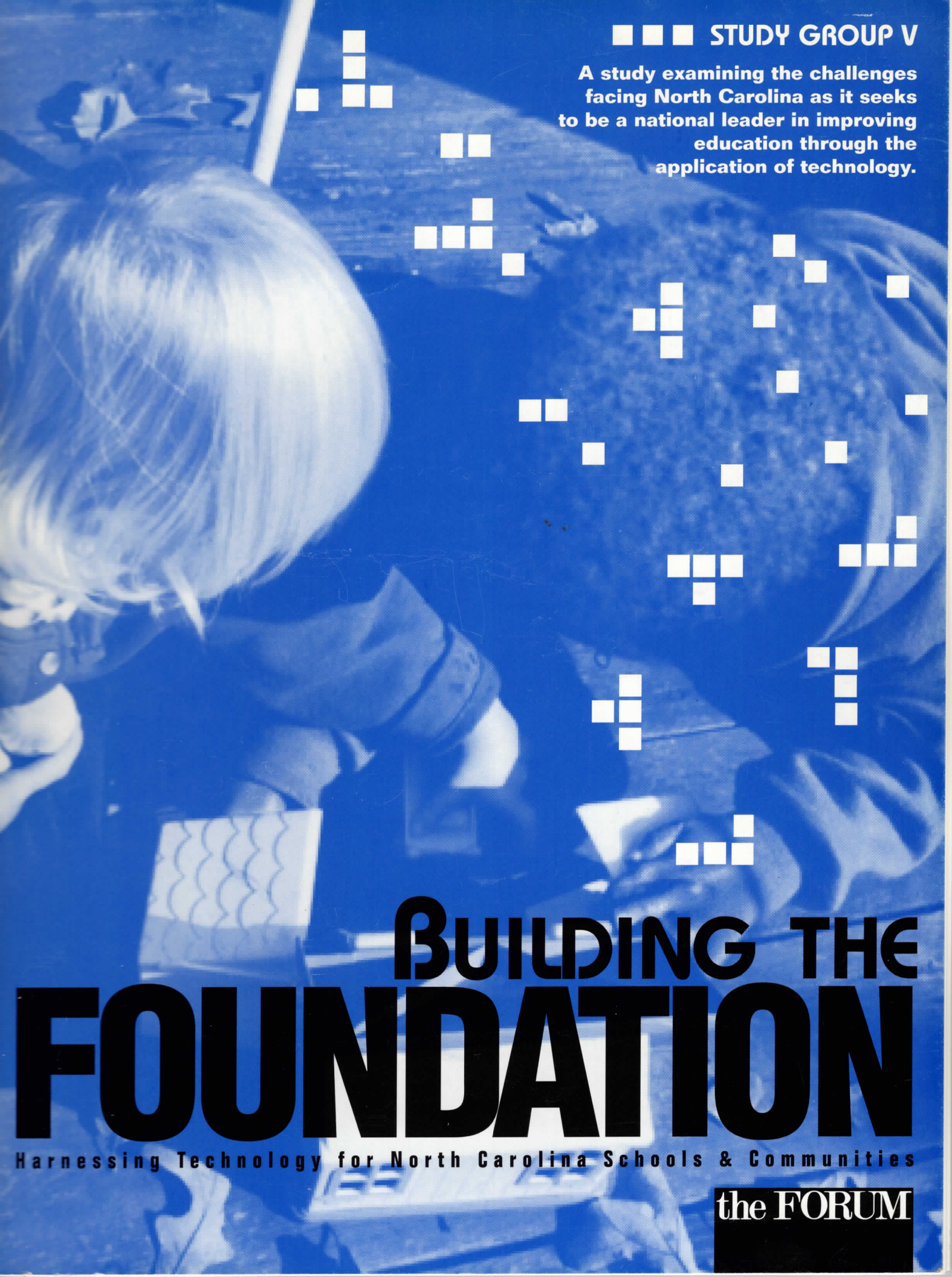


STUDY GROUP V

A study examining the challenges facing North Carolina as it seeks to be a national leader in improving education through the application of technology.

BUILDING THE FOUNDATION

Harnessing Technology for North Carolina Schools & Communities

the FORUM

Study Group V

The results of this year-long study are dedicated to those who believe that harnessing technology will create a tool that can unlock new horizons for our young people and new opportunities for the workforce of North Carolina's future. It is also dedicated to the policymakers, educators, business leaders and taxpayers who must collaborate if North Carolina's schools, economy and quality of life are to be second to none.

Building the FOUNDATION

Harnessing Technology for North Carolina Schools & Communities

Study Group V Members

Chair
MR. GERRY HANCOCK* Everett, Gaskins, Hancock & Stevens

■ ■ ■ GROUP ONE: PLANNING

Co-Chairs
MR. DAVID LANE Dir., Corporate and External Affairs, Southern Bell of NC

THE HON. WILLIAM "BILL" MARTIN* NC Senate

MS. SARAH STEWART* Pres., NCFT

MR. JIM BARBER* Asst. State Supt., NCDPI

THE HON. ANNE C. BARNES* NC House

MR. RICHARD BESSEY Program Mgr., NC Information Highway, Northern Telecom

MR. RANN CARPENTER* Mgr., Texasgulf

THE HON. BETSY COCHRANE* NC Senate

DR. JEANNETTE COUNCIL* Supervisor, Cumberland Co. Schools

DR. CC CRAIG* Exec. Dir., General Baptist Convention

MR. BOB ETHERIDGE* State Supt., NCDPI

MR. KEVIN GAMBLE Specialist, Technology Services Supervisor, NC Cooperative Ext. Services, NCSU

MS. BARBARA HARRELL* Pres., NCSBA

MR. HOWARD HAWORTH* Member, State Board of Education (Dr. Weaver Rogers)

DR. THOMAS HOULIHAN* Governor's Education Advisor

MS. EVELYN JOHNSON* Dir., Staff Instructional Dev., Edgecombe Co. Schools

MR. GEORGE KAHDY Exec. Dir., NCBCE

MR. PHILLIP KIRK, JR.* Pres., NCCBI

MR. WILLIAM MCDONALD* Pres., Sprint Mid-Atlantic Telecom

THE HON. AARON W. PLYLER* NC Senate

MR. J. BILLIE RAY, JR.* Chair, NCBCE & Pres., Southern Bell of NC

MS. BOBBY ROBINSON* Asst. Principal, Forsyth Co. Schools

DR. JAY ROBINSON* Member, State Board of Education

THE HON. GENE ROGERS* NC House

MR. NEHEMIAH SMITH* Past Pres., NCSBA

MR. SHERWOOD SMITH* Pres., CP& L (Ms. Barbara Allen)

DR. BOB TYNDALL Dean, School of Education, UNC-Wilmington

MS. SONDRA WISE* Mgr., Duke Power Company

■ ■ ■ GROUP 2: TRAINING & TECHNICAL SUPPORT

Co-Chairs
MS. KERRY BESSEY* Vice Pres., Human Resources, Northern Telecom (Ms. Carol Lorenz)

MS. RUTH MURPHY* Exec. Dir. for Elementary Instructional Outcomes, Durham Public Schools

THE HON. BEVERLY PERDUE* NC Senate

MR. WILLIAM ARMFIELD IV* Vice Chair, Unifi, Inc.

THE HON. PHIL BADDOUR* NC House

DR. DAVIS BINGHAM* Exec. Vice Pres., PENC

MR. MOSES CAREY* Pres., NCACC

MS. MARY CAY CORR Instructional Television Coordinator, UNC Center for Public TV

DR. MARJORIE DEWERT Dir. of Instructional Technology, UNC-CH School of Education

DR. DENIS DUBAY Dir., NC Science & Mathematics Alliance (Mr. Robert Cullen)

DR. SAM HAYWOOD* Pres., NCPTA (Ms. Wanda Fox)

MR. WILLIAM R. KRESS* Site Gen. Mgr., IBM Corp. (Ms. Beverly Blount Smith)

MS. LORETTA MARTIN Exec. Dir., NCVA (Dr.Don Brannon)

DR. GRIGGS MCKINNON Computer Science Supervisor, Rutherford Co. Schools

THE HON. HELEN MARVIN* Member, UNC Board of Governors

THE HON. WARREN "PETE" OLDHAM* NC House

MR. MITCH OWEN Ext. Computer Training Specialist, NC Cooperative Ext. Services, NCSU

MS. SARAH M. PRATT* Teacher, McDowell Co. Schools, NC Teacher of the Year, 1993-94

THE HON. L. RICHARDSON PREYER* Former Member, US Congress

MS. PATRICIA SHORE* Dir., State Government Relations, R.J. Reynolds Tobacco Co.

MR. JAMES R. SIMEON* Pres., NCASA

DR. JAMES STROM Vice Chancellor, Univ. Advancement, Appalachian State University

DR. HOPE WILLIAMS* Pres., NCAIC&U

MS. JANET H. WILSON* Former Vice Chair, Caldwell Co. Board of Education

■ ■ ■ GROUP THREE: INTERGOVERNMENTAL COLLABORATION

Co-Chairs
MR. RONALD AYCOCK* Exec. Dir., NCACC (Mr. Ed Regan)

DR. GENE CAUSBY* Exec. Dir., NCSBA

THE HON. WALTER "DUB" DICKSON* NC House

MS. SANDRA P. BABB* Exec. Dir., Governor's Commission on Workforce Preparedness

THE HON. JAMES "JIM" BLACK* NC House

MR. KEVIN FITZGERALD Asst. Co. Mgr., Guilford Co.

MR. WILLIAM FRIDAY* Exec. Dir., William R. Kenan Jr. Charitable Trust

DR. SUSAN FRIEL Dir., UNC Mathematics and Science Education Network

MR. BILLY RAY HALL Pres., REDC

MR. JON HAMM Mgr., Broadband Networks, Sprint Mid-Atlantic Telecom

MR. ROBERT JORDAN* Pres., Jordan Lumber Co.

MS. ROSE MARIE LOWRY* Pres., NCAE

DR. JOHN LUCAS* Vice Chair, Durham Public Schools Board

MR. JAMES C. MABRY* Sr. Vice Pres., Wachovia Bank

DR. W. THOMAS MCNEEL* Supt., Caldwell Co. Schools

MS. JANE SMITH PATTERSON Governor's Asst. for Policy, Budget, and Technology

MS. LYNN ROBERSON Education Relations Coordinator, Southern Bell of NC

MR. ROBERT W. SCOTT* Pres., Dept. of Comm. College (Mr. Parks Todd)

MR. LARRY SEIGLER* Vice Pres., Logistics, Burroughs Wellcome

THE HON. PAUL SMITH* NC Senate

MR. JOHN THOMAS Exec. Dir., The Glaxo Foundation

MS. REBECCA TROUTMAN Research Analyst, NCACC

DR. LEROY WALKER* Pres., U.S. Olympic Comm.

THE HON. MARVIN WARD* NC Senate

MS. BETTY WEST* Retired Educator

THE HON. LESLIE WINNER NC Senate

DR. PHAIL WYNN* Pres., Durham Technical Comm. College

MR. G. SMEDES YORK* Chair, NCCBI

**Indicates member of the Forum Board of Directors*

INTRODUCTION

The challenge of harnessing technology to meet the needs of North Carolina schools and communities is daunting. However, with North Carolina positioned to become a national leader in information technology, the already daunting challenge is magnified even more.

The impetus for this study of technology in North Carolina schools was the realization that for North Carolina's young people to gain the competitive educational edge that technology can provide, it is imperative that a solid technology foundation be built. To use an old adage, "A child must walk before he can run." In like fashion, schools must have a firm grasp of how to plan for technology, how to use technology and how to adapt instructional practices to new technology before they can tap the enormous potential of the North Carolina Information Highway.

The realization that a sound technology foundation must be built was the result of a previous Forum study on technology in North Carolina's schools. That study, *Technology in the School House*, found common foundation problems in high-wealth schools and low-wealth schools, in large schools and small schools. In too many cases:

- A lack of vision regarding technology severely limited the degree to which it was used effectively.
- Short-sighted purchasing decisions led to incompatible technology systems.
- Technology is outdated.
- There has been severe under-investment in training and technical support.
- There is a lack of in-house capacity to make comprehensive, long-range technology plans.

Thus, the focus of this study is on building a solid technology foundation that will enable North Carolina to be a national leader in utilizing the potential of technology for improving the education of its young people and for making all aspects of government more efficient and effective. The study focuses on three foundation issues: collaboration, planning, and training and technical support.

Collaboration

The full potential of technology will emerge as it connects schools to other branches of government and to information sources across the State, the nation and the world. For that to happen, schools must collaborate with government at all levels.

The potential of technology will not be maximized until all governmental entities, including schools, social service agencies, hospitals, community colleges, universities and law enforcement services, are networked together. The movement toward a new era of technology requires unprecedented collaboration between all branches of government and the private sector.

Planning

Sound planning is at the heart of effective technology use. For schools to effectively use technology, they must develop the capacity to plan wisely. To plan wisely, schools must have a clear vision of the instructional, productivity and administrative applications technology offers.

Training/Technical Support

Without adequate time and resources to train educators, potential technology gains will not be realized by schools; without quality technical support programs, technology will be a problem-creator, not a problem-solver.

To find answers and make recommendations that could lead to a foundation-building program for technology, the Study Group looked to:

- Businesses in which technology is central to increased productivity.

- Ground-breaking schools and other governmental agencies which have effectively harnessed technology.
- States which have placed a high priority on building a technology foundation.
- Technology providers in the public sector who help government build technology foundations.

The resulting suggestions are aimed at state policymakers, at educators, at county officials. Included in the material which follows are policy recommendations as well as operational suggestions for those charged with building a technology foundation for North Carolina and its people.

Two Cautions

Before making any recommendations, it is necessary to give readers two cautions:

First, researchers who have studied technology utilization in the schools have found that additional technology in and of itself is not a panacea for education's problems.

If North Carolina schools are to be second to none, the current drive to reach a consensus on the goals and standards of schooling must be successfully concluded; attempts to restructure the decision-making and management philosophies of schools must continue; and a foundation upon which the instructional potential of technology can be realized must be built.

Put very simply, if we don't change the way we approach teaching and learning as well as the way we structure our schools, no amount of technology will assure us of improved student outcomes.

Second, the recommendations which follow lay out a path which is not modest. They call for an expanded role of state government in the technology arena; they call for the creation of new state-funded positions; implicitly, they call for a massive investment in new technology and long-term training.

Before the implications of the recommendations overwhelm the reader, it is necessary to remember what is being discussed. Just as technology is "reinventing" corporate America, so does it have the potential to "reinvent" schools and government.

This is not a small undertaking. If the potential of technology is to be effectively harnessed, it will cause an overhauling of today's classrooms, a rethinking of today's teaching practices. Technology could be the major driving force behind change in schools for the foreseeable future.

In the past, government has been faulted for underestimating the cost and the unintended consequences of major initiatives.

These recommendations are issued in the hope that policymakers will have their eyes open as the movement into the technology era gains momentum. It will do little good to buy technology if the training and support needed to build a sound foundation are not present. It will only cause problems in years to come if the State lacks the foresight needed to insure today's investments will serve tomorrow's needs. Further, if state and county governments do not define which branch of government is responsible for emerging technology costs, it will create ill-will and confusion in the future.

In Conclusion

As the following suggestions are considered, the Study Group asks the reader to remember the premise underlying the study and the urgency with which it was undertaken: the Study Group believes a sound technology foundation is the key to harnessing the potential of technology. The decisions made at this critical juncture of North Carolina's technology evolution could spell the difference between a state which could emerge as a national informational technology leader and one which fell by the wayside because it did not anticipate the enormity of the task being undertaken.

RECOMMENDATIONS

Building the FOUNDATION

Harnessing Technology for North Carolina Schools & Communities

EXECUTIVE SUMMARY
Recommendations

■ Recommendation One

For North Carolina to emerge as a national leader in information technology, the State must assume a much greater leadership role. Specifically, the General Assembly should:

- Create a permanent Cabinet-level Department of Information Technology. The Department should be charged with creating an interconnected, expandable information system linking together all governmental entities; further, it should provide leadership and support for technology innovation.
- Create a standing informational technology oversight body similar to the General Assembly's Education Oversight Committee or the Mental Health Commission. That body would be charged with insuring that North Carolina's technology initiatives are responsive to all branches of education and government, cost-effective and flexible enough to meet the needs of North Carolina's people.
- Through the new Department of Information Technology, create a network of Regional Technology Centers which would be accessible to governmental entities across North Carolina. The Centers would be charged with providing support, offering technical training and brokering information technology services for all schools and governmental entities.

Through technology...

a teacher will receive training at a Regional Technology Center on navigating through vast amounts of information from thousands of databases. In turn the teacher will train his or her peers back home, demonstrating the potential for integration of database information with the curricula.

■ Recommendation Two

State funding policies should spur governmental collaboration and innovation in the school technology arena; they should also insure that the benefits of technology reach all children and schools in North Carolina. State policymakers should:

- Establish a school technology trust fund supported by a dedicated stream of revenue.
- The trust fund should provide a) a base-line of technology funding to all schools
  b) supplemental technology funding to low-wealth schools, and
  c) supplemental technology funding on a competitive basis for innovative technology initiatives which could be models for other schools and/or which model collaboration between schools and other governmental entities. School systems wanting to access support from the trust fund would be required to respond to an RFP issued by the State.
- Fully anticipate all costs, including training, technical support and retrofitting existing buildings, when appropriating technology funds.
- Clarify the funding obligations of counties versus those of the State especially in areas like phone usage charges and retrofitting buildings for new technologies.

- Provide state college and university Schools of Education with the new technologies needed to adequately train and prepare tomorrow's teachers and administrators.

Recommendation Three

The State Department of Public Instruction and the State Board of Education should anticipate regulatory changes which new technology initiatives will necessitate. Specifically, educational policies should:

- Broaden the definition of "technology funding" to enable school systems to adequately support costs in areas like training, technical support and retrofitting buildings.
- Update today's personnel policies to provide school systems a rational way to categorize and pay employees in new technology-related positions such as technical support personnel, technology coordination personnel and instructional technologists.
- Align today's certification and in-service development policies and requirements for teachers and administrators with the new skills required to work and lead in an information technology era.

Recommendation Four

County government should be a full partner in aligning policies and funding patterns which will spur inter-governmental collaboration, innovation and improvements in service through technology. County Commissions should:

- Establish local technology funding policies which reward school and county government initiatives that result in economies of scale, improvements in service and innovation in the technology arena.
- Formalize networks of technology specialists from all branches of government which receive county funding to foster collaboration, better long-range planning and improvements in government services.

Recommendation Five

For the benefits of informational technology to reach the young people of North Carolina, local school policies and practices need to support and encourage the movement of schools into a technology age. Local school boards and administrators should:

- Delineate between technology policy decisions which must be made at the school system level and those best made at the school building level. As a general rule, decisions regarding the creation of information technology systems should be made by school boards; decisions regarding instructional applications should be made at the building level.
- Take the initiative to enter into collaborative arrangements with county government which would offer community-wide access to information technology.
- Explore collaborations which could lead to "grow your own" technical support apprenticeship programs.
- Adopt best planning and training practices as they enter the technology arena (see following sections, "Planning Model" and "Best Practices for Training and Support").
- Avoid cutting corners on building renovations which would limit technology system expansion in future years.

RECOMMENDATIONS

Introduction

Schools and government in North Carolina, like schools and government across the United States, did not enter the technology age as a result of comprehensive strategic planning; rather, technology evolved as a result of an experiment here, a self-taught technology pioneer there.

While the process may have been haphazard and rife with false starts and stops, evolve we have. In a remarkably short period of time technology has the potential to change the way schools and government in North Carolina are organized and delivering services.

At the local school building level, schools have moved from tentative experiments with computer labs to giving students and teachers the power to access information around the world using technology in their own classrooms.

In the General Assembly, the legislative process has moved from reliance on typewriters and photocopying machines to an information network that allows anyone with a modem access to the latest proposed legislation under debate.

The potential for North Carolina to become a national leader in harnessing the Information Highway has focused the spotlight of attention on technology as never before. With 106 sites coming on line this summer, the implementation of the North Carolina Information Highway is moving at breath-taking speed. The complexity of the task makes it imperative that the trial and error evolution into the technology arena that brought the State to where it is today be replaced by a better, more comprehensive system.

For North Carolina to access the Information Highway and for young people across North Carolina to realize the potential learning benefits of technology, the State must assume a much stronger leadership role in planning for and supporting a system of informational technology.

Additionally, schools and government at all levels must learn to do something which is not the norm in government – collaborate – if the young people and taxpayers of North Carolina are to realize the full benefits of technology.

The promise of technology rests on collaboration. It presumes a sharing of information. Its potential will only be realized as frequently competing, non-cooperative branches of government seek ways to streamline or reinvent government through crossing over and blurring turf boundaries.

It is in that spirit of collaboration that the recommendations which follow are offered.

Recommendation One

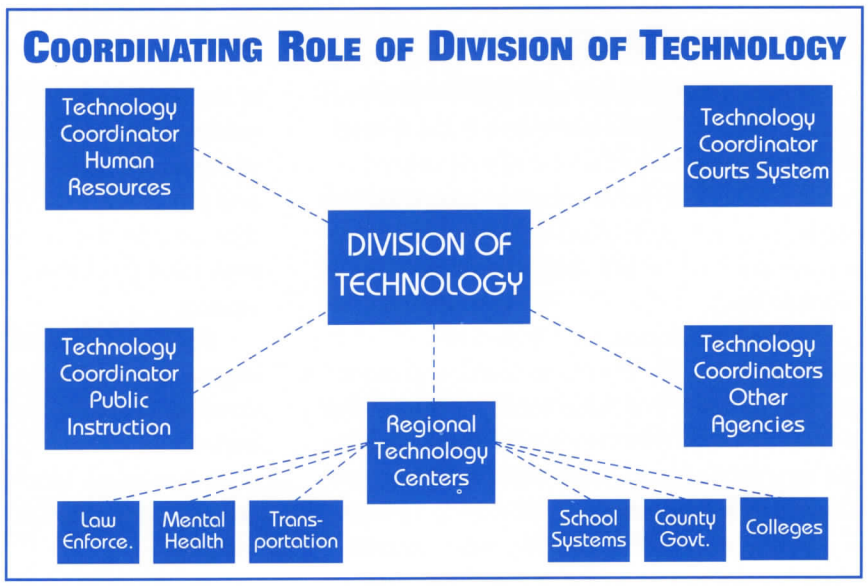
State government must assume the responsibility of a greater leadership role if the promise of technology is to be realized.

The General Assembly wisely established a cross-agency Information Resources Management Commission (IRMC) in 1992 in an effort to insure that the State's technology efforts were coordinated.

The IRMC has served the State well, but the time has come for North Carolina to assume a much broader technology leadership role as the potential impact of technology on government and the complexity of the transition to an information technology era becomes clearer.

■ ■ ■ Create a permanent Cabinet-level Department of Information Technology with a charge and resources far greater than today's IRMC.

The new Department would carry on the existing roles of the IRMC and assume new roles which the movement into a technology age necessitates. The overriding charge to the Department would be to establish a statewide system that is compatible, connected and capable of expansion. It should establish technology standards for the State and bring state purchasing policies and procedures into alignment with those standards.



The primary role for the Department would be to create a system of support for all branches of government. That support would take the form of providing planning assistance, technical support training, disseminating information about innovative technology practices and brokering information and service to schools and governmental entities across the State.

In creating the new Department, every effort should be made to avoid duplication of roles and costs; specifically, the IRMC and potentially other existing government-funded technology functions should be consolidated into the new Department.

■ ■ ■ The new Department would build and maintain a system of information technology; it would not be responsible for technology applications.

The new Department would focus on system issues, not on technology applications. A third grade teacher, for instance, wanting information on technology applications to support reading instruction would go to the Department of Public Instruction; a health-care provider wanting technology application assistance to better monitor clients would go to the Department of Health.

However, school officials or health-care providers wanting assistance on creating local technology networks, long-range technology purchasing plans, or new technical support approaches would go to the new Department.

The new Department would focus on the creation of the statewide information technology system and, subsequently, on supporting and maintaining the system. The new Department would insure the system was working right; individual agencies would work to see that users use the system to do the right things.

■ ■ ■ The new Department should establish a network of Regional Technology Centers.

The local assistance capability of the new Department would flow through a series of Regional Technical Centers established to insure that all schools and governmental entities have access to quality technology services.

The Centers should be established through a competitive bidding process open to community colleges, four-year colleges and universities, existing state agencies, private enterprise, nonprofit organizations or

consortiums combining one or more groups.

Centers should facilitate and broker technology services to governmental entities and public schools. They should create networks of technical support personnel servicing all branches of government; they should provide technical support training through those networks.

They should provide planning and purchasing assistance to local governmental entities. They should disseminate information about "best practices" and innovations in technology.

Most of all, the new Regional Technology Centers should be "customer driven" and accountable to the mission of helping to create and maintain a world-class information technology system within North Carolina.

■ ■ ■ Create an Information Technology Oversight Committee.

The General Assembly should create a standing information technology oversight body similar to the Educational Oversight Committee or the Mental Health Commission.

A recommendation to bring into existence a new coordination agency inherently has the potential to raise fears of a "big brother" in the technology arena. To insure that the new Department be a collaborative partner with schools and all branches of government, a standing oversight body should be charged with insuring that the new Department is responsive to all levels of schooling and all branches of government; that it avoid rigid, "one size fits all" prescriptions for technology usage; and that policies it recommends, especially in the purchasing area, are flexible enough to co-exist with rapidly changing technologies.

Recommendation Two

State funding policies should spur governmental collaboration and innovation in the school technology arena.

Just as planning for technology has been haphazard, so has the funding for technology. Because of "feast or famine" technology funding in the mid-eighties, much of the technology now in schools is outdated. Because few schools entered into technology purchasing with a system-wide vision or plan for the future, it is not uncommon to find incompatible equipment within school systems much less within school buildings.

With the State now poised to be a national informational technology leader, state funding practices need to be overhauled.

State funding policies should spur governmental collaboration and innovation in the school technology arena; they should also insure that the benefits of technology reach all children and schools in North Carolina.

■ ■ ■ The General Assembly should establish a school technology trust fund with a dedicated revenue stream.

Today's "spend or lose" budgeting practices require that money appropriated for use within one budget year be spent in that same year or it reverts to the general treasury. Subsequently, when technology funding is appropriated, schools typically buy technology – even if they are unsure of how they want to spend their technology dollars.

A trust fund approach would enable the State to insure a level of planning for technology that does not exist today. By requiring schools to adopt a long-range technology plan, the General Assembly could use a trust fund approach to also insure a wise use of taxpayers' dollars. This approach, similar to that used for the State's highway fund, would also regularize funding and make schools less subject to abrupt starts and stops in technology funding.

■ ■ ■ Appropriate funds in three ways.

Trust funds should be appropriated in three ways:

- All schools would be eligible for "base technology funding" that would guarantee per-pupil basis foundation funding for all schools.
- Supplemental funds would be earmarked for low-wealth schools which, because of a lack of local resources, have typically under-invested in technology and have farther to go than do wealthier systems.
- Finally, a portion of the trust fund would be earmarked for supplemental funding for school systems which propose innovative technology initiatives that could be a model for other schools or which propose collaborative models in conjunction with other governmental entities.

Three levels of funding are proposed to address several different issues. The base funding approach would not penalize systems which had already invested in technology, and they would guarantee that all schools, rich or poor, received State support in technology.

The supplemental funding for low-wealth schools would guarantee that the potential instructional benefits of technology reach all children, regardless of their place of birth. As the Information Highway opens up the potential for distance learning, that funding could prove to be especially critical in isolated and rural areas.

Finally, the supplemental funds for innovation would enable the State to be a catalyst for innovative educational applications of technology and for encouraging schools to cross jurisdictional lines to collaborate with other governmental agencies, widen community access to information and arrive at economies of scale.

■ ■ ■ Before a school system could receive funding, it would be required to submit a comprehensive technology plan to the new Department for approval.

As previous studies of technology have found, the lack of long-range technology planning is a weakness in many school systems. Through an RFP process (i.e. request for proposals), the State could guarantee a level of thorough planning that otherwise is unlikely to occur. The RFP review process would be a collaboration, with the new Department reviewing system issues and SDPI reviewing application issues. The State could also be a catalyst for comprehensive planning if it required plans to demonstrate adequacy in areas like training and on-going technical support; further, it could spur inter-governmental collaboration if it provided incentives for collaboration in its funding policies.

By using a trust fund approach, the State would remove the fear that if a plan were rejected, funds would be lost due to fiscal year budgeting policies. With the trust fund, if a school system did not have a plan approved within a budget year, the funds would remain in the fund and could be issued in the coming year once an acceptable plan was put forward.

To help schools which may not have either the planning nor the grant writing expertise necessary to satisfy a comprehensive RFP

School Technology Funding Timeframe

Year 1	Year 2	Year 3	Year 4	Year 5
Create Education Technology Trust Fund Planning funds distributed to all LEA's; technology plans must meet criteria established by Division of Technology.	Technology Funds made available on a per pupil basis to all LEA's. (When LEA's meet planning guidelines.)	➡	➡	➡
		Additional funding provided for low-wealth and small school systems.	➡	➡
			Incentive funding begins for systems which have framed innovative and exemplary uses of technology	➡

process, the Regional Technology Centers could offer both planning and grant writing assistance.

■ ■ ■ To further be a catalyst for long-range technology planning, the State should fund schools through a phased-in approach which would allow ample time for planning.

The implementation of the three-tiered funding system proposed here (i.e. base line, low-wealth and innovation funding), should begin with a planning period. School systems would have one year to respond to the State's technology funding RFP; however, schools which are already at an advanced stage of technology planning could reply to the RFP in less time. Schools whose technology plans were approved would begin receiving base line funding in the first or second year of the program. Schools eligible for low-wealth supplemental funds would receive those funds in the third year of the program. Innovation grants would not be awarded until the third or fourth year of the plan.

Not only would such a phased-in approach insure ample time for planning, it would give a school technology trust fund ample time to grow in size before being exposed to the full impact of funding demands.

■ ■ ■ Clarify funding responsibilities between county and state government.

As more and more schools begin to harness technology, four areas are emerging as major unresolved funding issues:

- Technology training
- Technical support
- Utility and phone usage charges
- Retrofitting buildings for technology

The State must quickly resolve which branch of government, state or county, is going to be responsible for technology-related funding, especially in the area of utility usage charges, technical support and retrofitting.

As the Information Highway opens up the potential for distance learning, should additional telephone charges that accompany distance learning be added to the routine phone charges now paid by county government; or will the additional charges be considered educational program costs that would more appropriately fall to the State? The same question applies to increased electrical charges that accompany an expanded use of technology.

As instructional technology grows more common at the school building level, the need for technical support personnel will mount. Currently, the State does not have a job category to cover technical support specialists (see later recommendation), nor consensus on whether those positions receive state support or be shouldered by county government.

Finally, if the State begins to fund school technology at a much higher level than it does now, can school systems use a portion of the funding to defray the cost of retrofitting school buildings which were not built to support sophisticated technologies?

■ ■ ■ The definition of "technology funding" needs to be expanded to include costs related to training, technical support and renovations.

Schools and businesses which are successfully using technology routinely invest sixty cents to one dollar for training and technical support for every one dollar used on technology purchases. Typically, state funding has focused on buying technology, not on insuring that people are trained to use it or that people are hired to keep it running.

In the future, policymakers will need to factor in on-going training and technical support costs, increased phone and utility usage charges, and building renovations necessitated by technology.

■ ■ ■ Create school funding policies that insure flexibility and avoid a top-down approach.

The area of instructional technology is too complex to lend itself to a "one size fits all" prescriptive approach to funding.

Just as the needs of local schools varied so much that BEP staffing formulas did not accommodate the needs of all school systems, so do the technology needs of schools defy "one size fits all" appropriations policies.

In one locale, distance learning might have the potential to make available an array of instructional offerings that would not be possible without technology; conversely, in resource-rich communities distance learning might be the lowest of a school's priorities. Some schools favor computer lab-based instructional technology while others are moving away from labs and dispersing technology into classrooms.

In schools which have routinely used technology for years, the need for staff training might be less pressing; in other schools which are just introducing technology, equipment purchases might logically be delayed while needed training takes place.

If the State adopted a funding schedule prescribing the technology needs of all schools, it would be short-sighted, especially in an arena where new developments make today's technology a thing of the past in a matter of months if not weeks.

■ ■ ■ Schools of Education in state colleges and universities will need to be outfitted with today's technologies if teachers and administrators are to receive first-class preparation.

In later sections of this report much will be said about the centrality of teacher and administrative training in technology. Most of the teacher and administrator training programs housed in the State's colleges and universities are just beginning to conform their preparation programs to the informational technology needs of schools. If Schools of Education are to be major contributors in building a foundation for technology, policymakers will need to provide them with the resources needed to do the job.

Recommendation Three

The State Department of Public Instruction and the State Board of Education should anticipate regulatory changes which new technology will necessitate.

Just as legislation needs to be in alignment with changing technology needs, so do the implementation and regulatory policies established by the State Board of Education and the State Department of Public Instruction.

The bodies should anticipate regulatory changes which new technology initiatives will necessitate.

■ ■ ■ Personnel codes need to be updated to accommodate information technology-related staffing needs.

The State Board of Education has contributed to professionalizing school management by funding positions such as Finance Officers and establishing requirements for those holding the positions. The State Board has also facilitated change through establishing new positions such as School Community Relations Officers.

As the impact of technology is felt by schools, it is time to revisit personnel codes and bring them into alignment with technology. This is especially true in the areas of coordination and planning, technical support and instructional applications. The State Board should consider creating the following personnel categories:

- DIRECTOR OF SCHOOL TECHNOLOGY: This administrative position would oversee the establishment of a comprehensive system of informational technology within entire school systems. In systems too small to support such a position, the Director of School Technology could serve consortiums of two or more collaborating school systems.
- TECHNICAL SUPPORT SPECIALIST I & II: A previous Forum study found that on-site, readily accessible technical support was a key ingredient for successfully utilizing instructional technology. Technical Support Specialist I would be the "fixers" and maintain the technology systems. They would be the first people called when there were system or equipment failures. In large systems, the Technical Support Specialists II would supervise and oversee support

programs system-wide.

- INSTRUCTIONAL TECHNOLOGIST: This position would differ from today's media specialist or media coordinator in that the individual would work with teachers in both a training and instructional application capacity. Depending on the needs of a local school system, such a position could be full-time or part-time, functioning like today's lead teachers.

■ ■ ■ Align State personnel policies with technology-related job functions and needs.

The Study Group is not recommending that the State fund hundreds or thousands of technology-related positions at the same time. Rather the Study Group is recommending that the State's personnel policies be brought into alignment with technology-related job functions that many, if not most, school systems are already utilizing.

It is not necessarily true that all school systems will need a full-time Director of Technology. As technology utilization increases, small systems may find that a shared Director of Technology would serve their needs well. Other systems may choose to use the personnel flexibility available through today's waiver procedures to create technology-related positions.

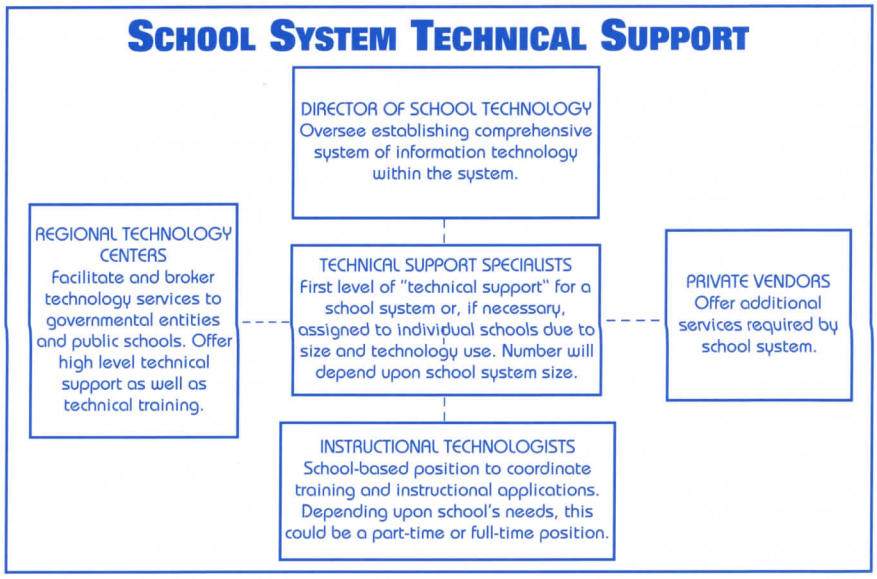
Whatever staffing patterns emerge, it is almost certain that the four job functions described above will become more and more common as technology utilization grows. The State Board of Education would be wise to anticipate the need for updating its personnel policies.

■ ■ ■ Certification requirements and in-service staff development practices need to be aligned with technology.

Only a handful of the Schools of Education which prepare the bulk of North Carolina's teaching and administrative workforce have formally begun requiring course work in information technology and instructional applications. If the potential of technology is to be realized within the educational arena, the State Board of Education needs to determine what an adequate level of technology training should be and give Schools of Education a time line during which such training must be incorporated into their programs.

In fairness to Schools of Education, the revolution in technology has occurred rapidly, making it difficult to predict the degree to which intensive teacher and administrative training is now needed. However, many Schools of Education are responding slowly to current demands for preparation in the area of information technology.

With the State now confronted with a massive training challenge in the existing workforce, action must be taken to insure that higher education gears up rapidly in the technology arena; otherwise, the State will continue to subsidize training teachers and administrators twice – once during their formal



training and again when they enter the workforce. The State Board could accelerate teacher and administrative technology training by including technology preparation as a new standard when making decisions regarding the accreditation status of Schools of Education.

In like fashion, the Department of Public Instruction and the State Board should reassess existing in-service staff development practices including leadership development programs, the Initial Certification Program and the Teacher Training Academy administered by the Department to guarantee technology is an integral component in all state-funded training initiatives.

Recommendation Four

County government should be a catalyst for collaboration.

County government should be a full partner in aligning policies and funding patterns which will spur inter-governmental collaboration, innovation and improvements in service through technology.

■ ■ ■ Reward technology collaboration.

County Commissions should adopt local funding practices which reward technology collaboration and innovation.

More and more County Commissions are becoming regular and sizable funding partners in supporting school technology.

Just as the proposed state-level school technology trust fund could be designed to spur innovation and collaboration between schools and other governmental agencies, so could county-generated funding which is earmarked for school technology.

County Commissions which support technology funding should create policies which provide incentives and rewards for schools which collaborate with other governmental entities in areas such as staff training and technical support.

Further, County Commissions should provide rewards and incentives to schools which expand information services throughout their communities and/or schools which can demonstrate a savings of money through collaboration with other branches of government.

■ ■ ■ County government should create a network of technology coordinators for all county-funded governmental entities.

In examining the degree to which different governmental entities cooperated in the technology arena, it became painfully clear that there was very little collaboration between schools, county and city government, law enforcement agencies, medical institutions, and the courts in the area of technology.

If county governments used the leverage that funding support gives them, they could bring together networks of technology coordinators in the hopes that communication might lead to collaboration in areas like planning, purchasing and improvement of services.

By creating a network of technology coordinators and enacting funding policies that require collaboration and innovation, County Commissions could become a major catalyst for North Carolina assuming a leadership role in harnessing technology at the community level.

Recommendation Five

Local school policy should support schools moving into the technology age.

For the benefits of informational technology to reach the young people of North Carolina, local school policies and practices need to support and encourage the movement of schools into the technology age.

■ ■ ■ Local school boards and administrators should adopt practices modeled on the best technology practices of others.

In too many of North Carolina's schools, teachers are the last people to be given access to telephones and information technology. While most studies of successful utilization of technology have found that it is necessary to put the tools into the hands of those who are expected to use them before any gains can be expected, schools typically provide technology for young people but not for employees.

It is highly unlikely that the benefits of technology will be realized as long as today's paradigm that teachers do not need technology remains in place. Thoughtful school boards and local administrators need to reshape that paradigm and begin focusing more on providing the teachers who are expected to lead young people with the necessary resources.

Through technology...

a family new to town will visit a total living terminal where they will register to vote, get a library card, enroll in school and set up a bank account. A three dimensional hologram of the town will show them the location of everything from public transportation routes to hospitals to the town hall.

■ ■ ■ School budgets need to reflect the training and technical support demands new technology creates.

Just as the State cannot underestimate training and technical support costs created by technology usage, neither can local school boards under-invest in either area.

■ ■ ■ Delineate between proper decision-making roles at the system level and at the building level.

Current efforts to expand the strategy of site-based decision making should not be substituted for enlightened system-wide technology planning. Certain technology decisions are appropriately made at the school system level; others are best made at the building level.

Just as this document suggests that the appropriate role of a new Department of Informational Technology would be to create and maintain a system of technology, so should local school boards establish school system standards for technology. While instructional applications decisions are best made at the building level, school systems should set standards for technology purchases, establish training and technical support guidelines and insure that building level technology plans contribute to the school system's overall plans.

■ ■ ■ Local school boards should take the initiative in fostering collaboration that could offer community-wide access to information and greater efficiency.

Across the country there are a growing number of examples of places where schools and local government have collaborated to offer community-wide information services through school-based technology. School systems should take the lead in fostering county, city and school system collaboration in an effort to improve services to taxpayers while avoiding costly duplication of efforts.

Longer term, technology offers a wonderful opportunity for local school systems and community colleges to work together in

designing apprenticeship programs aimed at communities "growing" their own technical support specialists. With technology use expanding, the demand for technical support staffing will increase as well; far-sighted apprenticeship programs in the technical support area could anticipate growing demand and competition for skilled technical support staff. Technical support will be an increasingly critical staffing issue for rural schools and governmental entities if the training need is not anticipated in advance.

■ ■ ■ Training and planning are at the heart of successful technology plans; local school boards should insist that school systems follow the models of best practices in both areas.

Research on technology in the schools finds that where more people have been involved in the planning process, plans tend to be better. In schools which have invested in the time and effort needed to adequately train educators to use technology, technology is better used.

School boards should start by learning from best practices in schools and businesses which have successfully harnessed technology.

PLANNING MODEL

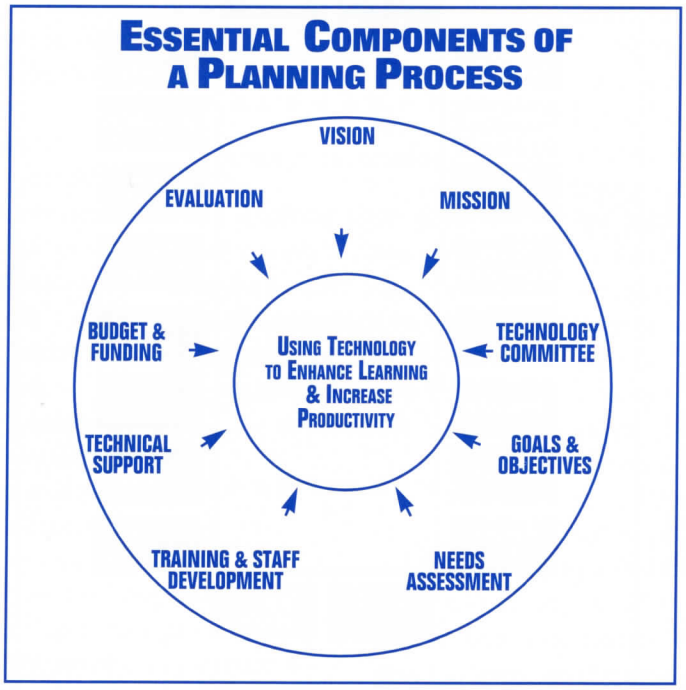
Building the FOUNDATION

Harnessing Technology for North Carolina Schools & Communities

PLANNING MODEL

Introduction

Planning is the process of establishing a detailed strategy to accomplish an objective. North Carolina is on the verge of changing the lives of its citizens through the use of technology. Contemporary technology is complex and has the potential to both challenge and change old paradigms while simultaneously requiring tremendous investments in resources of time, effort and funding. Sound technology planning assures those resources will be wisely used. Before and during the planning process, keep in mind that:



- Technology is an extremely powerful tool holding enormous potential for use in education; it provides a world of information with the touch of a button. Technology does not replace but changes the role of the teacher. Perhaps most importantly, technology enables the teacher to facilitate learning in a broader and richer environment.
- Technology is not limited to computers. Laser discs, fiber optics, and CD-ROMs are only a few examples of other technology tools offering great promise for education.
- True success in implementing a technology plan will require commitments to time, support, flexibility, teamwork and widespread involvement. Trying to cut corners will most likely result in end products that require even more time and money.
- Technology is not the solution to many of the problems we currently face in education. Alone, it does not enhance interpersonal and social skills. Most importantly, it cannot substitute for the extremely important one-on-one attention from teachers and parents that all children need.
- This model is not a blueprint to be used in creating a technology plan. It is a guide to provide assistance on one's technology journey. Each school or school system must blaze its own unique trail to create the plan that will meet the individual needs of that school or community.

Key Elements of Planning

Vision

Vision gives direction and provides a glimpse of the future role of technology in schools, districts or states. Vision can be broad, but it must be followed by specific goals and objectives for the use of technology.

An example of a vision statement: *"Enable, empower, and inspire students, school system personnel and the community to utilize technology as a means to improve and enhance all aspects of their daily lives."*

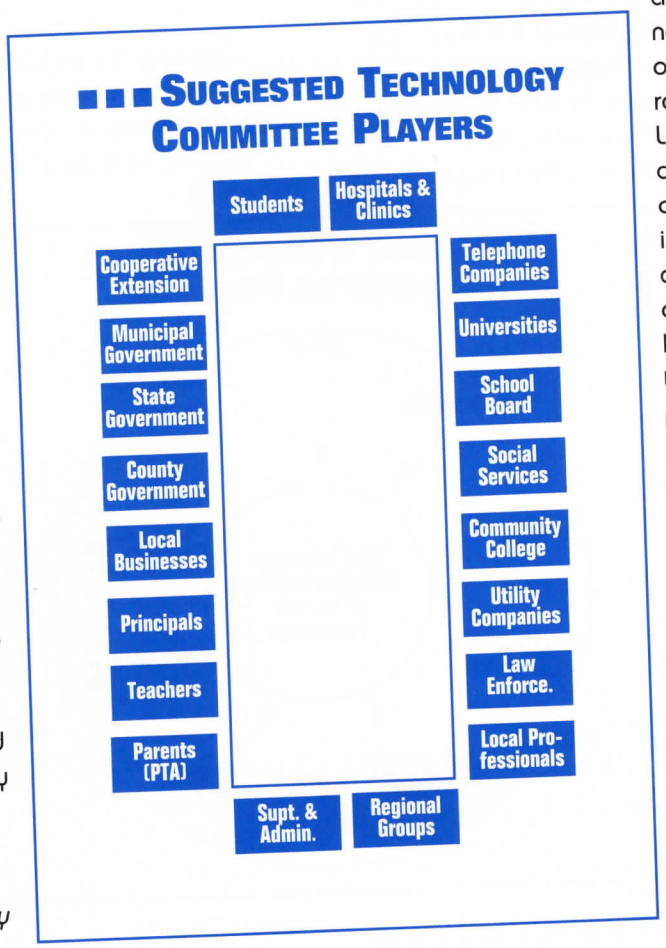
Mission

A clear statement of the purpose for the incorporation of technology planning is essential. Whether through the efforts of a few or many, a core group must begin the process by establishing a shared concept of technology use in education.

An example of a mission statement: *"Integrate technology into those facets of the educational process which will lead to the enhancement of instruction, administration, communication and collaboration with local, national and international communities. Technology will be used as a tool to shatter existing paradigms and barriers, facilitate learning in new and innovative environments, and enable everyone to learn from and about the world around them."*

Technology Committee

By sharing its vision and proposed objectives with others in the community, a core group can create grassroots support from teachers, administrators, parents, businesses, local governments, community colleges, chambers of commerce, state-level agencies, and regional and national organizations and representatives. Limitations on the degree of collaboration and involvement are dependent upon one's willingness to look beyond the traditional school players. Participation from as many facets of the school, community, state and region will greatly determine the success of the entire effort.



Involvement does not require serving on a central committee. Related committees, such as those looking at research on success stories in other schools; cabling and networking; end-user applications; administration or instructional management; training and staff development; technical support; or simply resources for information and guidance can be established within given areas of interest or expertise. Empower teachers by using their expertise to make selections in areas such as applications and student management. This will lend greater support and momentum to the initial efforts.

A fundamental component of the technology committee must be leadership from the schools

(principals, teachers, the superintendent, and school board), business community, PTA, and local and state government. Such leadership advances fundamental support, increases access to essential resources, and improves the potential for partnerships and collaborative efforts. Solid leadership within the school and community is critical to success.

■ Goals & Objectives

First and foremost, it is important to determine how technology can be integrated into current school-based functions such as instruction, administration and communication. Research on possible solutions to these tasks might furnish the best information to guide decisions. Be careful to avoid the hammer/nail mentality: when adept at using a hammer, everything tends to look like a nail. From a cost and practicality standpoint, technology may not provide the best solution. Goals and objectives should focus on education or administrative outcomes that are both realistic and achievable as well as far-reaching and ambitious. Set early goals that are easily attained and others that will require more time and effort. Identifying a need and the complementary role for technology will facilitate the integration of technology and education. Strategies adopted to achieve goals and objectives might result in:

- Establishing a system-wide technology committee, drawing upon individual schools, parents, businesses, community colleges, universities, as well as other local resources.
- Identifying individual school technology teams as well as teams relating to possible areas of technology use within the school system (instruction, administration, library, transportation, food services, etc).
- Conducting research and gathering information for areas of use through local, state, regional and national clearinghouses or technology-related sources.
- Establishing an infrastructure design that will ensure communication and data sharing within the school system as well as beyond.
- Reaching a consensus on specific uses of technology to enhance student learning, efficiency and the effectiveness of teachers and administrators.
- Evaluating the use of existing technology to meet present needs before purchasing new equipment.
- Prioritizing implementation based upon need and degree of utilization.
- Establishing training and support based upon the amount and degree of technology usage and needs.
- Soliciting funding from a number of sources (state, local, national, foundations, etc).
- Establishing a continuous evaluation process.

Through technology...

an anxious sixth grader will be able to go to the television and log onto the school's network to view his teacher's comments on the report he gave that afternoon.

In this era of site-based management and growing access to and sharing of information, it is essential to incorporate standards that are fair, just and ethical. When purchasing new equipment, establish a set of agreed-upon criteria which will guide technology purchasing priorities. Factors such as compatibility (both systems and platforms), equity and utilization should be given serious consideration.

It is necessary to separate price tags from goals and objectives. The inclusion of funding at this stage often leads to short cuts that result in even greater fiscal needs in the future. Opportunity costs (i.e. the forgone opportunities resulting from making one decision versus another) should also be a guiding principle in these decisions.

■■■ Area of use

Distinguish between different areas of technology use such as instructional, administrative, transportation, food services, etcetera. The goals and objectives for each may vary and should be grouped separately, clarifying the purpose and attainment level. One should also strive to demonstrate the potential relatedness of the technology uses.

■ Equipment Needs Assessment

An assessment of existing technology is vital to moving forward. The fast pace of technological change makes obtaining state of the art a somewhat elusive goal considering that most technology is often outdated by the time it is installed. Nevertheless, that should not preclude attempting to acquire needed equipment. In addition, remember that even computers over eight years old, considered dinosaurs by many, still have uses in today's classrooms. In today's world of doing more with less, an attitude of "out with the old and in with the new" has no place.

■■■ Facility needs

As schools integrate technology into classrooms and front offices, they must be aware of hidden costs aside from the purchase of the hardware and software. Sharing information and communicating by establishing a technology infrastructure may require addressing facility issues such as asbestos removal or containment, voltage requirements to meet electrical needs, laying wire and possibly conduits, providing security, and installing or upgrading air conditioning to meet the needs of the technology as well as handle the thermal output (heat) generated by the technology. Each school's needs will vary depending upon the age of the facility, technology applications, location, the amount of technology, and plans for future needs.

■■■ Implementation Strategy & Schedule

This area requires perhaps the most attention to detail and hard work. Once goals and objectives have been established, "how to get there" is the next issue to be explored. At this stage, known best practices that have led to successful utilization should be examined. Starting with an end-user application such as electronic mail often leads to an increased acceptance of technology. It provides teachers and administrators with an easy application that helps them immediately recognize technology's usefulness. Measures should also be taken to provide the needed resources for those at varying levels of technology familiarity.

Incorporate as many of the faculty in this phase of the process as possible. Having a sense of ownership and inclusion provides needed support when adjusting to change. Recognize that the process will take time. Start with something easily attainable and progress from there. Accept that since people cannot foresee all possibilities, their efforts and products will not be entirely predictable.

Establish a plan that insures the ability to adjust when necessary. Just as this model is only a guide for establishing a technology plan, an individual plan should be flexible and able to adapt to changes down the road.

■■■ Prioritizing

Prioritizing means deciding who gets technology and in what order. Designing a multi-tiered implementation strategy can be very helpful. During the beginning phases, possibly the best strategy is to distribute new equipment to educational teams consisting of teachers and administrators involved in the core planning group. Their proven interest in technology can lead to rapid utilization and integration of technology, and they will quickly advance to formal or informal Technology Master Teachers. Those not included in the first implementation wave should be up-dated and involved as much as possible.

Lending support to technology pioneers creates an environment conducive to innovation and allows those individuals to alter the nature of the traditional classroom through the use of technology. Support can mean arranging additional time for training or experimentation, providing ready access to hardware and software, and/or allowing for opportunities to visit other schools or technology-related conferences.

■■■ Time Frame

A multi-tiered strategy helps establish realistic benchmarks for the implementation and incorporation of technology over time. Six months to a year is a reasonable time frame for the planning process itself. Provide time for

experimentation and do not expect full implementation overnight. Although the time frame sets certain phases for technology implementation, like the overall plan, it must be readily adaptable when other factors, such as limited funding, interfere.

Training & Staff Development

Teachers and administrators need to be informed about the applications and use of technology for instruction and administration. If we have learned anything from the past, it is that there is much more to technology than the initial purchase of the hardware and software. End-users must receive constant training.

- Before training, it is essential to communicate the uses and potential benefits of technology. Teachers, administrators, students, parents and businesses should see a direct use for the technology and how it will help. Equally important is establishing the technology training needs of the individual. It is a waste of time and funds to require someone to take unnecessary training.
- Either make initial training mandatory or allow the user to demonstrate a sufficient level of proficiency before he or she receives the technology.
- Identify lead technology teachers or administrators who have expressed an early enthusiasm for the technology. If dollars are limited, train these individuals first. Use them as coaches to provide first-level troubleshooting and informal support and mentoring for others. These individuals should be encouraged, supported and compensated, if possible, for their efforts.
- Training must be viewed as an on-going expense. Refresher and continual training is just as important as the initial training. Any introduction of hardware, software or upgrades should also be accompanied by training.
- On-site in-service training is perhaps the optimum situation for any organization. Technology will be integrated into the daily routines of end-users if they are provided with the time to train, experiment and become familiar with the technology and its applications. Technology may also provide teachers or administrators with additional time and resources not only for training but for other needs as well. In most cases, users will experience what is termed the "J-effect" – the tendency for productivity to dip with the initial implementation of new technology, then recover and, finally, soar.
- During the training process, focus upon communicating the benefits, mandating initial training, providing support from peers with visible leadership, involving people to address concerns, rewarding effort, and emphasizing commitment to teamwork and technology. Perhaps the greatest challenge is sustaining enthusiasm through frustrating delays caused by budgeting and scheduling.

Through technology...

via fiber-optic distance learning a child from the coast will participate in a project that compares marine life in the rivers and lakes of North Carolina.

Technical Support

Regardless of the quantity or quality of equipment and training, technology that does not run is useless. Overloading the workload of an existing position, such as the SIMS coordinator or media specialist, without understanding the crucial role technical support plays is a prescription for failure.

Technical support includes two areas: user troubleshooting and maintenance/repair. Troubleshooting is problem-focused intervention designed to identify the obvious cause of the trouble and help a user complete the task at hand. It often focuses on software and "hand-holding" for nervous users. Maintenance and repair focus on fixing root causes to build longer term equipment fitness for duty. It is usually not done in real-time and is independent of the task at hand – even

urgent problems cannot always be solved immediately.

The most effective technical support structure is closely tied to establishing a hierarchy within the system. The first level involves one individual on-site to whom someone would go with any problem. This individual can be a lead peer who has the experience and training to either answer the question, solve the dilemma or make the best assessment of what to do next.

The second level includes a group of individuals who may be accessed via phone or beeper and provide troubleshooting and repairs. These would include fundamental technology repairs, such as replacing a hard drive or a power supply, and troubleshooting and diagnosing more complex problems.

The third level involves an advanced level of support, often provided by a vendor. In most cases, only large organizations retain staff with this level of expertise.

Many schools, systems and businesses have found that agreeing upon a certain platform and hardware standard cuts down on the need for technical support down the road. Establishing infrastructures is another area where the more up-front planning there is the less problems there will be down the road.

■ Budget & Funding

Available funds should be directed toward meeting the implementation strategies of the technology plan. Alternative funding sources should be pursued. Priorities based on degree and amount of use, access and need should be utilized for the allocation of available funds.

Continuous funding is fundamental to the successful use of technology. Technology is no different than other pieces of equipment, such as school buses. It breaks down, needs to be repaired, upgraded, and eventually, replaced. Since doing more with less is imperative, do not restrict funding to one or two sources. There are many less apparent funding resources available to schools including foundations, state and national grants, and local community resources.

Another issue is expanding the definition of technology. Technology costs mean more than computers and software. They include telephone lines and usage charges; construction of buildings and system-wide infrastructures; and retrofitting older buildings to handle cabling and electrical needs.

■ Evaluation

All technology plans require continuous review, constant adjustment and sometimes dramatic changes. This includes reassessing school and system needs, goals and objectives, and technology advances and capabilities. As Peter Drucker states, "long-range planning does not deal with future decisions, but with the future of present decisions."

The importance of this final signpost on the technology plan pathway should not be underestimated. Periodically evaluating the technology plan helps guarantee the plan is current and spurs the process along in a more successful and effective manner.

Obstacles & Strategies

■ Resistance to Change

Establish a core team of teachers and administrators who have bought into the process. Openly support those teachers and administrators willing to incorporate technology into their classrooms and schools.

■ Lack of Awareness

Utilize peer teaching and support to provide exposure for other teachers and administrators. Involve as many in the process as possible in a variety of ways. This helps teachers, administrators, parents and businesses buy into the process by developing a sense of ownership. Another way to build awareness is to implement a given use or technology application, such as electronic mail, that requires buy-in on the part of the end-user.

Lack of Time to Stay Informed about Technology

Work with scheduling, reallocate time and use technology itself to make time and resources available to teachers to stay current with changes. Periodicals, journals or newsletters; visits to other schools, businesses or conferences; and on-line discussions with others outside his or her immediate area through peer networking are all avenues for technology updating.

Lack of Training & Staff Development

Flexible scheduling as well as re-allocated time and money to provide teachers with knowledge about implementation and the application of technology must be available.

Lack of Funding

Even without state funding, many creative communities have found ways to build their technology foundations.

Small and large towns alike have many of the same resources. Most have small or large local businesses, pharmacies, restaurants, veterinarians, physicians, attorneys, some type of local city or county government office, agricultural extension services, and law enforcement. Most of these organizations utilize technology in some form. They are all potential resources for meeting some of the schools systems' technology needs, such as technical support, training and donations.

Needed help can be acquired through collaboration with groups such as local community colleges and law enforcement agencies, foundations, grants, the federal government and regional organizations.

Lack of Access

Technology needs to be readily available to the end-user before he or she will buy into its use. A major difference in usage will result when there is a computer on one's desk versus having to walk down the hall to a computer lab. Allowing teachers and administrators to take computers home not only improves individual access and usage but reduces problems of security.

Questions to Ask About Your Plan

- Is it flexible?
- Does it take into consideration the use of existing hardware, software, building needs and other resources?
- Is it fair and equitable?
- Does it have a realistic time frame?
- Is it adaptable?
- Is there a clear pathway of progression?
- Does it provide for open and shared information?
- Has anyone been left out of the process?
- Is there a connection between the use of information technology and school and community strategies, policies and education goals?
- Are mechanisms to measure a plan's success reliable and relevant?
- Is there a built-in mechanism for feedback?
- Does it address state accountability requirements?
- Does it address all possible areas of use (instructional, administrative, transportation, etc.)?
- Does it consider the possibility for future needs/changes?
- Is it understandable?
- Does it offer an explanation of terms, wording, etc. that will enable the reader to comprehend the entire plan?
- Is it both short-term and long-term?
- Is there a built in mechanism for feedback?
- Is it people-focused? Does it address the needs of the learner?

BEST PRACTICES

A Special Thanks to Northern Telecom...

In addition to Northern Telecom's financial and in-kind staff support, the services of 95/5 Inc., a consulting firm specializing in technology and productivity studies, were made available for the Best Practices portion of this study.

Benchmarking Report and Recommendations Compiled by:

Robert VanKirk
The Public School Forum of NC

Debbie Morris
Northern Telecom

Dennis Melton
95/5 Inc.

Building the FOUNDATION

Harnessing Technology for North Carolina Schools & Communities

INTRODUCTION
Best Practices

"Realize that users are innovative. You can never fully anticipate how they will use technology; therefore, your training and support must be flexible and as close to the end-user as possible."

The implementation of information technology is no minor undertaking. The process of planning, establishing an infrastructure, purchasing hardware and software, and providing the necessary training and support is filled with potential pitfalls and stumbling blocks. It is critical to learn from the mistakes and successes of those who have gone before us. Businesses, governments, and schools can offer powerful lessons about the effective and efficient utilizations of technology.

This guide on best practices for training and support is designed to serve as a resource for any organization. The nature and extent of technology training and support will determine the success or failure of a technology initiative. It is essential to understand that technology evolves rapidly. By properly training and preparing the end-users while providing the necessary support, an organization will be better suited to adapt when faced with technological innovations.

This guide demonstrates how a commitment to the spirit of cooperation among various groups is not only wise, but essential. It also demonstrates the valuable insight organizations, both public and private, can gain through communication and collaboration, leading to improvements in organizational efficiency and productivity through the informed use of technology.

EXECUTIVE SUMMARY
Best Practices

"By the year 2000, being at home with computer technology will be a prerequisite not only for opportunities in the work place but for full participation as a citizen." *Arthur G. Wirth*

■ Benchmark Organizations

The search for best practices led to interviews with four school systems outside North Carolina; one system and one school inside North Carolina; six businesses ranging from local to global in scope; and five non-educational government entities.

■ Focus

Instructional and non-instructional uses of technology; technology platform; network planning, oversight, and purchasing procedures; training and support strategies were among the areas examined.

■ Key Findings

■■■ Planning

- Involve end-users from the outset.
- Keep a tight focus on primary applications and outcomes.
- Variations of central versus site control work equally well.
- Technology committees work best in decentralized environments.
- Hardware is only 20-50% of the total cost.

■■■ Implementation

- Expect resistance.
- Utilize early adopters as "lead implementers".
- Senior leaders must use technology visibly.
- Start simple: One process or application.
- Combine coaching with mandate for use.

■■■ Training

- Mandate training; budget along with hardware and software purchase.
- Combine in-house and external training. A lead peer often teaches basics for extra pay (summer classes two days to two weeks long or after-school on-site during term). Vendors teach special/advanced applications (on- and off-site models can be found).
- Future training possibilities: Delivery via network to desktop.

■■■ Support

- Standardize hardware and applications.
- Target critical users first, usually administrative.
- Repair & Maintenance: Most have some parts for change out and/or backups; start computer/telecom repair classes; let students do limited repairs.

BEST PRACTICES for Training & Support

Benchmarking the Best

...In Education, Government & Business

To identify best practices in computing and network training and support for education, the Study Group selected four noted school systems outside North Carolina. One county system and one elementary school from within North Carolina were also identified as potential sources of best practices in the use of information technology.

The Study Group identified six leading business firms, ranging in scope from local/regional companies to global manufacturers and service providers.

Five government agencies ranging from state to county and municipal levels from within the state were also interviewed for best practices.

Interviewing

Phone or personal interviews were conducted with each organization's leaders in the field of information technology. A standard set of questions was used. Schools were asked in more detail about the scope and uses of their technology.

Use of Technology

"Include people at the lowest level, and they will tell us what they need. We can then pick the best solutions."

The wide variety of uses for information technology by benchmarked organizations illustrates a point emphasized by a senior manager for training and recruitment: "Realize that users are innovative. You can never fully anticipate how they will use technology; therefore, your training and support must be flexible and as close to the end-user as possible."

Increased Productivity & Effectiveness

There is ample evidence from the benchmarked organizations that information and communication technology can dramatically increase productivity and effectiveness.

- BUSINESS: Increased production 38% while decreasing labor by 25%. A $3.5 million investment was paid back in 5.2 months.
- BUSINESS: 20,000 people re-enrolled in benefits program themselves using computers; less than 200 needed human help.
- GOVERNMENT: A 92,000-line report that once took 50 hours, now takes 10 hours. Printer cut check turn-around time from 10 days to one-half day.
- GOVERNMENT: Five years ago, staff handled five letters per legislator per day; they can now handle hundreds.

- BUSINESS: Attorneys look up case references from CD ROM and import into briefs instead of sending paralegals to do library research; untold hours are saved.
- SCHOOLS: Easier to handle messages from and communication to parents; able to treat each child individually and improve the quality of progress reports; makes sharing of curriculum updates easier.

The "J-Effect"

One word of caution accompanies such results. Several organizations reported the "J-effect" – the tendency for productivity to dip with the initial implementation of new technology, then recover and later, soar.

Role Redefinition

Many organizations, especially schools, pointed out the effect of technology on traditional roles. In many ways, people performed much of the same work but with a broader focus. Technology also turned skill requirements upside down; tasks which once required brawn now require judgment and analysis, creating new opportunities.

- SCHOOL: Secretary/receptionist spends less time on paperwork and interacts with students more.
- BUSINESS: CPA with technology know-how became the troubleshooter for an entire computerized saw mill system.
- BUSINESS: Feed mill operators became system controllers. Three or four people operate the entire mill from terminals. This had a leveling effect on the work place – less emphasis on hierarchy and more on teamwork.
- BUSINESS: Emphasis in their technical recruiting is now on teamwork, not technical expertise. "It's a cooperative world."
- BUSINESS: Formerly only programmers needed terminals; now they average 2.2 terminals per person (including production).
- BUSINESS: Accountability of every staff person increased dramatically. Direct communication via fax and e-mail between attorneys and any staff member.

Planning & Implementation

"Pick out one thing and do it well. Focus all efforts toward the success of the initial application."

Benchmarked organizations were asked a variety of questions about their initial planning and implementation for the technology. In two businesses, however, technology has been such an integral part of the organization for so long that information about initial implementation was unavailable. In one other, benchmarking was conducted only on the Human Resources Information Center.

Distinction of Instruction vs. Administration

Schools distinguish between instructional uses of technology and non-instructional or administrative uses. One school carries this to the point of completely separating the instructional network from the administrative network; an extreme and admittedly inefficient set up. (The school administrator must gain access to the Internet by going through the library system, which is technically instructional and thus outside of his/her control.) This distinction is even emphasized by systems which utilize a single network and platform for both.

Combining instructional and administrative uses in a single network is the most common approach because of its cost effectiveness, even though it complicates the focus of network planning.

BEST PRACTICE

Combined Network

Lead Implementers

One school selects lead implementers from each administrative department which will be using the network and gives them responsibility for ensuring that needs are met.

Reactive Planning Common in Schools

Most organizations report a mix of previously existing and new equipment in their networks. These groups utilized "reactive planning" – creating a plan that takes into account existing equipment and applications, and evolving over time toward the desired configuration. These plans typically focus on networking, platform evolution, and standardization of hardware and software over time.

- BUSINESS: Migrating from mainframe-based terminals toward desktop workstations and LANs.
- SCHOOL: Network plan designed around built-in networking, which they already had deployed.

Advance Planning & Block Implementation More Common in Business

Businesses, and to a much lesser extent some government bodies, tended toward true advance planning and block implementation – designing a system to meet anticipated needs and then making most basic purchases over a relatively short period. For governmental bodies, this usually required a grant proposal or formal budget hearings.

- BUSINESS: HR Information Center set up based on vision of key leaders; specifically designed for task.
- GOVERNMENT: Obtained grant to place workstations on most desktops, because without daily usage users can't retain skills.
- GOVERNMENT: Applied for little-known federal program which offers leasing so that initial cost could be bypassed. Installed hardware in phases per plan.
- BUSINESS: In stages over a two-year period, went from almost no computers to computers on all desks.

■ Implementation: Different Models

The vision for deploying technology in both classrooms and workrooms often comes from one person or a very small cadre of people. When it came to implementation, organizations took differing approaches.

■■■ Program manager

Some businesses, schools and government agencies charged a program manager with planning and implementation. This person often convened task forces to involve users in planning but was given overall responsibility for the success of the implementation. In later stages, a department may have been formed around the program manager.

■■■ Staff departments

A variation on this is driving implementation through a staff department rather than a single manager. Other departments may take the initiative, but the staff provides consulting, planning and often purchasing for the new users. Some government agencies and schools follow this approach. One government agency initially convened a task force which made recommendations for implementation.

■■■ Committees or task teams

Task teams, study groups or technology-focused committees often took the lead in identifying appropriate uses of technology and planning for implementation, particularly in education. Many schools make extensive use of such groups. The composition and role of such groups vary. In one school, a 15-member technology committee works with the system administrator; the administrator manages most purchases and support. In another, a community task force studied instructional uses and proposed a plan to the Board. In yet another, the entire school technology strategy was planned by a regional committee with extensive contributions by business sponsors; ongoing direction has been provided by a technology committee made up of teachers.

BEST PRACTICE

Decentralized model best for committee.

The effectiveness of committee-based implementation appears to be related to the decentralization of planning and purchasing decisions. In one school where many decisions are made by the central staff, a technology committee was born and died three times because it had no ongoing role. They now convene a project team only when major network changes are envisioned; people with technical expertise are called upon to help choose the right solution. Committees seem to work best in areas with decentralized control of expenditures – often called "site-based management." If a technology committee is convened, be clear as to what it is to be responsible for, including how and when responsibilities will transition to a central staff or program manager.

In one school's environment, probably the best of all possible worlds, a business supplied a full-time employee to be on-site each day for a year and has continued weekly contact since. This

level of expertise has enabled the school to reach a high level of effectiveness but is probably unrealistic for most schools. However, it is not unreasonable to expect that business expertise is available in many communities. "The school found that business knows what skills are needed and can contribute expertise."

BEST PRACTICE

Utilize local business expertise.

■ Implementation Success Factors

■ ■ ■ Maintain focus on key objectives for technology – the reason you are implementing in the first place.

- BUSINESS: "You have to decide what you are: if your number one focus is customer service or being a low-cost producer of information. This decision totally changes all other decisions."
- BUSINESS: "You have to recognize technology as a tool. If it's not cutting cost or increasing effectiveness, it's not functional."
- SCHOOL: "Pick out one thing and do it well. Focus all efforts toward the success of the initial application."

■ ■ ■ Involve users in planning to the greatest extent possible. This increases the chance of acceptance.

- GOVERNMENT: "We have come to recognize that we must include people at the lowest level, and they will tell us what they need. It doesn't always yield the best technical solution, but it gives input. We can understand the needs, then we can pick the best solutions."
- GOVERNMENT: "If you don't survey end-users and get them involved in the decisions, you have tremendous resistance when you implement."

■ ■ ■ Standardize applications & hardware...

- GOVERNMENT: "The Information Highway will offer so much, but you have to be able to exchange the information." (They chose DOS/Novell platform.)
- SCHOOL: "As equipment dies we replace it with standard. We won't fix it unless it's standard." (They chose Macintosh/ AppleTalk and the Microsoft Office software suite.)

■ ■ ■ ...But ensure flexibility. Users will be the final judge of what works best and how to best use it.

- SCHOOL: "Five years ago, we had a plan that said what they could use but we've gotten away from that and tried to focus on what they want to do. There are certain things we support, and the things we don't they can purchase, but we can't support it." (They standardize on the Apple platform, but have a mixture of DOS machines in high schools.)

■ ■ ■ Leadership by example from the top is essential.

- GOVERNMENT: "I would urge support from the top; not just at a local level, but a state level."
- GOVERNMENT: "One Friday afternoon, the director sent an e-mail saying that people needed to work a full day on Friday because he looked at the parking lot and it was empty. After that, e-mail became a way of life."

■ ■ ■ Combine communicated mandates with lots of coaching to overcome inevitable resistance to change.

- SCHOOL: "One thing that helped is that the principal directed all teachers to use the narrative progress report [on computer]. It was non-negotiable."
- BUSINESS: "We've communicated well enough with our people the importance of getting there. If I see they are trying, then we will get them help until they catch on, no matter how long it takes."
- BUSINESS: "Employees learn at different speeds and in different ways. People can learn once they get over the initial fear factor."
- GOVERNMENT: "The majority of trouble calls are very low task, very high contact needs. You need to encourage people when they do well and give constant reinforcement."

■ ■ ■ Budget for training.

Budget for training, software, support and installation, not just the network or work stations.

- SCHOOL: When money is requested for hardware or software, funds for training and support are added.
- GOVERNMENT: Initial hardware purchase is 15-30% of the cost of supporting and using the system.

■ An Observation on Hardware Platforms

Participants in this study used a variety of platforms: Apple II, Apple Macintosh, IBM PC, MS DOS clones, mainframes and midrange with terminal emulation, and hybrids. The reality is that the world is hybrid, and schools typically must work with existing hardware. The rationale for choosing one platform over another varies:

- APPLE MACINTOSH: Simple, inexpensive networking built in; special applications (graphics, multimedia); already had some; popular in education.
- APPLE II: Already had some; popular in education.
- IBM-BRAND PC: Outstanding support; compatibility.
- MS DOS-COMPATIBLE PC: Inexpensive; interchangeable parts; easy to build/fix; compatibility; special business applications.
- MAINFRAME: Accommodate high volume; already in place; custom applications for large number of users[networked applications].
- HYBRID OR MIXED: Used what we had before standardization; allow users freedom to choose. One school has a deliberately mixed environment and supports both Apple and DOS-based products. Most would prefer a single platform and vary in their provision of support to non-standard hardware/software from zero to 100%.

■ Reality: Network Will Cross Platforms

The reality is that any statewide network will include a variety of equipment and each platform has passionate defenders and critics. The information world is increasingly cross-platform; technology is moving the IBM-compatible PC running Microsoft Windows closer together with the Apple Macintosh environment – particularly with the advent of the PowerPC processor jointly

developed by IBM, Apple and Motorola, and the emerging ability to run both Windows and Macintosh applications on a single machine. It would seem to make more sense to standardize or cross-platform application suites and cross-platform networking than focus on a single workstation platform.

End-user Training

"Training is a journey, not a destination."

In the area of training for end-users, one consistent recommendation and one consistent issue were noted: Training must be a requirement and finding time for training is a problem.

Before Training...

Communicate

Communication as to the reason technology is being implemented and its potential benefits is an essential predecessor to any training. Communication creates buy-in, demand and motivation from users.

- BUSINESS: Spent a great deal of time communicating in the beginning – three to four hours per week in meetings.
- SCHOOL: "Teachers have to see a direct use for the technology and how it will help."
- BUSINESS: "Because they knew of the benefits, they were happy to go to the community college [company paid] and get the training."
- BUSINESS: "We gave them the feeling that the training was not only valuable to the company, but also to them."

Assess Needs of Individuals

Before embarking on any large-scale training initiative, a needs assessment is vital to avoid costly repetition of training and gaps in knowledge.

- GOVERNMENT: Formal evaluation of needs every year; mandatory for new hires. Exempted people with skills from initial training.
- BUSINESS: Needs assessment tool and training registration put on-line; manager and employee can do real-time assessment and scheduling of training.

Make Training Mandatory

Most benchmarked organizations urged mandatory initial training before equipment and/or software is provided to a user.

- GOVERNMENT: "You can spend three hours in training up front, or you'll spend 10 hours over six months in five to 10 minute increments bailing them out, and the staff might not be there when you need them...Policy is that you have to have the training before you get to use either hardware or software. You get your password at the training."

BEST PRACTICE

Make initial training mandatory.

- SCHOOL: "Our strategy was to give every teacher access, but you get nothing until you get trained." They required users to attend an initial three-day "technical institute" in the summer (part of their in-service catalog) and commit to 10 additional hours of application training before a Mac would be installed.
- SCHOOL: Started with a 15-week, three hour/week program – teachers received a computer after completion. Have since cut back to 10 weeks; use remaining time for advanced training. Training occurs after hours on teacher's time.
- BUSINESS: Trained users in small groups; when class ended, machines were on their desks.
- GOVERNMENT: Minority viewpoint: does not mandate training because there's no need due to high acceptance – "we can't get them fast enough."

■ Who Gets Trained First?

Initial recipients of training varied based on the implementation model.

- Secretaries and administrators were first if primary goal was improving efficiency.
- Technology committee was usually first, if one existed.
- Lead implementers, lead peers or lead teachers and individuals who expressed early enthusiasm were designated as local champions by some organizations. These people received training first, then provided coaching to peers and first-level troubleshooting at each location. They attended regular system-wide meetings to share information and receive more training. This approach formalized the informal mentoring which always occurs anyway. Lead teachers were sometimes allowed to teach basic courses to others for additional pay.

BEST PRACTICE

Lead Teacher or Lead Peer

■ Who Provides Initial Training?

Initial training was usually provided by a vendor: either the vendor who provided the software and/or equipment or a third party contractor. In organizations with support staff, the staff sometimes supplemented the vendor to reduce cost. Off-site and on-site venues worked comparably overall.

■■■ Community Colleges

Two North Carolina businesses were enthusiastic users of community colleges to deliver generic training. Specific technical training on their production system is provided by the selling vendor using a "train the trainer" approach.

In this effective model, an external vendor trains organizational support staff and lead peers, who in turn train other users. Internal resources provide basic skills, while external vendors are still used to teach advanced courses or to stretch internal availability.

BEST PRACTICE

Train the trainer.

- SCHOOL: Mentor program (previously in place) expanded to add technology; mentors teach others and have stipend for increasing their own knowledge. Mentors teach in summer "technology institute."
- SCHOOL: Uses teachers and central office staff to deliver basic courses; teachers get extra pay.
- SCHOOL: "Concentrate on the risk takers. Get the teachers who want in first." In summer, master teachers lead classes while others interested in becoming qualified take turns leading the class under supervision. They pay $400 per day in summer to these master teachers for teaching in-service classes; 45 seven-hour sessions last year, 90 this year.

■ Disappointments

Two major disappointments surfaced in connection with initial training.

■■■ Training quality

First, training provided by the hardware or software vendors was sometimes disappointing in quality and cost. Third parties seemed to be well accepted.

■■■ Effectiveness

Second, initial training was not as effective as some had hoped. Most would have planned for supplementary training from the onset and not placed so much stock in a one-time event. This is perhaps due to unreasonable expectations as well.

■ Ongoing Training

The need for ongoing training was universally recognized. Planning for it and finding time for it proved difficult.

- BUSINESS: "In the past, we've pulled PC's off people's desks and had training on Saturdays."
- GOVERNMENT: "[Looking back] I would have done another course six months later [but we didn't have money]."
- SCHOOL: Time (after hours) and meeting space (they must displace students to get equipment) are issues. They can only get access one night per week.

■ What Kind is Needed?

Refresher training for users who have daily contact with the system is rarely needed. Ongoing training usually focuses on building advanced skills or on changes to the system such as upgrades. Specialized training in unique applications not standard to the network is usually referred to vendors and not paid for centrally.

■■■ Lead peers supplement training & support

The lead peer concept may reduce the need for refresher or remedial training by providing continuing reinforcement in the work place. It can also provide first-level troubleshooting. Managers also must find ways to reinforce success and build confidence on the job.

- BUSINESS: In smaller offices, secretaries help each other with macros, etc. "They take pride in being on the cutting edge."

■ BUSINESS: Used simple rewards (pins, recognition, celebrations) to support transition; also modified the work environment (dress, flexible hours, books).

■ Issues with Training

Several major issues with no clear resolution have emerged in discussing training for technology implementation.

■■■ Who pays?

Centralized payment, chargeback and direct local purchase models are all common. In site-based management, each site makes its own purchasing decisions – then sometimes must work through central purchasing functions. Each site must budget for training. In centralized models, a central budget is maintained and meted out based on the central plan. There is no clear favorite, but a combination of central budgeting and chargebacks for basic training – with local control and local choice – would seem to provide flexibility.

■■■ Should training time be paid?

A stickier problem is the issue of when to do training: during the employee's regular work hours or after hours (nights, weekends, summers).

Most private businesses offer on-site training during work hours. Off-site training, like community colleges, is sometimes taken on personal time as "personal improvement."

Most schools require in-service teacher training, taken on personal time without compensation. In contrast, one school provides three days of staff development during the year, with school closed and teachers paid. Many of the schools consider initial training an in-service requirement and usually a pre-requisite to getting equipment. Most do not compensate for this time. Ongoing training during the year is handled after hours or on workdays. This requires limiting the number of hours a teacher devotes to training, but the amount of training which can be provided is also limited by budgets. Those same schools offer mentor or master trainer programs whereby teachers can become certified to train others and earn extra money.

■ Tolerance for Slow Learners?

Businesses seem to express more tolerance for people who cannot adapt quickly to technology and had more ability and willingness to move someone into a job that was not technology-dependent if learning was extremely difficult. There was less tolerance for individuals who refused to use technology.

BEST PRACTICE

Focus needs assessment on attitude toward technology, not just knowledge.

■ BUSINESS: "We try to make it easy, but time is the problem. If they are really resistant, then we change their job description and move them out of that job. If you told us you had experience and we find that you still aren't willing to use the technology, I won't put up with it. If I see they are trying, then we get them help until they catch on, no matter how long it takes."

- GOVERNMENT: "If I had to do it differently, I might be less patient, put more pressure and try to move faster..."
- GOVERNMENT: "I was perceived as arrogant as I did the training. I used the approach, 'This is how the world is going to be, and if you don't learn, you will be left out.' I had to be arrogant, because a lot of people had already decided that they were not going to learn. This goes back to needs assessment; not just how they can use it, but understanding the attitudes and perception... and roles. Secretaries were concerned they would lose their jobs; administrators thought they were paid too much to type. When the systems were being installed, they were excited but there was resistance to overcome and some fear. People need to be motivated. Most adults are self-learners; they learn what they want to learn."

Non-participation Not an Option

Should people who remain highly resistant or refuse to be trained be dismissed? No schools or government entities cited such instances – yet – although business did. Benchmarked organizations preferred to focus less on resistance and more on communicating the benefits; mandating initial training; giving lots of support from peers and visible leadership; involving people in addressing their concerns; rewarding effort; and emphasizing commitment to teamwork and technology.

BEST PRACTICE

To overcome resistance: communicate, mandate training, lead by example, provide peer support, reward, emphasize commitment to teamwork.

Refusing to participate is usually not an option. Non-participation is not usually a problem with teachers. The more common concern is sustaining enthusiasm through frustrating delays due to budgets and scheduling.

Future Delivery Vehicles: Network-based Interactive Modules

Two businesses are exploring models for delivering both initial and refresher training interactively at the desktop. Programs would be delivered both via satellite and over fiber; both live trainers and interactive computer-based training would be incorporated. Modules could be accessed by users on their own schedule 24-hours a day. The modules would be constructed so that individuals with 15-minute blocks of time could build skills in one area. Issues include job interruptions and lower perceived value by managers.

Technical Support

"Whatever you do, get the funds for training and support."

Technical support includes two major areas: user troubleshooting and maintenance/repair. Troubleshooting is problem-focused real-time intervention designed to identify the cause of the trouble and help a user complete the task at hand. It often focuses on software and "hand-holding" for nervous users. Maintenance and repair is subsequent to troubleshooting and focuses on fixing root causes to build longer term equipment fitness for duty. It is usually not done in real-time and is independent of the task at hand – even urgent problems cannot always be solved immediately.

Three Levels of Troubleshooting

A composite look at the benchmarked organizations shows three major levels of troubleshooting support: On-site by lead peer or local technician; Helpline to central staff; and advanced vendor support.

Level One: On-site by lead peer or local technician

In businesses, this was often provided by staff professionals or contractors. In education, it usually involved either informal peer support or formalized "lead peers" who could be accessed by other users. The selection, training and role of lead peers is discussed under implementation. A few systems relied totally on district staff for troubleshooting; response times of days or weeks were common.

- GOVERNMENT: Three levels of peer support identified; if first level can't help, the second level is called. There are 12-14 peer support reps in level one; two in level two; one in level three.
- SCHOOL: Two lead teachers are identified for each school; they attend monthly meetings and are taking on more troubleshooting duties with help from the district staff.
- SCHOOL: One teacher per campus is trained as a tech support liaison. Each is paid a stipend and receives monthly training. Teachers call the campus tech support person, who can then call the hotline as needed.
- SCHOOL: Formal help provided on-site by business representative; informal peer help is common.

Level Two: Help line to central staff

This level was usually provided by district staff who are skilled in troubleshooting. Sometimes service is provided under contract by vendors. Service is accessed by phone, beeper or e-mail. Trouble calls are often logged for analysis and tracking. Typically, network problems are referred to the helpline first, not to lead peers. Helplines also address local hardware and software issues.

- SCHOOL: Four district staff members respond to troubleshooting and repair calls; they do not provide 24-hour coverage.
- SCHOOL: Two technicians staff a hotline from 7-9AM and from 3-5PM. It's intended to be a resource for the campus technical liaisons mentioned above; they can call on issues which they can't handle or on repair needs.

- GOVERNMENT: Two trainer/support technicians answer customer calls; two others do maintenance and repair.
- SCHOOL: Hardware and software support provided by a business sponsor.
- GOVERNMENT: Internal helpdesk support contacts in each office. Tried using external contracts but found they could give better help themselves.

■■■ Level Three: Advanced vendor support

All except the largest organizations referred advanced troubleshooting to vendors, often the manufacturers of the hardware or software. Most organizations used their staff as a gateway to these resources; users could not call directly, but staff members called if they could not resolve a problem themselves.

■ Issues with Peer First-line Support

- SCHOOL: "We don't want users to call Microsoft or Apple. They don't have all the information. Often, users don't just need an answer, they need consulting."
- JOB INTERRUPTIONS: Immediate access to teachers is disruptive to the classroom environment. As a result, guidelines on appropriate response times and means of access are usually necessary.
- SCHOOL: "Peer support is very important, but it does interfere with daily routines."
- SCHOOL: "If a person is in class, we don't want them disturbed. Teachers are asked to do this before and after school and during conference time."
- LACK OF TECHNICAL KNOWLEDGE: Few people have enough up-front knowledge to do meaningful troubleshooting. Training takes time, and users can't always wait.
- GOVERNMENT: "People are not necessarily giving correct information. The quick fix may not be suitable for the problem."

■ Peer Support Success Factors

Successful strategies for peer technical support:

- Provide accessible staff backup via a hotline, including direct access for users when site prime is not available.
- Clarify the site prime's role in troubleshooting.
- Provide regular, ongoing forums for learning.
- Select people who love to learn and help others.
- SCHOOL: "I distinguish between a techno-nerd and a [campus] technical support person. They must be interested in change; in helping. I can teach the [technology]."

■ Standardization

Standardization was seen by most as crucial in providing adequate technical troubleshooting and maintenance. The difficulty of standardizing hardware across a statewide network was discussed earlier; however, standardization on basic cross-platform applications will be vital. Limiting hardware support, such as stocking spares

BEST PRACTICE

Standardize software & hardware.

for only a small range of workstation models, may also be necessary.

- GOVERNMENT: "What we've learned is not to tell people what to buy. We tell them that we will help them if they buy what we suggest, but it's their money and their choice."

■■■ Donated equipment

One barrier to standardization is donated equipment, especially "grocery store programs" as cited by one school. Where possible, encourage businesses to donate money instead of equipment. PTA and other donations can usually be channeled into standardized gear.

■ Maintenance & Repair

Maintenance and repair is the other major category of technical support provided by benchmarked organizations. Most organizations provide a modest level of maintenance and repair through staff technicians. This usually consists of exchanging interchangeable parts, such as hard drives or extension cards, and sending more extensive repairs to a vendor. A smaller number rely on maintenance agreements with vendors or contractors.

■■■ Turnaround on repairs

Turnaround time standards for repairs varied greatly based on availability of resources and complexity of repair.

- GOVERNMENT: Currently has several technicians for repair. Tries to solve hard drive crash in 24 hours. More major problems take two to four days. They strongly encourage county offices to carry hardware warranty agreements so repair cost is minimal.
- GOVERNMENT: Contracts with outside firm for repair. Contract standard for downtime is less than four hours. Carry three spare machines. Very satisfied.
- GOVERNMENT: One internal technician for repairs. Standard turnaround target is one day.
- SCHOOL: Two repair technicians, Apple certified. Target is a 48-hour turnaround for hardware. No spares; they cannibalize unrepairable units for spare parts.

BEST PRACTICE

Equip high schools as repair centers.

One school district has equipped two high schools as certified computer repair centers; one for Apple, one for DOS. A third school will be certified this year as a repair center for networking equipment. Each school is outfitted with a centrally funded parts closet. One instructor got started with help from a local vendor. High school students are trained to become computer repair technicians. Items needing repair are identified by central support staff and sent to the appropriate center. Students repair the equipment and return it. A chargeback system provides funds to replenish the spare parts closet. This structure provides another "instructional use of technology" and saves money.

■ Prioritizing Service Needs

Not all service problems must be addressed immediately. These organizations had different criteria for determining which needs were answered first.

■■■ Type of work

Some users' needs were more critical because of their job responsibilities.

- SCHOOL: "Secretaries come before teachers. Without the computer, they're dead. We get to the classroom as soon as possible."

■■■ Type of failure

Prioritizing based on severity.

- GOVERNMENT: "The highest priority is a completely dead PC."
- BUSINESS: "If the problem can't be fixed, a machine will be available. Time is money."

For education, a priority matrix based first on type of work and second on severity seems most reasonable.

Uses of Technology

■ Schools: Instructional Uses

- CURRICULUM DEVELOPMENT & DISSEMINATION
  - Developmentally appropriate instruction tracking and analysis of each student
  - On-line curriculum notes; curriculum CDs; production of instructional materials
  - In-class integrated learning systems (used only for remediation in some cases)
  - School-based computer labs
  - Student access to applications for projects; multimedia production
- OFFICE AUTOMATION
  - Word processing, spreadsheet, desktop publishing applications used by teacher
- DISTANCE LEARNING
- COMMUNICATION
  - Access to the Internet for research (usually restricted to specific classes/schools)
- MOBILITY
  - Portables for use by instructors with multi-site responsibilities (music, art, special education); dial-up access to networked applications, peripherals, and e-mail.
- MEDIA ACCESS
  - Distance learning (instructor at one site teaches students at other sites); dial-up access to video; video production capability within school; video "broadcasting" within and between schools
- CLASSROOM INSTRUCTION
  - Teacher's computer can display on video monitor for entire class

■ GRADING
- Templates on-line to help educator create narrative about performance rather than simply using letter grades

■ Schools: Non-instructional Uses

■ FOOD SERVICES
- School lunch programs; lunch vouchers; inventory mgt.; tracking of student meal intake "Did Johnny eat breakfast today?"

■ ATTENDANCE
- Scanned cards; SIMS reports

■ TRANSPORTATION
- Bus routes; optimizing routes; equipment maintenance records and trending

■ PURCHASING
- PO tracking; on-line supply purchasing

■ ACCOUNTING
- Tracking of budgets (on-line or off-line); remote access to budget data

■ STUDENT LOCATOR
- Can access schedule to find out where students are located and whether they are in school

■ TRAINING
- Distance learning for teachers and administrators

■ LIBRARY
- Circulation administration; university library look-up; Internet research

■ BUILDING MAINTENANCE
- Computerized heating/cooling (administered by vendor outside school system); bidding and estimate management; vendor tracking

■ COMMUNICATION
- Voice mail: Put daily learning/assignment on mailbox for parents, private messages for teachers
- Homework hotline: Audio only or video/cablecast (live answers to questions)
- Electronic mail: E-mail into classroom for teachers (in some cases, only principal); distribution of memos; message taking and delivery; establish lists/groups around subjects' grades for faster access

■ Government Uses

■ OFFICE AUTOMATION
- Legislative bill writing and retrieval; electronic storage/retrieval of Supreme Court rulings

■ COMMUNICATION
- E-mail; file transfers; emergency information/preparedness communication; publication creation and distribution; Internet access to Federal information and research; remote dial-in for status of legislation

■ ZONING, PLANNING AND ASSESSMENTS
- Remote title searches; automated assessment

- POLICE
  - Fleet management; dispatching with better information; records; tracking prisoners in jails
- INSPECTIONS
  - Notebook computers used in field to capture records; automated filing and access
- FINANCE
  - On-line ordering of supplies/materials; billing; payroll; Medicaid, AFDC, and other payments; tax processing; automated funds transfer
- SERVICES
  - Library circulation; record keeping

Business Uses

- INFORMATION RETRIEVAL
  - Storage and retrieval of documents such as legal briefs; access to research information; providing personal data access directly to employees; instant change of market data such as lumber prices
- COMMUNICATION
  - E-Mail; voice mail; wide-area networking to share files; automatic call distribution to next available operator; communication with other offices; meeting scheduling
- TRAINING
  - Interactive desktop learning delivered by CD ROM or over network; interactive distance classroom; satellite delivery to classroom/desktop instructional support
- HUMAN RESOURCES
  - On-line employee development information; on-line training curriculum access and scheduling; tracking employee records; employee access to personal data (benefits, home address, etc.)
- PRODUCTION CONTROL
  - Automated optimizing of material utilization; linkage of market changes to production; optimized staffing of call center based on traffic; animal, farm, and machine productivity
- TRANSPORTATION/LOGISTICS
  - Optimizing trucking routes; maintenance; mapping service; tracking truck and rail car locations nationwide

INFRASTRUCTURE ISSUES

A Special Thanks...

Special thanks to the Division of School Planning Staff, State Department of Public Instruction, for their cooperation and assistance.

Building the FOUNDATION

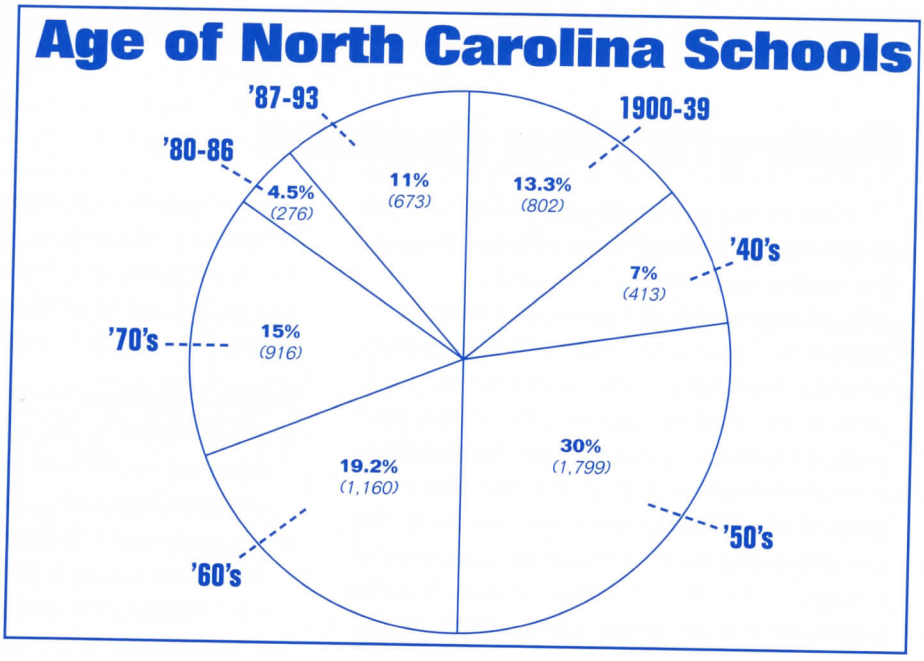
Harnessing Technology for North Carolina Schools & Communities

INFRASTRUCTURE ISSUES

Introduction

Thoughtful technology planning includes not only readily apparent issues such as technology training, support, and maintenance, but also underlying facility needs, fundamental to supporting technology. Such needs are based upon the following:

- Over 3,000 of North Carolina's 6,000 school buildings were built before 1960.
- Asbestos removal or containment needs in North Carolina schools is $45.5 million (1993 SPDI Long Range Plans).
- Air conditioning needs are $213.8 million (1993 SDPI Long Range Plans).
- The overwhelming majority of North Carolina classrooms are not equipped with telephones.



Learning from the BEP

In 1985, the North Carolina General Assembly adopted the Basic Education Program (BEP), an ambitious effort to "raise the floor" of educational resources throughout the State. It spelled out in detail the courses that must be available to every student; the length of the instructional day; promotion standards for grades three, six and eight; student services; and allotment categories and ratios for allocating resources.

One unintended consequence of the BEP was the hidden costs that soon became apparent after its inception. Lowering class sizes and expanding course offerings created 11,000 additional teaching positions, resulting in major school construction needs. To address these needs, the General Assembly subsequently passed the School Facilities Finance Act in 1987, creating two pools of money. The first dedicated a 10-year stream of revenue from the county shares of the 1983 and 1986 local option sales taxes to be distributed on a per pupil basis. The second was the creation of the Critical Needs Fund, providing construction funds for low-wealth counties, initially funded at $119 million and $10 million

per year thereafter. Though this legislation provides needed funds for school systems, current school facility needs are estimated to be in excess of five billion dollars.

■ Anticipating Hidden Costs

When considering a policy initiative, it is difficult to anticipate or identify all related consequences or costs. Many are overlooked or unforeseen. As North Carolina prepares to make a major investment in the area of instructional and administrative technology, it must anticipate related or hidden costs.

In 1992, the State Board of Education adopted new technology graduation requirements mandating that students exhibit certain proficiencies at various grade levels. By 1996 eighth graders must be able to use word processing and manipulate databases and spreadsheets. Remedial courses must be offered in high schools for those students not meeting the proficiency standards. In order to develop these proficiencies, every student should have ready access to the technology in primary, elementary, middle and high schools.

Before placing technology in classrooms, committees should first determine technology's role, where to house the technology, and how they can get it, keeping in mind that this will vary from school to school and grade-level to grade-level. The following are issues and factors affecting the direction and focus of meeting these goals.

Retrofitting Issues

Retrofitting needs will vary from school to school. Many of these issues take for granted the need to establish an information infrastructure within the school and school system. The true benefits of the North Carolina Information Highway exist in information sharing and ease of communication. There are some applications which may not require this form of information sharing. In those cases, some of the following items may not apply. The retrofitting and poor planning scenarios are not indicative of all North Carolina schools. They are presented to shed some light on issues schools and school systems may face as they integrate technology.

■ Asbestos

In 1987, the federal government enacted AHERA (Asbestos Hazard Emergency Response Act) requiring that school systems inspect and evaluate school buildings and decide whether the asbestos needs to be removed, encapsulated or enclosed. Those plans must be revisited every three years. Installing a technology infrastructure (running wires or conduits) may breach or threaten an asbestos-neutralized area. This may require running wires along walls and hallways; additional site surveys by asbestos removal groups; work to remove the asbestos; or efforts to further insure it is sealed properly. Some types of wire will require the use of conduits in walls and hallways, resulting in additional costs.

■ ■ ■ Questions to ask:

- Would installing the infrastructure breach an asbestos-neutralized environment or require asbestos removal?
- Is it more cost effective to lay conduits or wiring trays to avoid an asbestos-neutralized environment (along corridors, hallways, etc.)?

■ Electrical

The majority of North Carolina schools cannot adequately handle the electrical needs of today's technology. Due to the sensitivity of most technology, every outlet must have a true ground with filtered power (no surges or interference). Another requirement is ample outlets offering adequate power in classrooms and offices. Many schools have less than three outlets per room, do not carry adequate load capability, and are often ill-placed to serve the needs of the end-user.

Schools built in the '20's and '30's require major electrical retrofitting. For an elementary school, this could mean upwards of $300,000.

With increased use of telecommunication equipment, telephone lines must also be protected against surges and interference.

■ ■ ■ Questions to ask:

- Can the existing electrical capacity support the technology?
- Are there adequate numbers of outlets in the rooms?
- Is the technology protected from surges?

■ Climate Control

Schools must be able to offer a climate-controlled environment for the proper and adequate operation of technology. Excessive heat may result in malfunctioning equipment. It comes as no surprise that items fundamental to creating this environment – i.e. necessary air flow, humidity control, etc. – are inadequate in many schools. Complicating the issue of heat output is the addition of technology to classrooms, such as computer labs.

In 1989, the School Planning Division of the State Department of Public Instruction found that over 4,500 buildings (not limited to schools) were without air conditioning, with installation cost projections exceeding $878.8 million. The 1993 SDPI Long Range Plans project air conditioning needs to be one quarter of those in 1989, or $213.8 million.

■ ■ ■ Proper planning, communication and funding can prevent the following:

- A school in the Piedmont placed three window unit air-conditioners in each computer lab to create an environment needed to support the technology. In mid-May, the computers began to malfunction because the wall units could not sustain the necessary climate control and air circulation.
- In a new $22 million high school, the electronics control room houses the network server and a satellite dish, providing digital conversion of satellite feed to the school-wide and system-wide network. The technology requires 200 cubic feet/minute of air flow to work effectively. Only one duct providing 50 cubic feet/minute was installed. As a result, the technology often malfunctions, resulting in the school's and system's inability to down-load information, run television programs, and conduct other technology-related work in the room, such as video production and editing.

■ ■ ■ Questions to ask:

- Is the air conditioning/circulation capable of handling the technology, especially in technology-dense areas such as labs and equipment rooms?
- Is there humidity control?

■ Conduits

Conduits are tubes used to shield wire. The decision to lay conduits depends upon whether there is exposed wire or an interest in physical appearance. Again, conduits must meet future needs as well as those of today. Many schools are now using wiring trays, an alternative to conduits.

■ ■ ■ Proper planning, communication and funding can prevent the following:

- In a new $20 million high school, the school system's technology coordinator specified the need to install 1.5 inch metal conduit to accommodate the necessary type and amount of wiring. Instead, .5 inch plastic conduit was installed, resulting in the need to completely re-engineer the technology infrastructure based upon the limited type and amount of wire that could be installed. This also resulted in the need to equip every computer with a $30 filter, at a total cost exceeding $1000.

■ Wiring/Cabling

Schools/systems must decide what type of wire to use (type one through five) based upon the chosen network topology (star, ring, daisy-chain, arc-net, etc.); the physical limitations of the wire one can pull (size of conduits, drilling through walls, etc.); and the necessary band-width (amount of information that can be carried). In making these decisions, schools should consider both present and future needs. (Schools may consider laying larger conduits and higher capacity wires which will provide higher band-width and information carrying capacity for future use).

■ Telephone Lines

Many schools currently have rotary PBX systems (allowing for conference calls, multiple line-switching, call waiting, etc). These are not compatible with computer modems. Modems require clear separate lines that cannot be tapped into or accessed by other users or outside sources. Depending upon where the line is located, it may cost anywhere from $50 to $250 to install a single line. For a school of 40 teachers, only one user could access that line at a time. Providing simultaneous access for more than one teacher is recommended though it will entail larger costs. Another telephone-related cost is usage charges which may range from $25 to $45 a month per line.There are cost-effective alternatives available such as network modems with dial-in and dial-out access to a network.

■ ■ ■ Proper planning, communication and funding can prevent the following:

- The plans in a new "high tech" school called for a telephone line in every room. The telephone lines were run into the classroom communication panels for phone use only. There was not a modem jack even though telecommunication use had been discussed in the planning stages. Modem jacks had to be added to the panels at an additional cost of $4,500.
- In the same school, after the plugs were installed, teachers found that they were unable to use the lines via computer modem. The lines were installed as part of the integrated telephone system. When teachers attached modems to the jacks, they were unable to call out due to the integrated communication system. As a result, with no separate lines, they are limited to using modems before 7:30AM and after 3:30PM.
- Schools in two of North Carolina's more affluent counties that opened as recently as August 1993 are finding that they face technology retrofitting costs due to a lack of technology planning. One school lacked a separate phone line for modem use, space for the electrical equipment (placed in the office of the SIMs coordinator), and compatible computer connectors. Not a single teacher was involved in the planning and decision-making process.
- For a three-story middle school, installing telephone lines in every room meant running wires up walls and through physical structures, laying conduit, and removing asbestos, resulting in a cost of $20,000.

■ ■ ■ Questions to ask:

- Are there separate telephone lines available for modems?
- Is there a budgeted amount for an increase in monthly telephone usage charges?
- Will installation require breaching physical barriers such as fire walls, asbestos areas, etc.?

■ Space

Similar to decreasing class size or expanding course offerings, installing technology in schools brings with it additional demands on space. While adding five computers per classroom may not require more room, the addition of 10 to 20 computers to the average North Carolina classroom will require additional space as well as air conditioning, electrical capacity, and cabling. Networking the entire school will require additional space for telephone and electrical closets that accompany establishing a technology infrastructure.

■ ■ ■ Questions to ask:

- Is there space to accommodate the technology, especially labs, electrical and wiring closets, etc.?
- Is it more cost effective to retrofit an existing facility versus building a new one?

■ Power Bills

One can naturally expect an increase in power bills as a direct result of using the technology. Another power-related cost is the result of providing the climate control necessary to handle the increased thermal output (i.e. heat produced as a direct result from the technology/hardware).

■ ■ ■ Questions to ask:

- Is there a budgeted amount for an increase in monthly power usage charges?

■ Security

Technology is a significant investment. Computer chip and component theft is a rising concern for businesses, schools and governments around the world. Systems and schools should seriously consider alarm systems as well as security personnel, especially when a typical school could be equipped with more than $400,000 worth of technology in a central area.

■ ■ ■ Proper planning, communication and funding can prevent the following:

- After three burglaries, resulting in the loss of thousands of dollars worth of technology and computer equipment, a school system decided to install an alarm system and motion sensors.

■ Platforms, Connections & Network Topology

The following are issues to consider in establishing platforms and selecting network topology, all of which will directly affect costs:

- Number of users
- Type of use they require or could require (data, video, voice, etc.)
- Size of processor
- Amount of RAM memory
- Amount of storage memory (Ten years ago, 640K of memory was considered more than adequate; today common uses have increased 1,000 fold to megabytes in RAM, and gigabytes in hard drives.)
- Transmission speed requirements – how fast do you need to get information from point A to point B
- Interconnectibility – being able to connect and readily share information with other platforms, e.g. between instruction, administration, food services, library services, and transportation
- Connectors which guard against movement
- Ease in maintenance
- Availability of support
- Physical structure of school
- Number of platforms running at the school or within the system

■ ■ ■ Questions to ask:

- Do the proposed platforms enable communication and sharing of information across platforms (school with school, instruction with administration, transportation with central office, etc.)?
- Is the structure expandable to meet future needs?
- Can the infrastructure tie into outside networks and resources (local, county, state, national and international)?
- Is the infrastructure (wiring, platforms, etc.) compatible with the North Carolina Information Highway?
- Can it handle the resources and benefits the Information Highway will bring to its doors?

Retrofitting Cost Scenarios

The following scenarios are actual retrofitting expenditures of school buildings constructed before 1930, similar in age to 20% of the public school buildings in North Carolina.

Scenario I

This school was built in 1928. It has 14 classrooms and two trailers, 19 certified personnel and 290 students.

The school's principal initiated and led the retrofitting process. There was no outside funding. Today, everything is interconnected – from the classrooms and front office to the cafeteria and library.

Four individuals provide network maintenance: the principal, the SIMS coordinator, the media specialist, and the remedial teacher.

The following costs were incurred:

Fixed Costs	NONE
• ASBESTOS REMOVAL	$5,000
• ELECTRICAL *install 220 volt line*	$13,380
• CLIMATE CONTROL *20 a/c wall units 220 volt/24,000 BTU*	$21,000
• WIRING/CABLING	$432
• CONDUITS *3/4" galvanized 10-14'/rm (18 rms)*	$300
• PHONE LINE INSTALL *two lines*	$37,000
• COMPUTER LAB *includes software and hardware*	$36,000
• CLASSROOM COMPUTERS *24 computers*	$5,000
• SERVER	$4,000
• SOFTWARE *Lan Version*	
Subtotal	**$122,112**
Variable Costs	
• ANNUAL A/C BILLS *(when in use)*	$3,000
• MONTHLY PHONE BILL	$80
• MONTHLY POWER BILLS	$1,100
• ANNUAL SECURITY	$3,125
TOTAL	**$129,417**

Scenario II

This school was built in 1923. It has 40 classrooms, 43 certified personnel and 683 students and five buildings. The school system faced the need for constructing a new building at a cost of $12 million. At a savings of $10 million, the system decided to completely renovate the five buildings for $2.2 million. This included the cost of wiring, constructing a fiber backbone and installing copper wire (type one) for a total of $65,000.

There are two data and two telephone drops, and a minimum of one computer in every classroom. There are three computer labs with double air ducts and each has a minimum of four data and two phone drops.

The following costs were incurred:

Fixed Costs	$48,000
• ASBESTOS REMOVAL	$255,793
• ELECTRICAL *entire project*	$307,912
• CLIMATE CONTROL *central a/c*	$65,000
• WIRING/CABLING *conduits, 3/4" galvanized connections, platform, network*	$7,000
• PHONE LINE INSTALL	$46,400
• COMPUTER LAB *includes software and hardware*	$45,000
• CLASSROOM COMPUTERS *30 computers*	$10,000
• SERVER	$8,000
• SOFTWARE *Lan Version*	
Subtotal	**$793,105**
Variable Costs	
• MONTHLY PHONE BILL	$150
• ANNUAL SECURITY	$3,125
TOTAL	**$796,380**

APPENDICES

Information Technology Resources

■ National Organizations & Committees

- CAUSE, the Association for the Management of Information Technology in Higher Education *4840 Pearl East Circle, Suite 302 E., Boulder CO 80301-6114*
- Center for Technology in Education *Bank Street College of Education, 610 West 112th Street, New York, NY 10025*
- Council of Chief State School Officers (CCSSO) *One Massachusetts Avenue, NW, Suite 700, Washington DC 20001*
- Institute for Transferring Technology into Education (ITTE) *National School Boards Association 1680 Duke Street Alexandria, VA 22314*
- International Society for Technology in Education (ISTE) *1787 Agate Street Eugene, Oregon 97403-1923*
- National Center for Technology Planning (NCTP) *Dr. Larry Anderson, Mississippi State University, Drawer, NU, Mississippi State, MS 39762*
- National Coordinating Committee on Technology in Education and Training (NCC-TET) *PO Box 4437 Alexandria, VA 22303*
- National Information Infrastructure (NII) *National Telecommunication Information Agency, US Department of Commerce, 14th and Pennsylvania Ave., NW, Room 4898, Washington, DC 20230*
- Office of Educational Technology (OET) *400 Maryland Avenue, SW, Room 4015, Washington, DC 20202*

■ Periodicals, Journals & Newsletters

- Education Technology *Business Publishers Inc. 951 Pershing Drive, Silver Spring, MD 20910*
- Electronic Learning PO Box 3797, Boulder, CO 80322-3797
- T.H.E. Journal, Technology Horizons in Education *150 El Camino Real, Suite 112, Tustin, CA 92680*
- The Computing Teacher, ITE *1787 Agate St., Eugene, OR 97403-1923*
- The Global Village Schools Institute, Inventing Tomorrow's Schools *PO Box 22075, Alexandria, VA 22304*
- Technology and Learning *Peter Li Education Group 330 Progress Road, Dayton, OH 45449*

■ Videos

- Our Future State *Cresta Productions, Inc., sponsored by BellSouth, GTE and Sprint 780-2470 (if calling from Southern Bell territory in NC) or (704) 378-8400 (all other calls)*
- Telecommunications and School Restructuring *Video Conference, National School Boards Association ITTE. PBS Elementary/Secondary Service; 1991 NSBA Video, 1320 Graddock Place, Alexandria, VA 22314-1698*
- Vision T.E.S.T. *International Society for Technology in Education (ISTE) Vision; ISBN; 024667-96-6*

■ Commercially Developed Planning Tools

- K-12 Technology Planning Tool *EduQuest. 1992 (multimedia planning kit)*
- Lightways-Integrated Community Networks *Northern Telecom, 1-800-NORTHERN*
- Teaching Learning & Technology; A Planning Guide *Apple Computer, Inc. 1991 multimedia planning kit)*

■ Documents

- Accomplished Teachers; Integrating Computers into Classroom Practice *Karen Sheingold and Martha Hadley, New York; Center for Technology in Education, 1990*
- Adult Literacy and New Technologies - Tools for a Lifetime *US Congress, Office of Technology Assessment, OTA-SET-550*

(Washington, DC; US Government Printing Office, July 1993)

- The Distance Education Handbook; An Administrator's Guide for Rural and Remote Schools *Bruce O. Barker, America: ERIC Clearinghouse on Rural Educational and Small Schools, 1992*
- Education Reform: The Critical Role of Information Technology *Alden E. Dunham, Occasional Paper #14, Washington, DC: Institute for Educational Leadership., 1992*
- Edutrends 2010 - Restructuring, Technology, and the Future of Education *David Thornburg, ISTE, 1787 Agate Street, Eugene, Oregon*
- Images of Potential, and Images in Action *National Foundation for the Improvement of Education (NFIE) 1201 Sixteenth Street, NW, Washington, DC*
- Improving Student Performances through Learning Technologies *Council of Chief State School Officers, Policy Statement 1991. Washington, DC, CCSSO, 1992*
- The Key Elements of Effective State Planning for Educational Technology *Southern Regional Education Board, Atlanta, SREB 1993*
- Report of the Effectiveness of Microcomputers in Schools *Software Publishers Association, Washington, DC, SPA, 1990*
- Technology for America's Economic Growth, A New Direction to Build Economic Strength *William J. Clinton and Albert Gore, Jr., Washington, GPO 1993*
- Update: The Latest Technology Trends in the Schools *Technology & Learning Editors, Feb. 1993:28-32*
- Uses of Technology in Education *James Okey, David Brittain, Ted Hasselbring and George Uhlig, A Task Force Report to the BellSouth Foundation, Atlanta; BellSouth Foundation, 1991*
- Using Technology to Improve Teaching and Learning *SouthEastern Regional Vision for Education (SERVE), PO Box 5367, Greensboro, NC 27435*
- What Presidents Should Know About the Integration of Information Technologies on Campus *HEIRA, ed. Background paper for HEIR Alliance Executive Strategies Report #1, HEIRA, 1992*
- What Presidents Should Know About the Integration of Information Technologies on Campus *HEIRA, ed. Background paper for HEIR Alliance Executive Strategies Report #1, HEIRA, 1992*

Glossary

■ **Band-Width** Determines the amount of information or data a wire can carry. The wider the band-width, the greater the carrying capacity.

■ **CD-Rom** Similar to an audio CD, this five inch disc holds large amounts of information and offers full-motion video for computers.

■ **Clones** (computers) DOS-based computers which operate using similar components to IBMs.

■ **Conduit/Wiring Trays** Tubing or trays varying in size which carry computer wire.

■ **Distance Learning** The ability to provide interactive instruction through voice, data, and video transmissions.

■ **E-Mail** Electronic Mail-involves sending and receiving electronic messages using information technology.

■ **FAX** (facsimile) A machine that scans a document, converts it to code, and sends it to another machine at another location.

■ **Fiber Optics** A cluster of tiny glass fibers capable of transmitting large amounts of voice, data, and video simultaneously at record speeds.

■ **Hardware** The physical components of information technology (monitor, printer, CD-ROM, etc.)

■ **Information Highway: National** The elaborate network of inter-connected telecommunication systems throughout the nation and world.

■ **Information Highway: North Carolina (NCIH)** The combination of establishing a fiber-optic network throughout the state interfaced with hardware providing interactive two-way audio, video, and data transmission, capable of carrying immense amounts of information at record speeds.

■ **Information Technology** Hardware and software providing schools, governments and businesses with the ability to store, access, and manipulate information regionally, nationally, and internationally. Some examples include computers, fiber optics, laser discs, CD-Roms, facsimiles, modems, video cameras, etc.

■ **Interconnected Systems** Systems able to share information and communicate using a commonly defined mechanism.

■ **Local Area Networks (LANs)** A network usually confined to a physical area/region allowing users to share information and communicate (desk to desk, office to office, classroom to classroom).

■ **Laser Disc** Twelve-inch disc holding large amounts of data and video.

■ **Macros** An individualized series of commands within a software program carrying out a specific task.

■ **Mainframes** Large centrally located computers providing software and storing data.

■ **Network Topology** The physical nature of how the network is interconnected and shares information.

■ **Platform** The chosen technology structure upon which a system or network topology runs.

■ **Software** Programs running on computers which allow the user to communicate electronically and share information.

■ **Technology Retrofitting** The measures taken to physically overhaul an existing structure to foster the use of information technology.

■ **Technology Infrastructure** The hardware and software which enables a user to communicate electronically and share information.

■ **Telecommunications** The hardware and software relating the sharing of information, voice, or video via phone lines or fiber-optic cable.

■ **Vendors** Private businesses or organizations providing information technology services, ranging from consulting, hardware, software, wiring, etc.

■ **Wide Area Network(WANs)** interconnected systems established over broad areas (building to building, city to city) providing communication and information sharing.

■■■ TECHNICAL ADVISORS

MR. RANDY AUSTIN, Southern Bell of NC
MS. MARGARET BINGHAM, NC Dept. of Public Instruction
MR. IKE BUNN, Enterprise Network Services
MR. BLAIN BUTTERWORTH, IBM Corporation
MS. SHEILA DALMAT, Northern Telecom
MR. JOHN GENTRY, Southern Bell of NC
MR. L. A. JORDAN, IBM Corporation
MR. JOHN KILLEBREW, Southern Bell of NC
MR. DOUG KOONTZ, IBM Corporation
MR. ARNIE LEBOV, IBM Corporation
MR. DAL MACKIE, IBM Corporation
MR. DOC MCCULLOCH, Johnston Co. Schools
MS. CAROL PARKER, Southern Bell of NC

■■■ STUDY GROUP PRESENTERS

MR. RANDY AUSTIN, Southern Bell of NC
MS. CAROL BLANKENSHIP, Halifax Co. Schools
MR. CURTIS CLARK, NC Government Performance Audit Comm.
MS. SHEILA CORY, Chapel Hill-Carrboro Schools
DR. MARJORIE DEWERT, UNC-CH School of Education
MS. KNOX EFLIN, Orange Co. Schools
MR. ROBERT GOTWALS, Microelectronics Center of North Carolina (MCNC)
MR. JOHN KILLEBREW, Southern Bell of NC
MR. DAVID LANE, Southern Bell of NC
MR. DAL MACKIE, IBM Corporation
DR. LOIS MAKOID, Staff Dir., Human Resources, Northern Telecom
DR. GRIGGS MCKINNON, Rutherford Co. Schools
MS. DEBBIE MORRIS, Northern Telecom
MS. GAIL MORSE, Computerworld Smithsonian Education Fellow
MS. RUTH MURPHY, Durham Public Schools
MR. MITCH OWEN, NC Cooperative Extension Services, NCSU
MR. RUSSELL PRATT, Durham Technical Comm. College
DR. BRENDA ROGERS, Durham Technical Comm. College
MR. THOMAS RUNKLE, Information Resource Management Commission (IRMC)
MS. DEBBIE SERGI, Northern Telecom
MS. GERRY SOLOMON, New Hope Elementary School, Orange Co. Schools
MS. REBECCA TROUTMAN, NCACC
MS. RUBY WHITTEN, IBM Corporation
MR. STEVEN WRENN, Lee Co. Schools

■■■ BEST PRACTICES FOCUS GROUP SITES

Businesses

Federal Express, TN
IBM Corporation, NC
Jordan Lumber Company, NC
Murphy Farms, Inc., NC
Northern Telecom, NC
Poyner & Spruill, NC

Governments

NC Dept. of Human Resources
Wake Co. Government, NC
NC Cooperative Extension Services
NC General Assembly
Winston-Salem Municipal Government, NC

Schools

Rutherford Co. Schools, NC
New Hope Elementary School, Orange Co., NC
Cupertino Union School District, CA
Baltimore City Public Schools, MD
Hurst-Buless-Bedford ISC, TX
Alief School District, TX

■■■ COLLABORATION FOCUS GROUP PARTICIPANTS

MR. WALTER HILL, Asst. Co. Mgr., Wake Co. Government
MR. RUSSELL GOFF, Information Services Administrator, Wake Co. Government
MR. FARRELL HANZAKER, Assoc. Supt. of Administrative Services, Wake Co. Schools
DR. GERALD MCDOWELL, Exec. Dir. of Information Systems, Wake Co. Schools
MR. WILLIAM MCNEAL, Assoc. Supt. of Instructional Services, Wake Co. Schools
MR. JOHN RINGO, Asst. Supt., Wake Co. Schools
DR. MICHAEL WARD, Supt., Granville Co. Schools
MR. JOHN LEWIS, Co. Mgr, Granville Co.
DR. BEN F. CURRIN, Pres., Vance-Granville Comm. College

Staff

John Dornan
President & Executive Director

Jo Ann Norris
Associate Executive Director

Gladys Graves
Director, Teaching Fellows Program

Robert VanKirk
Director, Research & Public Policy

Gail Morse
Director, Technology & Partnerships

Peggy Dickerson
Business Manager

John Buxton
Coordinator, Special Projects, Teaching Fellows Program

Sherry Woodruff
Program Officer, Teaching Fellows Program

Carolyn Britt
Secretary, Teaching Fellows Program

Lucinda Casson
Research Assistant

Todd Holland
Research Assistant

Kathy Fuller
Receptionist

■ For additional copies

Additional copies can be ordered from:

Public School Forum
3739 National Drive, Suite 210
Raleigh, NC 27612

1-5 copies	**$15.00 each**
6-10 copies	**$12.00 each**
11 or more	**$10.00 each**

the FORUM

Koger Center . Cumberland Building . 3739 National Drive . Suite 210 . Raleigh . NC . 27612
TEL: (919) 781-6833 FAX: (919) 781-6527