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ABSTRACT

Technology utilization in the schools of North Carolina was the focus of a research collaboration between the Rural Economic Development Center and the Public School Forum of North Carolina. The study was broke in to two phases. The first was to design and send out an instrument to assess how much technology is utilized in North Carolina schools, what the condition of that technology is, and how much training and technical support is provided for the technology. Of 1,900 schools, 498 returned a completed survey. The second phase involved case study analyses of four counties across North Carolina, differing in size and wealth. This study of technology utilization found three broad areas of concern, each of which requires serious policy consideration. These include the need for: (1) local school systems to develop the expertise needed to make long-range plans for technology utilization; (2) the state to assess not only what type of equipment is needed for the future, but what is the condition and capacity of equipment currently in use; and (3) the state to avoid the toll which is being paid today as a result of too little training in technology use and too little ongoing technical support. (AEF)

TECHNOLOGY
IN THE SCHOOL HOUSE

A Look at the Utilization of Technology in North Carolina Schools

TECHNOLOGY IN THE SCHOOL HOUSE

A Look at the Utilization of Technology in North Carolina Schools

Research conducted by the Public School Forum of NC

As part of its mission to focus on issues that can develop the capacity of rural communities across North Carolina, the NC Rural Economic Development Center has focused on a variety of issues ranging from how rural schools are financed to this study which looks at the utilization of technology in North Carolina schools. The Public School Forum of North Carolina conducted the study. Earlier, the Forum and the Rural Center collaborated on a major study of school finance. The recommendations from that study helped lay the foundation for the General Assembly initiative which is now infusing additional funds into small and low-wealth school systems, the majority of which are located in rural North Carolina. The Rural Center and the Forum hope that the findings in this study will help policy makers and educators make wise decisions as the state moves to harness technology in such a way that young people across North Carolina can grow and learn to their capacity.

"If you think about it, teachers are the only professionals who go to work and don't have ready access to a telephone at the office."

Jerry Reedy, manager, Ameritech Services

the FORUM

RURAL CENTER

A NEW DAWNING

Technology at its best...

It's another school day at Ocracoke High but school isn't like it used to be in one of North Carolina's most geographically isolated K-12 schools. With only 12 teachers and 104 students, Ocracoke is offering a curriculum as rich as that found in schools ten times its size. How? Through the use of distance-learning technology. Long-distance learning offers over 30 different courses which may be beamed into the school each year from a studio located 1,300 miles away in San Antonio, Texas. Thanks to satellite technology, graduates of this Hyde County school are receiving courses that were only dreamed about a few years ago.

...and worst

In looking at the use of technology across the state, the study found one building that unexpectedly received 60 computers from a business which was upgrading its systems. Because the school only had room for one computer lab and ideas for using the computers weren't forthcoming, half of the computers went into storage.

The technology revolution is reaching North Carolina's schools and some of the greatest breakthroughs are happening in rural schools. That is the good news. The bad news is that the revolution is reaching only a handful of schools and is moving much slower than it must if North Carolina is going to reach that elusive goal of creating a world-class system of schools that is second to none.

Technology utilization in the schools of North Carolina was the focus of a research collaboration between the Rural Economic Development Center and the Public School Forum of North Carolina.

Nearly 500 of North Carolina's 1,900 public schools completed a comprehensive survey and the research team did additional, in-depth case studies in four NC school systems. Working closely with the effort was an advisory committee with representatives of the Rural Center, the Forum, the State Department of Public Instruction, the NC Science and Mathematics Alliance, and local school systems. The findings of the study can be categorized into good news and bad.

FIRST, THE GOOD NEWS

Thanks to a farsighted decision of the NC General Assembly, North Carolina is one of a handful of states which has created a statewide Student Information Management System (SIMS), a computerized information system that links every school building and every school system to each other and to Raleigh.

That decision put sophisticated computer equipment in every school building in the state. Better yet, it provided training to principals and support staff and it has given schools the tools needed to decrease paper work burdens and to have access to information about students that previously would have taken weeks to compile by hand.

North Carolina also gave technology a jump start in 1985 when the General Assembly appropriated $28.6 million over a three-year period specifically for the purpose of enabling schools to buy new instructional technology. That decision allowed schools across the state, rural and urban, rich and poor, to make one-time purchases of technology that led to computer labs, instructional software programs, and, in some cases, long-distance learning facilities that schools in many states are still without.

Both of those actions by the General Assembly gave the state a potential competitive edge as schools move toward an era where technology has the potential to make a revolutionary impact on schools as it already has on the work place.

THE OTHER SIDE OF THE COIN

While some locations in North Carolina can take satisfaction in knowing that they are ahead of most states in the area of harnessing technology to schools, there is, as is usually the case, another side to the story of technological advances in schools.

This study of technology utilization found three broad areas of concern, each of which requires serious policy consideration, especially as the state debates making additional funds available for technology in our public schools.

The broad areas of concern include: the need for local school systems to develop the expertise needed to make long-range plans for technology utilization; the need for

the state to assess not only what type of equipment is needed for the future but what is the condition and capacity of equipment currently in use, and; the need for the state to avoid the toll which is being paid today as a result of too little training in the use of technology, and too little on-going technical support as more technology reaches the schools.

The balance of this report will focus on those concerns. The findings are offered to policy makers and to educators who are jointly searching for ways to harness technology to the benefit of young people across North Carolina.

"It is obvious that technology needs in schools are great, but resources are almost non-existent."

DON'T PUT THE CART BEFORE THE HORSE

While North Carolina's decision in 1985 to make an investment in technology gave the state a technological advantage, the decision also found many school systems woefully ill-prepared to make thoughtful, long-range decisions about technology needs.

It is not surprising that schools in many of North Carolina's rural counties don't have local technology plans. In 1985, when the appropriation for technology was made, schools, like the private sector, were just beginning to see the potential application of technology. Only ten years ago, neither schools nor corporate America could have foreseen the dramatic and rapid advances that were to occur in the field of technology. Also, there was parental and faculty pressure to get computers into the schools, albeit, few parents or teachers at that time knew how best to harness and utilize computer technology for student learning.

For those and other reasons, much of the one-time money appropriated for technology went toward computers. And the typical decision-making process at the local school level went something like this:

1. State funds for technology were appropriated.
2. Most school systems purchased computer hardware for their schools.
3. After the hardware was ordered, educators were under the gun to order software.
4. Many of the hardware, software and application decisions were left to local buildings. Thus, early purchases frequently resulted in Apple systems here, IBM systems there, with little foresight going into compatibility issues. In most cases, it was the hardware or software vendor who essentially made the decision as to which products were purchased.
5. After the infusion of technology funding ended, the state moved into today's accountability program and the onset of report cards and accountability indicators sent educators back to the drawing board in an effort to determine how best to harness technology to new accountability standards.

The need for systematic planning became even more acute when the state, in 1985, began a multi-year implementation of the Student Information Management System (SIMS). Early on, the decision was made to go with a DOS-based operating system. That meant that in a short period of time, all principals' offices would be operating on compatible hardware and software for information management systems. Because of prior purchasing decisions, however, the mishmash of hardware purchased for classrooms could not be easily networked once the advantages of Local Area Networks (LAN) became evident.

MORE CHOICES MAKE DECISIONS HARDER

Technology at its best...

In Rutherford County, students in a science class in Chase High School watch with fascination as a computer accesses an international, computerized, research data base and searches through files that would take dozens of libraries to store. In seconds, the students hold an article about a topic they are researching in their hands. It is written in German because it appeared in a German magazine and hasn't yet been translated into English. The students, who saw a passing reference to the article in another publication, go down the hall and have a German teacher translate the article into English. In a few minutes, the students have the benefit of an article which has never been available in a US publication.

...and worst

One system bought electronic chalk boards, a technology that would allow lessons taught in one site to be sent to classes at different sites. A combination of difficulties in the implementation of the program and a change in the system's superintendent ended the experiment, and throughout the system, unused electronic chalk boards still reside in closets.

In the mid-eighties, when people talked about new technology for education, most often they were talking about computers. In 1993, when someone mentions educational technology, they might as easily be talking about long-distance learning, laser discs, new automated phone systems, graphic calculators, or networking and data access.

In the mid-eighties, the typical school system was networked only in self-contained computer lab environments. In the nineties, networking has taken on a different meaning.

In the eighties, computer technology typically was dependent on software that, by today's standards, was fairly primitive. Today, CD ROM's make even the information in an encyclopedia come to life. Modems make it possible for students in Rutherford County to access international data bases once reserved for university scholars.

Obviously, the school technology field has exploded since the mid-eighties. However, most technology decisions are still being made at the school building level and most of those decisions are being made by people familiar with only a limited portion of the technology universe.

Equally troublesome, in school systems with coordinators of technology, many are largely self-taught educators who have become versed in the instructional applications of technology, but often are not familiar with the office productivity application side of technology or with using data as a management tool for educational decision making. Conversely, in other systems, the technology coordinators know office and data systems, but are unfamiliar with instructional applications. It is difficult to find school systems with the in-house capacity to make long-range plans which harness technology in all three arenas: instruction, office systems and data management.

POLICY IMPLICATIONS

- The need for sophisticated, long-range planning is acute if the state is to make the best use of its technology dollars. The first part of that process must involve an assessment process of where systems currently are.
- If there is going to be future technology funding for schools, the needs of schools, not the purchase of technology, should drive planning. Also, needs in all areas (i.e. instruction, office systems and data management) should drive the process.
- Recognizing the state's drive to move toward site-based decision making that places final authority at the school building level, there needs to be a way to guarantee that technology plans encompass the needs of the entire system and insure the wisest long-term use of state dollars.
- Through a combination of private and public collaboration, more information about technology and its potential benefits needs to reach the school system level. Unless those involved in making the decisions have a vision about the potential application for technology in all three areas – instruction, office systems and data management – it is unlikely that technology dollars will be well spent.

A NEED TO ASSESS WHERE WE ARE TODAY

"Which is more important to most school systems – outfitting a football team or outfitting a computer lab?"

North Carolina has approximately 91,000 computers in its classrooms, one computer for every 11 students. On the face of it, that doesn't appear to be so bad. Factor in the age and use of those computers, and you have an entirely different situation. Not surprisingly, the study found that the technology in use today ranges from the sublime to the ridiculous. As has been noted, much of the technology in use was purchased in the mid-eighties when one-time state money was earmarked for technology purchases.

While equipment that is only five, six or seven years old is fine in a static environment, computers of that age are now considered "dinosaurs" in an era which has seen five generations of computers come and go in only twelve years.

A survey of software vendors found that only five to 10% of the productivity software on the market today could be run on over 77% of the computers currently in North Carolina schools. That figure becomes even more staggering for elementary schools, with a reported 86% of the computers being three years old or older. Because of the wide range in ages of computers within schools, instructional software for virtually all types and ages of computers is still on the market and in use. However, the breakthrough in computers is mirrored by the

A Closer Look at Computers in Schools

	Dinosaurs	Outdated	Compatible
Elementary	48%	38%	14%
Middle/High School			
Administration	25%	42%	34%
Science	36%	35%	28%
Math	44%	34%	21%
Social Studies	34%	32%	34%
Language Arts	32%	44%	24%

Dinosaurs: over 5 yrs old; Outdated: from 3-5 yrs old; Compatible: from 0-2 yrs old

Computers that are over five years or older have been categorized as "dinosaurs." For those familiar with computers, they would be IBM XT's and AT's, Apple IIs, IICs, and IIEs. Those categorized as "outdated" are between three and five years old (early MACs and IBM 286s). Only those purchased within the last two years are considered "compatible." Funding is the main reason so many school computers are out of date.

breakthrough in instructional software and the vast majority of computers in North Carolina schools are simply not capable of using the best instructional software now on the market.

The primary reason for schools using so many outdated computers is funding, especially for rural schools that are more reliant on state dollars for technology than are more wealthy areas. If one looks at the chart on the next page (State Technology Expenditures), it is easy to see the correlation between the age of computers and the availability of state dollars for technology.

Looking beyond computer technology, the study found another stark fact as it looked at the availability of other technology. Because of limited past funding, long-distance learning

Technology at its best...

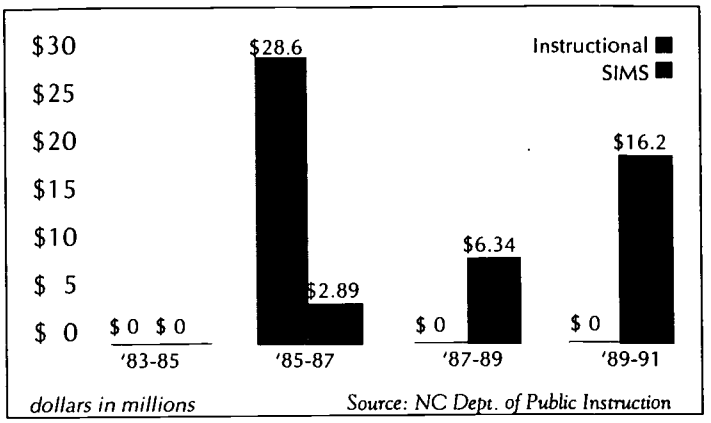
In Rutherford County, a principal is trying to isolate why too many students are missing school each year. Using North Carolina's Student Information Management System (SIMS), he does a class-by-class analysis of absentees for the last five years. In one class, a piece of data jumps off of the computer printout. For the last five years, girls have been in attendance 96% of the time while boys have only been in attendance 68% of the time. Probably without knowing it, the class's teacher is sending wrong messages to male students. Thanks to a computer, the SIMS system and asking the right questions, the principal may have found a key to one attendance problem that could be solved.

...and worst

While Ocracoke High School is offering a curriculum made richer by the classes brought to them by satellite, another high school linked to the same system is entirely under-utilizing the same technology because it has not been able to see its way clear to adjust schedules and teaching styles to take advantage of the system.

is available in only six percent of the nearly 500 buildings which responded to the study; only 18% of the buildings reported using modems which would allow them to connect directly into informational data banks; and only 14% reported accessing some type of on-line data base. With the growing array of sophisticated technology available in many school buildings, the most widely used technology remains the overhead projector. Most overhead projectors are reported to be in use over two hours per day, while long-distance learning equipment and other telecommunication's technology were found to be in use less than one hour per day.

State Technology Expenditure



The situation in poor rural counties is even worse. Computers are more scarce, and technology such as LCD pallets, modems, and CD ROM's are not even available. The case studies showed that urban counties can afford to spend a smaller share of their budget on

Reported Use of Technology in Schools

	Modem	Distance Learning	On-line Data Base	CD ROM	Network
Elementary	22%	06%	14%	29%	51%
Middle/High					
Administration	17%	N/A	29%	07%	50%
Science	19%	05%	08%	13%	44%
Math	11%	06%	14%	10%	49%

Reported Use in Schools on Warning Status*

	Modem	Distance Learning	On-line Data Base	CD ROM	Network
Elementary	11%	02%	02%	12%	37%
Middle/High					
Administration	10%	N/A	09%	02%	10%
Science	02%	07%	02%	02%	14%
Math	02%	08%	02%	08%	02%

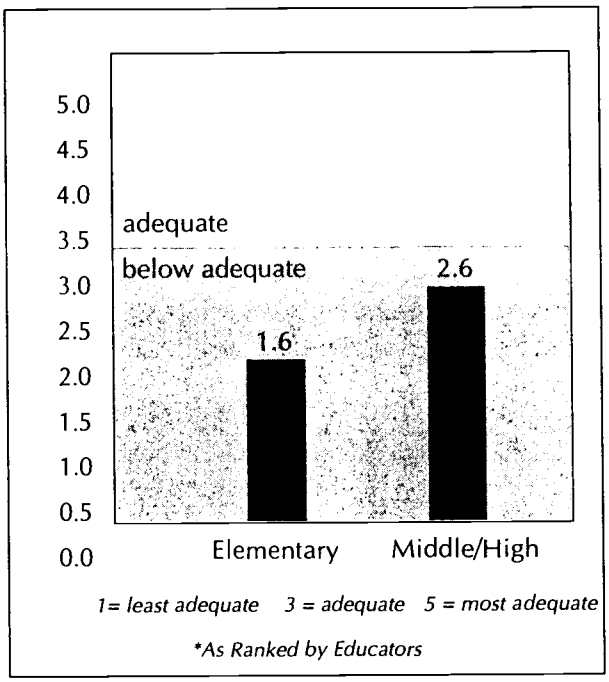
* *as set out in the state's annual report card*

technology than their rural counterparts, yet better equip their schools.

The disparity with technology in poor rural systems is even more striking when limiting the focus to those systems on warning status, as set out in the state's Annual Report Card. These are, for the most part, the low of the low-wealth counties. Most reported having little to no access or use of technology hardware or facilities such as CD ROM's, videodiscs, networks, distance learning, and on-line data bases. Further, they typically have no technology plan, provide little to no technology training, and lack any form of technical support. Any infusion of technology in these systems would essentially be starting at ground zero.

The survey showed that technology is not the only thing lacking in schools. Results showed that science lab facilities are less than adequate, and 94% of the wall maps are three years old or older.

Adequacy of Science Lab Facilities*



"Our only computer coordinator for the county spends 99% of her time on data processing for the Student Information Management System."

POLICY IMPLICATIONS

- Feast or famine funding appropriations for technology will almost certainly insure that much of the technology in use at any given time is outdated or obsolete. Additionally, large, one-time infusions of technology funds, while "jump starting" the process, also force schools into quick decisions about technology which can limit their ability to plan systems that are comprehensive and capable of adapting as technology improves.
- As schools grow more dependent on technology, funding patterns will have to take into account the need for repair and replacement just as the state does for school busses.
- As in planning, the need for information that will expand the educational definition of technology is vital. Schools not only need to harness technology, they need an information base which allows them to choose between technologies that can serve them best.

A TECHNOLOGICAL ACHILLES HEEL

Closely related to the problem of replacing outdated or obsolete equipment is being able to service and maintain the equipment which is available. While technology, especially computer technology, continues to proliferate, many systems, especially small, rural and low-wealth systems, do not have the technical support needed to adequately service the equipment available. As anyone currently in a work environment dependent upon technology knows, nothing can bring productivity to a halt faster than a system which is down, a critical machine which is broken, a new software program which is user-unfriendly. The same

productivity-killing hazards now exist in schools as technology becomes more common.

The four, on-site case studies drove home the disparities between school systems being able to adequately service the technology in use today. In a large, urban, high-wealth school, there were five people on payroll full-time to maintain and service the technology of schools. Some are based out of the central office. Others are based at the schools in order to be more accessible.

Technology at its best...

Parents at New Hope Elementary School, in Orange County are calling the school at anytime day or night to access a recorded message from their children's teachers. The message lets parents know what the day's homework assignment is and gives parents news about what is coming up this week at school. Thanks to a breakthrough in telephone equipment and a partnership with BellSouth and Northern Telecom, any parent can plug into their child's school day with the touch of a few buttons.

...and worst

In one of the state's neediest counties, students in the system's only high school shuffle in and out of a single computer lab. Only 15 of the 20 computers in the lab are working, and must accommodate classes ranging in size from 25 to over 30 students. In addition, many of those computers are at least five years old, limited to running outdated word processing, spreadsheet, and programming software. In an average size and mid-wealth county in Western North Carolina, students go through an entire computer class without even touching a computer. The system went down the previous week, and has not been restored. Unfortunately, the individual providing technical support is also responsible for the Student Information Management System for the school system, and expected to provide technical support for the system's other 20 schools.

Differences In Equipment Availability

	MODEM AVAILABILITY			LASER DISC AVAILABILITY		
	High Wealth	Low Wealth	Difference	High Wealth	Low Wealth	Difference
Elementary	59%	47%	12%	66%	34%	32%
Middle/High						
Science	53%	35%	18%	69%	45%	24%
Math	54%	32%	22%	64%	35%	29%

In smaller, poorer systems, the study found one person at the system-level, usually the SIMS coordinator, responsible for providing technical support to the entire system while wearing other "hats." Such multiple responsibilities lead to computer systems being down for days at a time.

An equally serious, but in retrospect, predictable, technological Achilles Heel is the need for continuous, intensive training of administrators, faculty members and support staff in the use of technology.

Differences In Training

	High Wealth	Low Wealth	Difference
Staff Trained	52%	32%	21%
Length of Training *in days*	3.6	2.2	1.4

High-wealth counties are defined as those counties above the state average effective property wealth while low-wealth counties are below the state average.

The study examined this training area carefully and found a serious lack of training in the area of technology. Because of the training provided by the state when it implemented the SIMS system, the percentage of administrative staff (i.e. principals, assistant principals and school secretaries) which have received training is slightly higher than that in other areas. However, with that exception, the study found that less than 20% of the high and middle school staff received training in technology.

Following up with closer questioning in the case studies, the researchers found that the lack of training was seen as a major contributor to what, at best, can be called a "spotty" harnessing of technology in most schools.

Those who have been given technology training are obviously far more likely to use technology than those who have not. Further, one-time training is not enough. To master technology, one needs time for trial and error, and time with skilled users of technology.

That is as true for classroom instructors who are expected to use increasingly sophisticated instructional software programs as it is for principals who are under the gun to provide

Applying Industry Standards to Educational Staff Development

	Industry Standards	Currently
Salary & Benefits	$2.1 billion	$6 million
% of Budget	2%	0.29%
Per School	$21,582.73	$3,083.25
Per Instructor	$700.00	$100.00

The industry standard is 2% of salary and fringe benefits for staff training and development. If schools were to follow these standards we would be putting 2.1 billion dollars into staff training. Instead, we are spending only six million dollars which equates to less than half of one percent. In other words, the amount currently being spent in our schools for training is dramatically lower than that standard.

data which can help frame instructional strategies which will help schools meet more rigorous accountability standards.

Both of these issues, technical support and training, are more of a problem in rural, low-wealth areas than they are in more urbanized areas which have access to a growing number of private computer vendors and trainers, as well as business partnerships with large local employers.

Ironically, many distance-learning facilities which have shown a decrease in instruction-related use, show an increased use of the facilities for staff development and training.

"We are starved for technology-related training and materials. There is so much out there and we have little knowledge of what it can do for us in education and even less about how to operate it."

POLICY IMPLICATIONS

- An unintended consequence of introducing technology into the school environment is the creation of three vital, on-going expenditure categories: technical support, on-going training, and replacements or upgrades.
- In the foreseeable future, a combination of the growth of technological utilization and the rapidity with which technology is changing, will intensify the need for accessible technical support and training.
- Those providing technical support and those providing training in technology will also need continuous upgrading if they are to serve the needs of schools. Additionally, they will need regular information about changes, upgrades and breakthroughs related to educational technology.
- Finally, as the state-supported SIMS system grows more sophisticated, those operating the system need to be given periodic retraining opportunities, especially as the system grows more capable of providing data which could be of use to educators at the building level.

A POSTSCRIPT

Few would disagree that the rapid technological advances which have been made and which are being made even as this report is being written could hold the key to moving North Carolina closer to the elusive goal of schools that are second to none.

Further, few, especially those that have seen technology transform the work place, would disagree that the productivity advances and application of data to decision making that could result from harnessing technology could dramatically increase the ability of schools to respond to new demands for accountability, increase educational productivity, and enhance student learning.

"We bought huge quantities of technology for the revolution, but we neglected to train the troops."

Boe (1989)

The potential gains make the technology decisions of today and tomorrow even more important.

There is much to be learned from nearly a decade's experience in the area of new school technology. Some of the more basic lessons can be summarized very simply:

- Good planning is the base upon which advances will be made. At the moment, the state of planning in schools is very under-developed.
- The field is expanding and changing so rapidly that most systems, especially small and low-wealth systems, will be hard pressed to stay current in the field and need assistance as they make and reverse long-range plans.
- Technology, like school busses, has a predictable life span and future funding needs to factor in normal maintenance and replacement.
- Feast or famine funding will limit the ability of schools to make wise decisions about technology, capitalize on future breakthroughs or build wisely for the future.
- There is great disparity between what currently is available to schools in the area of technology. While some schools are approaching "state of the art," others are barely scratching the surface. For schools, especially in rural and low-wealth areas, which are heavily dependent on state funding, their development will be even more slow without additional support.
- Finally, the most sophisticated technology will not be harnessed effectively without continuous and on-going training and technical support.

IN CONCLUSION

Technology offers endless possibilities for education in North Carolina. It can help teachers teach better, manage the classroom more effectively, accommodate different student learning styles and levels, and offer the same instruction to students, regardless of location, race, sex, or wealth.

This report is offered to policy makers and educators in the fervent hope that the state continues to be a leader in the area of educational technology. With that, the report is offered in an equally fervent hope that the state will draw on its early experiences and make decisions that will allow technology to be harnessed as wisely as possible.

METHODOLOGY

The Advisory Committee for this study was composed of personnel from schools, the State Department of Public Instruction, NC Science and Mathematics Alliance, and school research and reform organizations. It's task was to guide the study process.

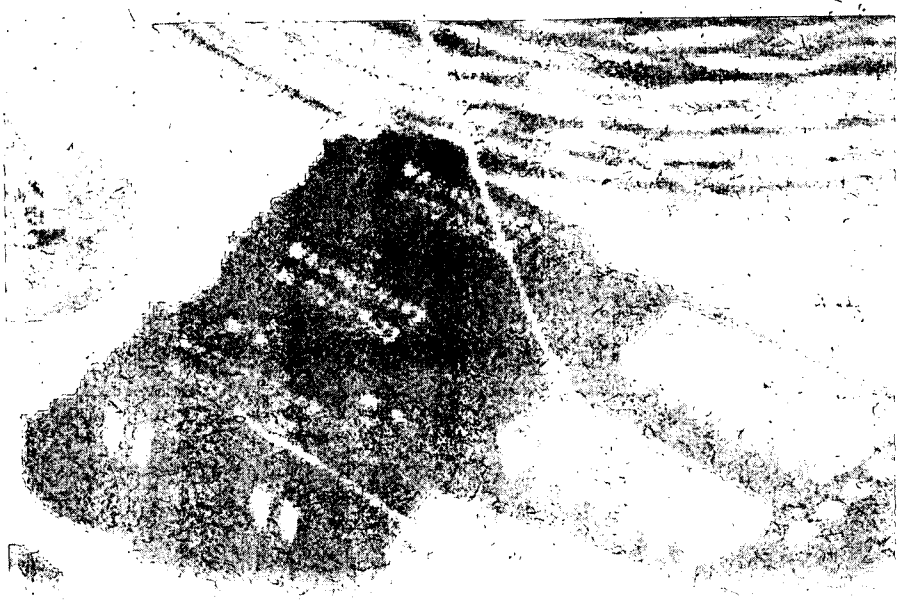
The study was broken into two separate phases. The first phase was to design and send out a survey instrument to assess how much technology is utilized in North Carolina schools, what the condition of that technology is, and how much training and technical support is provided for the technology. The second phase involved case study analyses of four counties across North Carolina, differing in size and wealth.

The Advisory Committee decided that results would be most effective using two separate survey instruments: one for elementary schools and one for middle and high schools. The middle and high school survey would also be departmental based, including a section for Administration, Science, Mathematics, Social Studies, and Language Arts.

After review by the Advisory Committee, the survey instruments were piloted in different schools. Final adjustments were made based upon the pilots' comments.

Staff drew a sample of 1,250 schools using systematic random sampling, controlling for wealth and size of the school and school system. Two mailings were made in order to achieve a high rate of return. Of the 1,250 schools, 498 returned the completed survey results, a return rate of 40%.

After preliminary analysis of the survey results, staff structured a series of questions for face to face interviews in the case study analysis phase of the study. Individuals from the local schools, central office, business community, and county office were interviewed at each location. The case studies confirmed and expanded upon survey results.



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the FORUM

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