? Have you asked for, and checked, references?
- Have you explored all potential local resources such as students, local businesses, or parents? Do they have a proven track record?
- Have you explored a degree of standardization which could limit the extent of required technical support?
- Have you considered the use of a school or district telephone technology support hotline, bulletin board, or chat room for providing solutions to common problems?
- Does the specific technology require a maintenance contract?
- Are you keeping a record of various training requests as a means for targeting training and making training decisions?
- Does the vendor have a help desk? Is there a charge? Is it cheaper to call a 900 number or long distance?
- Have you posted your problem on a BBS or the Internet for other free input?
- After a problem is corrected, do you circulate among staff the reason for the problem to avoid repeat trouble?
- Does your school have the capability to provide level one and level two support?

- Establish the needs of the school or system. Tailor the needs to shape the services purchased.
- Comply with the standards in your district.
- Explore cost-effective and economy of scale options. While a few schools or districts can combine resources to provide an effective level of support for the technology, many individual schools cannot afford a full-time technician.
- Look at alternative means to provide support. More and more schools are finding that students can provide valuable assistance. This provides students with tremendous experience and satisfies a pressing school need.
- Identify and train someone on-site to provide at least base-level support and troubleshooting expertise. This can save time and resources for the site as well as vendors whose services may not be needed for minor problems.
- Keep track of all requests for assistance. It may be the case that some issues like fundamental troubleshooting can be addressed through end-user training which enables technical support personnel to tackle complex tasks.
- Consider keeping a small inventory of extra equipment such as disk drives, monitors, and network cards. The cost may outweigh the lost time and emergency service costs.

STATE BOARD OF EDUCATION

- Review personnel policies regarding technical support positions.

SUPERINTENDENT, BOARD, & PRINCIPAL

- Include in the technology plan how maintenance issues will be addressed and who will be responsible for what. See that this is a plan that is adhered to and changes with the changing needs of the school.
- Collaborate with community stakeholders to share resources.
- Budget for technical support personnel.
- Share with users state policy and standard information.

TECHNOLOGY COMMITTEE

- Work closely with vendors and monitor maintenance work.
- Create a complete inventory of all equipment.

CONTRACTS, CONSULTANTS, & VENDORS

optimizing your investment

CONTRACTS, CONSULTANTS, & VENDORS

A pressing need in schools across the nation is for school personnel to make more informed decisions concerning information technology. Many of these decisions require true technical expertise, beyond that which is often available in a local district. It is well worth the investment to use an expert during both the planning and implementation stages. Often, schools must rely on the private sector for guidance and decision making. However, simply hiring a consultant will not guarantee that your infrastructure needs will be met. While vendors and consultants understand technology, their understanding of education and public schools may be quite limited. These misunderstandings can lead to thousands of additional dollars and untold hours of work. On the school side of this equation, it is essential that one determine exactly what is needed, looking first at the applications, then at technology solutions. After establishing needs, it is essential to see agreements in writing, definitely for major items representing sizable expenditures. All too often, a school establishes its understanding of an agreed upon issue, but finds that vendors deliver something else. This is ultimately due to a breakdown in communication. Keep in mind, there are no wrong questions. You are the one purchasing the product or service, and it is the vendor's/consultant's responsibility to provide any and all related information that will assist you in making your decisions.

> "Recognize your limitations. Apparent cost-savings provided by doing work in-house may result in greater costs and problems down the road."

Be sure to make a sample contract to include the following:

- Scope of work
- System requirements
- System design, to include these subsystems: work location, horizontal, administration, backbone, equipment room, campus, and engineering
- Technical support staff and experience
- Customer record
- Letters of recommendation
- Proof of work performed/proof of concept lab
- Warranty
- Rate of pay
- Billing procedure
- Established time frame
- Customer acceptance

- Are there regional or state resources to assist with contracts and/or vendors and consultants?
- Who is responsible for what?
- What is an appropriate down-time/response time if a system is maintained by an outside source?
- Who is providing the support?
- Is the product only sold by a specific vendor?
- Is the implementation plan realistic?
- Are the products open standards or proprietary?
- Have you considered all resources when choosing a consultant?
- Has the vendor/consultant provided a list of clients?
- Is on-site support required for the technology?
- Has anyone contacted the consultant's/vendor's references or visited sites to check the level of satisfaction?
- Does the vendor provide local support? If not, have you discussed the possible need for additional time and attention after work is completed?
- Is there someone on the staff who can work with the vendor/consultant and be the school contact?
- Did the vendor/consultant provide the same or a similar product/service to the references or is this a new/expanded field for the vendor/consultant?

- Does the vendor/consultant have adequate staff to provide continued maintenance and support after the initial work is done?
- How much training is required to implement and operate the equipment?
- Are there state or locally established policies for contracts and/or working with vendors and consultants?
- Is the contract guaranteed? How is the contract guaranteed – replacement or refund? Is this specified in the contract?
- Does the contract include technical support?
- Is there a warranty on hardware/equipment?
- What is the duration of the contract?
- Are there any hidden costs written into the contract?
- Is training part of the contract? What is the nature of the training – initial or on-going? Does the training pertain to the use of equipment or does it also include instructional integration, and is this specified in the contract?
- Have you had someone with a technology background or legal experience review the contract?
- Is the response time for repairs included in the contract?
- Are the deliverables clearly defined?

WHAT VENDORS/CONSULTANTS SHOULD BE ASKING SCHOOLS

- What are you trying to accomplish with the technology? What are your instructional and administrative goals?
- Has a needs assessment been conducted?
- With whom are you currently working?
- Describe your past experiences with other vendors/consultants. What was positive or negative about the experiences?
- Which staff members are knowledgeable about technology and could act as a contact?
- Who will be using and/or maintaining the technology? Can we involve those individuals, including physical plant staff, in the process?
- What is the proposed schedule that needs to be met?
- What are current and future funding prospects?
- What are the school processes and politics of which one must be aware?

- Use the following people as consulting resources: parents in the field of technology, business, regional educational service centers, personnel in nearby school districts who have gone through the process, and universities.
- Ask for and check references.
- Research the field – do not limit yourself to one vendor/consultant at the beginning of the process. Retrofitting can be quite expensive to correct. More time spent researching and planning can yield tremendous benefits in the future.
- Deal with qualified vendors/consultants that have proven track records.
- Remember, you are the customer – require that the vendor/consultant meet your needs with products and services.
- Consider the location of the vendor/consultant. Most questions will occur in the period after the technology has been installed.
- Consider the implications when approached to be a test site for a beta product.
- Discuss with the vendor/consultant how they plan to work with other vendors to make sure equipment is compatible. If possible, have this information included in the contract.
- Establish an agreed upon down-time that is acceptable to you, not the vendor. However, realize that the cost is often contingent on the response time. Determine when it is important to have immediate, emergency assistance and when it is not.
- Try to provide as much information about your wants and needs as possible. Vendors/consultants may not know the right questions to ask which will shape the work that needs to be done.
- If a consultant is used for training, be sure that the vendor/consultant can train to both technical issues and curriculum integration. The amount of training in both areas should be included in the contract.
- Hire an on-site or district level technical support person to handle first and second level troubleshooting to prevent expensive and unnecessary calls to the vendor/consultant.
- Choose technology that has been proven in applications similar to yours. Remember, your instructional needs drive the technology.

- Request that the project be tested on a small scale, or build a proof-of-concept lab where the technology can be tested before being implemented system wide. Include this in the contract.
- Have someone familiar with technology and your educational and/or administrative needs review the contract before signing.
- Try to establish the hidden costs, such as retrofitting, overtime, insufficient training, travel, and working with viruses and incompatible hardware.
- Contact schools/districts that have dealt with vendors or consultants and request a copy of their contract for a source of reference.
- Put it in writing if the issue is important. Most problems occur when reaching only a verbal understanding.
- Check with other schools that have gone through a retrofitting experience. Their experience in these areas can be invaluable.
- Read the fine print.
- Be aware of contract guidelines/requirements established by the state.
- Request breaking the project down into clearly defined phases where completion of all phases is contingent on customer satisfaction. If there is dissatisfaction with the work at the end of any phase, another vendor/consultant can finish the project.

...OF SUPERINTENDENT, SCHOOL BOARD

- Check references before signing off on a vendor, consultant or contract.
- Have Board attorney read the fine print.
- Make sure that the contract provides what you want.

...OF PRINCIPALS, TECHNOLOGY COMMITTEE

- Make sure the contract provides what is needed and agreed upon.
- Assign a team to monitor contract activity and check references.
- Check regional and state contract policies/guidelines.
- Keep your focus on education goals and objectives, current and future.
- Request a copy of contract from references with respective contractor.
- Make sure the contract meets the needs of the physical plant staff as well as the instructional and administrative staff.

FUNDING

strategic use of resources

FUNDING

Information technology changes almost overnight. New releases in software and hardware make it impossible to establish and maintain "cutting edge." These rapid changes, understandably frustrating, should not detract from the benefits provided by the technology. Consider that you are buying a window of time for the use of the information technology. The strategy is to buy as big a window as possible with a certain piece of hardware or software considering your needs and budget. Though a certain processor may not be the latest on the market, it may very well run the programs at an adequate speed for a considerable length of time.

> "More and more businesses are turning towards the use of video-conferencing. This equipment could be shared with schools when it is not in use."

Technology is not cheap. Though the per unit cost of technology is decreasing, the overall amount spent on technology by firms is increasing dramatically. As a result, costing out and determining the source of funds are important reality checks for "phasing in" the technology plan. During this process, all possible financial resources should be considered. At each stage of implementation consider:

- maximizing existing funds
- applying for grants
- collaborating and sharing resources and personnel with government, business, and educational organizations
- obtaining resource commitment (personnel, money, time) from PTA's, service organizations, local business communities, the military, and community foundations
- the ability of any technology to be upgraded and integrated with other technology in the future

Cost analyses done by private firms have demonstrated that in order to effectively utilize the technology, one may very well spend more on training and support than hardware and software. Technology funding includes money, personnel, shared expertise, hardware, and time.

To ensure a successful technology initiative, a realistic implementation plan must be developed that involves all the "players" at each stage. Many districts implement the initial stages over a five-year timeline and provide for maintenance each successive year. Some districts focus on implementing the technology plan at one or two grade levels at a time before moving on to other grades.

...In Carrollton, Georgia Carrollton High School has benefited from bond referenda, district investments, and grants resulting in an average of seven computers per classroom. Students are able to create multi-media projects, take advanced classes via uplink, and work collaboratively.

[illegible] a s k

- Is there a funding committee with multi-stakeholders?
- What local funds can be redirected to support a technology phase-in approach?
- How is the district linked to the community college/university for joint technology initiatives?
- Who are the community grant writers and how can their expertise be tapped, either for grant-writing workshops or actual grant submissions?
- Do corporate resources have access to grant information, and how can the business community become involved?
- Is someone monitoring federal grants to form collaborations and seek federal money?
- How are classroom teachers involved in the process?
- Is leasing an option?

considerations

- Consider financing purchases. You can buy technology up front and pay it off over a five-year period.
- Size the task to the source when thinking of local funding. It is easier to obtain community funding for small chunks than the "big picture." A local PTA may be able to provide $3,000 to a school rather than try to tackle a $400,000 initiative.
- Focus on goals. While obsolescence is unavoidable, the technology is a worthwhile purchase if it does what you want.
- Be aware that donated equipment is often a barrier to standardization and may cost you much more in the long run.
- Beware of "bargains." Saving $200 on a piece of hardware up front may cost down the road. Keep in mind the five-year depreciation cycle.
- You are buying a window of time for using the technology; let your needs and budget assist you in making your decisions versus the need to have "cutting edge."
- Encourage donations in the form of time as well as funds and equipment.

...In Atlanta, Georgia Compaq, Dynacom, and the Atlanta school district are partnering to create a new school in downtown Atlanta that will allow students to construct knowledge through various technologies. Fiber networking, Internet access, and video conferencing will be used to integrate the city resources of museums, local government, colleges, and libraries.

SOURCES OF FUNDING

LOCAL	REGIONAL	STATE	NATIONAL	OTHER
• Business Partners	• Universities	• Grants	• Grants	• Private Grants
• PTA	• Community Colleges	• Technology Fund, if available	• Redirected Eisenhower funds	• Vendor Pilot Projects
• Government/ School/Business/ Health Provider Consortia	• Government/ School/Business/ Health Provider Consortia*	• Senior Citizen Groups retired teachers, principals	• Redirected vocational funds	• Military Partnerships
• Service Groups Lions Club, Rotary, special interest, local realtors	• Special Services school facility used for local training	• Statewide Organizations home contractors, telephone pioneers	• Regional Projects rural initiatives	
• Town Council local chamber, business roundtable				

* *As a member of a consortia, a school has greater power to access funding.*

responsibilities

...OF SUPERINTENDENT

- Establish a multi-stakeholder technology committee.
- Collaborate with community members on technology cost sharing.
- Involve county commissioners, business, and higher education in the technology discussion.
- Maintain a focus on instructional objectives, not hardware or software.
- Maintain realistic cost discussions, with emphasis on the "phase in" approach for funding.
- Establish a vehicle to report accountability to community members and funders.

...OF SCHOOL BOARD

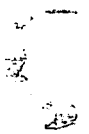
- Participate in the technology planning.
- Promote a marketing plan to inform all community members of the impact of technology on student performance and job readiness or workforce preparedness.
- Involve elected officials in the planning process.
- Help garner widespread support for a long term technology initiative.
- Ensure accountability for each phase of the initiative.
- Involve all community stakeholders.

...OF ELECTED OFFICIALS & BUSINESSES

- Participate in the planning process.
- Investigate areas to share resources between stake-holders.
- Gain widespread support for a long term technology initiative.

...OF SCHOOL STAFF & PARENTS

- Participate in and communicate all technology initiatives.
- Involve students, parents, community and business in technology discussions.
- Gain school based support.
- Involve parent organizations, and community groups (Lions Club, Rotary, service organizations, cooperative extensions and community development clubs).
- Focus on student performance.
- Share success stories.



RESOURCES 

RESOURCES

Arick, M.R., *The TCP/IP Companion: A Guide for the Common User*

Brown, Martin *Hardware Ergonomic Consideration in Middle School Classroom Computer and Video Display Terminal Installations*, University of North Texas.
Guilford County story.

Derfler, F.J., *How Networks Work*

Edutopia, *The Newsletter of the George Lucas Educational Foundation*

Espinosa, Leonard J., *Microcomputer Facilities in Schools*

Gale, Douglas, *An Administrator's Guide to Computer Networks*, EDUCOM '92

Handbook for Technology planning in Texas Public Schools
The Really Incomplete Guide to the Internet – "Netiguette" and ch 2

Hubbard, Lucas, Holmes, *Designing the Technology Infrastructure for Schools*

North Carolina Department of Public Instruction, *A Primer on Cabling Design and Implementation; Consideration for Decision-Makers*

North Carolina Instructional Technology Plan, *Guide: Technological Recommendations and Standards*, School Technology Commission

Schatt, S., *Understanding Local Area Networks*

Technology Demonstration Centers–regional consortium providing a cadre of well-trained "train the trainer" teacher trainers. *Office of Technology Assessment: Teachers and Technology*

Texas Guide

Washburn, Evans, TCP/IP: *Running a Successful Network*

WEB SITES
Education Technology Services
HTTP://dtpserv.cac.psu.edu/weblets

Technology Education Resources
HTTP://www.mstc.uiuc.edu/teched/techedlinks. html

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Continuity in Early Childhood Education: A Framework for Home, School, and Community Linkages	ECECE	$12.00
Designing Teacher Evaluation Systems that Support Professional Growth	RDTES	$8.00
Families and Schools: An Essential Partnership	SSFSP	$5.00
Future Plans Planning Guide	FPPLG	$8.00
How to Assess Student Performance in Science: Going Beyond Multiple-Choice Tests	RDSPS	$8.00
Interagency Collaboration: Improving the Delivery of Services to Children & Families	HTICO	$8.00*

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Special Offer #4—Southern Crossroads	P 04	$25.00
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Videotape Listing

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