Education Development Center, Inc.
Center for Children & Technology

National Study Tour
of District Technology Integration
Summary Report

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Introduction

School districts all over the country have been grappling with the difficult problems of integrating technologies for teaching and learning. While there is considerable anecdotal advice, the experience of districts who have successfully met these challenges has not yet been systematically analyzed. We therefore undertook national 'study tour' to examine eleven carefully selected sites around the country that have developed a range of models for integrating and using technologies well. This report summarizes the results of this national inquiry. We also provide short summaries of four of the most successful sites in an appendix. Full analyses of the factors that are key to effective use of the technologies, and experiences of the eleven individual sites are available in the complete project report.

Over the last fifteen years new technologies have been explored with enthusiasm for their contribution to innovation in education. Research has generally focused on large scale surveys about hardware and its uses, or on in-depth examination of small numbers of classrooms or schools. This work has examined the consequences of technologies for learning and factors that affect successful implementation. It has also documented problems encountered, and policies and procedures invented on the road to using technologies well.

A key conclusion from this collection of work has been that technologies almost never of themselves caused substantial change in schools. Rather, where there has been success, complex sets of factors change along with the introduction of technologies. For example, commitment to changing curriculum overall, or school scheduling, or the organization of work in classrooms have accompanied the arrival of technologies. Technologies are thus best viewed as playing key roles in solving problems to which they are well suited. Considerable time and attention needs to be given to supporting their introduction and use (e.g. coordinated and sustained staff development, and finance policies that enable long term planning and programs).

The effective use of technologies now require coordination at higher levels than single schools. The kinds of support services that are needed are often too costly for individual schools, and the design and organization of such resources is largely beyond their control (e.g. staff development, finance policies, regulations about time, curriculum, access to federal or private funding, union policies, assessment — except where schools are skilled at obtaining waivers). Information about how to address these challenges at the level of districts, and states, is now of value to many.

Technologies are a substantial part of education, yet their roles and effects continue to be defined. Two separate developments have heightened interest in recent years: the gathering commitment to substantial education reform; and, the evolution of communications technologies. First, since we believe the best route to making successful use of technologies for change is in coordination with education reform, innovation, or renewal initiatives, we were alert to this aspect of the work at sites we visited.

Second, communication technologies are now being adapted to education with the same sort of fanfare that greeted microcomputers some years earlier: the national "information superhighway". The notion of linking schools with each other, with libraries, museums, universities and other cultural resources, and with homes and community institutions has been greeted with great enthusiasm by many. Considerable effort has thus far been devoted to solving problems of access to new communications technologies by all schools, including text, audio, and visual resources. People have been experimenting with models of using these technologies within schools, within regions, nationally, and globally. The communications technologies require far greater coordination within and outside single schools than did the earlier education technologies, and they place greater demands on technical support services. But they also are showing great promise.

Study Design

Sites were selected using a variety of informants and mechanisms. We sought a portfolio of sites that represented a range of designs for using technologies well. Not surprisingly, a few sites we selected were in the group that are nationally well-known for their technology work. We also located several sites who are not well-known but doing very interesting work. And, a few of the nominated sites did not turn out to be exemplary with respect to district level technology integration. These sites tended to be larger districts where we found pockets of interesting activity but little overall coherence in technology integration for educational reform or renewal. We found that small to medium sized districts, and sub-parts of the larger districts were the more successful sites in terms of coherent experience.

We also decided to revisit three sites that had been identified and studied fifteen years ago as places on the vanguard of technology use: Dallas, Minneapolis, and Scarsdale, New York. These sites had been thoroughly studied in 1983 by a research team from Bank Street College of Education as representing different approaches to the use of technology in schooling. We went back to these sites to see how they had fared fifteen years later

Each visit lasted 2-4 days (or in some cases, shorter but repeated visits). Each site was visited by at least two people, including at least one member of CCT's senior staff. In addition to comprehensive tours of the sites with focusing on technologies, information was systematically collected through interviews with people in a variety of roles, visits to schools and classrooms, and through documents, reports, and local news stories. We were especially interested in exploring the following issues:

- What were the origins of the particular "design" for technology integration at the site; what problems was it designed to address; how and why have changes in the design happened over time?
- How did the program arise; who was involved and what kind of support was necessary, from which constituents? Is there a long term plan for the development of the program?

- What "reform" goals or activities are present? Is the use of technology directly connected to any of these goals or activities? What is innovative about it with respect to teaching, learning, or school and district management?
- How extensive and stable is the use of technology; how does it vary in different classrooms or locations throughout the site?
- What changes have taken place? What are the successes? What are the failures or significant problems? What aspects of the model appear to be promising?
- What have been, and are, the barriers to success? What future problems are anticipated?
- How has the program been financed? What is anticipated for financing in the future? What are the barriers (e.g. rewiring old schools, cost of long distance service, and so forth)?
- What professional development accompanies the uses of technology? Is this a continuing program? Is it related to professional development for other purposes?
- What kinds of technical support accompany the program? Is there a long term plan for technical support personnel, purchase, repair, and upgrading?
- Are partners who are external to the public/private school system involved, and how are these partnerships structured (e.g. commercial, private support)?
- Are there any research activities associated with the program? How is it organized and are there formative/outcome findings thus far?

Study Sites

Mendocino, California; Scott County, Kentucky; Boulder Valley, Colorado; Union City, New Jersey; Hawaii (single district); Wilmington and the state of North Carolina; Carrollton City, Georgia; Minneapolis, Minnesota; Dallas, Texas; Scarsdale, New York; (Ottawa, Canada).

Key Findings

We summarize below the key factors affecting the integration of technologies that we have synthesized from the experience of the districts. Not all factors are found in all sites, given their diversity of approaches. However, the features were found in several places, and were judged to be important considerations in understanding the sites. (See Chart, below, for overall summary).

Leadership

(1) High level, distributed & coordinated. As with other substantial education change efforts, the successful districts in our sample had strong leadership that focused on the integration of technologies *for teaching and learning,*. One or more people were in a position with the responsibility and the authority to carry out a clear vision.

Depending on the circumstances, this took the form of a "techie" superintendent, a superintendent or high level district administrator(s) who early recognized the necessity and value of technologies for key district goals; statewide planning teams that enjoyed the support of the governor or legislature; an activist school board. Whatever the specifics of the initial leadership, it was sufficiently high level that it could span the character of the technology-integration problem. We found that wherever the leadership began, it then extended in several ways:

- In time, transcending changes in superintendent, legislature, or school level leaders;
- In depth and distribution, eventually encompassing competent individuals who could sustain the integration of technologies at the classroom level;
- In coordination, articulating the various components that must work together to make and sustain the complex changes required by successful technology integration. In different sites, this included coordinating previously separated administrative and instructional offices of technology, state level planning with district level needs, community resources with school level needs.
- Leaders themselves used the technology; they incorporated it into their own work and reinforced its use.

<u>(2) Specific vision of good education</u>. Leaders are comfortable looking at technology as way of achieving the kind of education they seek. Districts used the technology to push forward their overall reform agenda. In addition, there was strong emphasis on student use as the driver behind widespread adoption. It was important that all students achieve with technology, even if all teachers did not.

In our experiences, both in and outside this study, if sites focus on large, generally top-down and separate technology initiatives, they are not successful in getting technologies well and broadly used at the classroom level. Dazzling and disconnected efforts, no matter how well financed, do not attract the needed interest, effort, and local distribution that is needed to integrate technologies deeply over the long term. Such approaches can be easily shed by practitioners, as is the fate of many innovative programs.

<u>(3) Long term & consistent course of integration</u>. In districts where technology is working well, people take the long view. Their benchmarks for progress each year have been appropriately modest, with a vision that is both ambitious and patient. They are willing to grow over the longer term, with five or even ten years as their horizon for consistent message and effort. Retrospectively, this characterizes the integration of computers; currently, it characterizes talk about the integration of telecommunications technologies. As noted above, the long view assumes, and is structured to accommodate, course corrections as experience warrants.

<u>(4) Recognize scope of the problem</u>. These districts recognized the multi-faceted nature of the challenge to integrate technologies well. That is, technology was not

seen as a separate and straightforward problem of acquisition and distribution, or if it was at the outset, leaders quickly regrouped. The problem was defined by these leaders as multipronged, including support for planning for novices, integration with other valued education efforts, creative experiments in technical support, understanding the depth and continuity of professional development needed (even if it couldn't always be provided immediately), connections with the community. The leadership had long range expectations, and plans that provided a framework for immediate actions. Based on consequences, the long range plans were modified.

Purpose

(1) Clear links between education/reform purposes and technology. Although specific purposes for technology integration differed, these districts made clear, meaningful connections between the acquisition of these tools and larger educational goals. The goals were specified in terms recognizable to teachers, parents, community locally. For example, some districts focused on the contributions technologies can make to the improvement of writing and reading (a key broad concern in those locations, and occurring repeatedly in our sample), others on the need for deep command of technology for workplace skills, others on the value of technology for connecting students to resources in the larger world, others on state-defined curriculum changes, others on special education. There was no one purpose that most effectively undergirded effective integration; what seemed essential was that the purpose(s) be broadly and seriously important within the district.

The purpose was not in name only. Clear and detailed plans about the acquisition, placement, instructional uses, and professional development followed from the definition of core goals. Districts didn't necessarily stop at achieving the initial core goals, and certainly didn't require that technology be used exclusively for these purposes, but the goals provided a meaningful framework.

(2) Emphasis on student work and student use. While framing purposes differed, districts clearly linked the technology to students and their experiences.

(3) Control of the narrative. Successful districts maintain control of the narrative about the overall significance of the investment in technology. (Thanks to Dennie Palmer Wolf for this notion). That is, at all levels of the system, people can tell a relatively coherent story about what is being done and why it is being done, with room to experiment and differ. This maintains a sense of overall direction, and also helps people to see where they might extend the design of the overall approach to new issues, problems, strategies. It allows coherent communication with the community as adjustments must be made, or conditions change

Organized Growth and Experimentation

(1) Create and learn from local testbeds. Some of the districts took a testbed approach to integration, trying things on a relatively small scale and determining their usefulness/costs for larger scale implementation in the district. Developing a capacity

for relatively small scale ‘experimentation’ has several advantages: modest investments allow for development of understanding of what actually happens in a district’s classrooms, allowing for evidence-based judgments; inventive teachers and others have a way to try out their ideas, sometimes leading the district; the district gains experience in what kind of support it takes to actually implement an innovation. Testbed experimentation is specifically linked to using technologies for improvement in teaching and learning — for example, in one case, encouraging innovation in promoting active learning.

Key to the successful use of the testbed approach however is a more-or-less systematic means to learn from the various tests that are tried out by people in the district so that what is learned can lead to refinements, and can be judged for broader use. One of the larger districts developed an iterative process of planning, research and development trials, study and revision, and then moving forward on a larger scale.

(2) Invest in lower grades and expand upward. Two of the districts developed the explicit strategy of putting their limited resources for technology integration first into the early grades, and growing upward. This has been successful because the lower grades — both the students and the innovative pedagogy — push the upper grades to meet new expectations for new tools and practices. It is also often easier to begin a substantial change in elementary or middle schools than in high schools. This strategy also appropriately focuses effort, and allows the often limited resources for technology to be concentrated. The district then has more opportunity to experience success. (This is similar to the strategy of creating new schools, where the new institution begins with one or two grades, and adds a grade a year).

Designs for Infrastructure

(1) Whole buildings or groupings. These districts have gone beyond the “pockets of innovation or excellence” approach to technologies (the isolated teacher-expert model), and have devised means to extend integration to clusters of classrooms and whole buildings. The overall vision of these districts is based on whole schools using technologies throughout instruction. While not all have achieved it district wide, physical planning and professional development are based on this view of broad distribution. They also recognize that technical support must reside in or be readily available at the building level.

(2) Roles of specialists. Personnel (computer coordinators, media specialists, district level technology experts) are focused on issues of curriculum as primary, rather than on technology separately. That is, support for instructional uses across the district transcends emphasis on technical expertise. Coordinators think first about helping teachers to make meaningful use of the technical resources in their teaching, and then focus on the technical skills required to do so. There was a trend away from technology or media specialists separated in a lab or media center, and toward working with teachers in their classrooms.

(3) Physical space: mixed models. No one design for physical placement of computers dominates across these districts. Just as they are flexible with respect to instructional uses of the technology in service of overall educational goals, they are flexible with respect to physical placement of the machines. In most places, this results in mixed models of placement, with some machines in classrooms, some in computer laboratories, and some in libraries or media centers. As they are integrating telecommunications technologies, the districts are having to again think carefully about the distribution of networking hardware/lines, since many face significant costs of retrofitting old buildings.

(4) Deep and reliable technical back-up. Because technical support is so critical to successful integration of technologies, and is becoming even more demanding with telecommunications, successful districts have figured out multiple lines of back-up. This can include training and enlistment of students, triage training for teachers or others at the building level, making district resources readily available (over the phone or network as well as in person). Technical personnel are able to handle problems from the perspective of teachers rather than the perspective of computer engineers. Multiple and reliable lines of backup that are suited to local needs and resource are needed, not a single source. Most districts employed a network engineer, at least in the roll out stages for communications technology.

(5) Small 'communities' of conversation. The accomplished districts we found tended to be small or middle sized, or sub-communities within larger districts. We believe that this reflects the need, while undergoing change, to have a connected conversation among people who are working together on different facets of a difficult problem. That is, practitioners have to be connected with each other as people, not only linked through administrative mechanisms.

With respect to the introduction of networking into these districts, two of them are paying particular attention to the development of an "innernet"/"intranet" which focuses on linking local people effectively. This strategy does not replace linking to the broader world's people and resources. It addresses a different problem: enabling more effective and frequent conversations within the district's community (in one case professionals, in another professionals and citizens) about educational issues, resources, and problems. This may be a strategy that can be adapted to aid larger districts.

(6) Most of the districts are currently on cusp of systemic networking, and that is creating new challenges for them. One of the districts we visited has networking fairly well integrated into teaching and learning, but most are in the midst of struggling with these new resources. It appears from the current efforts, and retrospective accounts of the earlier technologies, districts and schools move from first using technologies for "canned projects" or "canned instructional software", to creating their own local projects that take advantage of the resources for deep embedding in the curriculum. Professional development appears to follow this trend too.

Professional Development

(1) Substantial investment in growing human capacities. More significant changes seem to occur in places where substantial investment is shifted to building the human infrastructure, and emphasis is placed on utilization and adaptation of technologies to local purposes, rather than on access and direct or "raw" application of software.

Professional development must be specifically targeted to the learning/teaching reforms that are facilitated by technology rather than professional development for user proficiency in the mere operation of specific software and hardware. Two of the sites that had perhaps the most systematic and organized professional development in terms of number of specific technical courses offered and hours of training were getting only incremental impact from their investment. It is not training in the technology — it is training in how to leverage the technology to provide, increase, improve and/or assess student learning that is at the heart of the successful sites.

All of the successful districts have recognized the key significance of substantial and ongoing professional development that must simultaneously help teachers to integrate technologies into their teaching, and also provide them with enough technical expertise to be comfortable in exploring on their own. Professional development also helps teacher to become comfortable with the inevitable glitches that arise — knowing how to do first-level problem solving and how to get help.

The more successful districts have dealt with a number of issues in the design of their professional development: (a) the amount of *time* this takes (e.g. extended prep time, additional professional development days, reorganizing teaching load and time, experiments in telecommunications-based workshops, courses; (b) stable sources of *technical support* for teachers as they learn. They know who they can call on to help them as they try new things; (c) continuing and stable *support for curriculum integration;* (d) use of *seasoned practitioners* as trainers. Teachers who have actually tried these things in their classrooms appear to be especially popular; (e) *home access* to technology for teachers; (f) emphasizing *practical uses within framework* of an educational vision; (g) adapting training designs to *teachers' lives*.

The more successful districts have figured out how to grow local resources to accomplish this — how to draw in teachers, and in some cases, community members, to become the experts and then help their colleagues. This home-grown strategy appears to be more successful than importing specialists either permanently, or on a regular cycle. One district, for example, developed a long range technology integration strategy around identifying talented staff and community members, and carefully nurturing these individuals around the larger purpose of improving student learning. This is in contrast to use of local talent as isolated "teacher buffs", not connected to a larger and long term strategy for district-wide improvement.

(2) Recruit from and make commitment to those in community for both technical support and professional development. A strategy of growing local talent appears to characterize these districts. As noted above, this included helping teachers to learn how to become the supports for other teachers. It also includes recruiting students, parents, and members of the local community for aspects of technical support and instructional help in schools. recruit from and make commitment to those in community — rewarding and continually renewing members of the existing community who may initially bring little technical expertise to the job.

(3) Similar to leadership development rather than technical skills training.
Successful programs had explicit strategies for identifying and developing teaching staff to serve as change agents within buildings. These efforts focused on people rather than program or technical skills training. Many featured individual mentoring rather than pre-set or lock-step sessions. The professional development was closer to individual leadership training than to skill training.

This emphasis on strategies for building human infrastructure was carefully intertwined with the evolution of the physical infrastructure. The most vibrant sites had a history of building human capacity in addition to straightforward programmatic offerings. They often used words like "mentoring", "identifying and growing talent" to describe their professional development programs rather than words like "professional development hours", "summer institutes", "course descriptions". The more traditional formalized training programs are likely necessary, but they do not appear to be sufficient to explain the successful districts.

(4) Technology is a key feature in district hiring and career ladders. Technology integration into one's teaching was positioned either explicitly or implicitly as an important part of career advancement, and was also becoming increasingly important in hiring decisions for new teachers.

Community Connections

(1) Strategies for active community involvement. These districts have figured out how to communicate well with their communities about technology and its purposes (e.g. designing a bond initiative to fit into the community's values and goals. Districts paid careful attention to the circumstances, resources, and perspectives of their communities in constructing their overall approach to integrating technologies. They maintained active communications strategies with their communities about these matters over years.

(2) Technology used to attract parent and local business volunteers. Many have developed strategies to include community members in planning, technical or instructional support, raising external funds. Technology was an attractive way for some to bring local business interest and volunteers into the schools.

(3) Develop technology facilities for community use. Several districts consider it critical to make the technology resources more broadly available to community members, often by figuring out how to keep school buildings open in the evenings, on weekends and in the summers.

(4) No (or few) mixed messages. Districts provided clear and consistent signals concerning the importance, goals, and process of integrating technologies for change. The districts did not abruptly, frequently or inconsistently change course — adoption of the latest project or program without regard to an overall vision. The parts of the system from district level to student level were perceived to be more or less consistent, and in comfortable communication. Districts, however, were characterized by flexibility, by capacities to grasp, reflect on and refine their courses appropriately, but in line with a clear signal.

This links to a finance feature below, especially in larger districts. These districts generally simultaneously have a number of externally funded programs, often competing for time and attention. Serious efforts to coordinate these competing demands in designs for integrating technologies were advantageous.

Software Selection

At the time of our visits, wide area networking was just emerging in most of these districts. However, all of them had a considerable installed base of computers in the classrooms. In addition, these districts had some or all of their schools outfitted with one or more labs or resource rooms with a local area networking linking enough workstations for utilization by an entire class of students. With this hardware base, all of the districts had developed standard means for evaluating and purchasing software titles.

None of the sites expressed concern about inadequate amounts of software: they frequently cited the need for more computers or greater connectivity but availability of software was not one of the frequently expressed concerns.

(1) Emphasis on consistent and powerful suite of applications and tools. In the places where technology had been in place the longest, there was a definite bias towards using tool and productivity software over instructional packages based on specific content.

(2) Rich reservoir of accessible curriculum specific materials. Most of these sites also had rich stores of specific content software for use in particular parts of the curriculum. They made these titles easily available to teachers. Many were also noteworthy in their openness to experimentation with new things as they come along. But the overall software strategy tended to be based on tools, rather than the accumulation of bits of software for each piece of curriculum.

(3) Strategy for keeping abreast of developments. The majority used school-based resource personnel to expose teachers at the building level to new titles. These personnel had different titles — in Dallas they were teacher technologists, in Minneapolis, Union City and Scott County they were the building level media specialists/librarians. These people screened software titles, maintained inventories of packages on a loaner basis, and did both informal and formal (scheduled workshop formats) demonstrations for teachers of worthy titles.

These resource people had an annual software purchasing budget over which they often had complete control. However, in most of the districts visited, this budget was augmented by individual classroom teacher budgets for software. In some cases, these moneys were calculated on a per pupil basis or on a fixed amount per class. Depending on how the school was structured, these purchasing decisions might be made individually by teachers or by teaching cluster. These clusters ranged from grade level clusters, to multidisciplinary teams, to more traditional subject matter departments. Teachers used each other and the resource personnel to make their decisions. Only Kentucky and Ottawa had lists of approved software which limited purchase choices when using certain funds. In most cases, lists were used more in an advisory capacity.

The only exceptions to this localized purchasing was around district licenses to certain basic packages like Microsoft Works or Claris Works.

Most of the districts cited a re-allocation of funds spent at the classroom level over the last few years away from textbooks and consumables (workbooks) and into software. Because the shelf life of the software programs is long, schools that had been working on this for several years had classroom libraries and central school-based libraries that had grown to sizable collections even though the amount available in any one year was not that great.

Almost all of these sites proudly cited the phasing out, breaking up or altered use of former ILS (Integrated Learning Systems) labs which were originally funded by Title I. Some specialized labs still existed however. Carrollton was using (and expanding) a customized individual learning Algebra lab which used a self-paced programmed learning approach. Minneapolis had some schools that still use a dedicated lab that had a proprietary courseware authoring system developed at the University of Minnesota.

Overall, there were some consistencies in widely adopted specific content software titles across these districts. Where there were workstations in individual classrooms, one or more basic CD-ROM encyclopedias (Grolier's, Comptons, or Microsoft Encarta) were always part of the classroom software library. ClarisWorks was the predominant word-processing package. Printshop was another common title. Hyperstudio and to a lesser extent Powerpoint were the packages used frequently by teachers in lesson preparation and presentation. These were also packages which students were exposed to as report presentation tools (most notably in Scott County and in Mendocino). The Accelerated Reader program which promoted a literature-based independent reading program was used in some of these districts. This program supplies computer-based comprehension exams tied to many popular book titles. The program also manages the tracking of books read by individual students.

Finance

(1) Coordinated budgeting for essential components. All of the districts struggle with the difficult problem of financing technology integration — if they grasp the scope, they also grasp that costs extend far beyond purchase of hardware, to coordinated staff development, continuing technical support and up-grading policies, and equity issues.

(2) Financing options. Different districts have created different approaches to solution (although the problem continues), from special bond issues with appropriate community education, to restructuring existing budgets, to use of state-level special funds, to successful external fund raising. Since technology is not a one-time purchase, and few budgets are now large enough or adequately structured to incorporate the continuing costs of technology-enhanced schooling, financing remains a concern for all into the future.

In most cases, there was usually some outside initiative with new funding attached that allowed the initial purchases, even if the funding was only a percentage of what was eventually needed. Successful programs, in these years, had a quality of the entrepreneurial. They were alert to new ways to develop their capacity and agenda.

(3) Individual grants as coordinated building blocks. Individual grants and programs tended to be seen as building blocks for a larger plan, related to the educational vision.

Appendix

Brief summary analyses of four of the districts included in our sample are included below. These are the four districts that we recommend visiting as exemplars that represent different contexts, and varying solutions to the challenges of integrating technologies well. Expanded analyses for these and the other districts that were included in the study are available in the full report.

Scott County Kentucky School District

The Kentucky Educational Reform Act (KERA) has attracted national attention both for its commitment to fundamental change in schools and the comprehensiveness of its vision for change given that it is a state-wide mandate. Scott County is a district that has used that mandate, along with creative implementation of technology, to nurture school restructuring throughout its schools. The story found here is particularly interesting because it is unfolding in a district that is neither wealthy nor a hotbed of progressive thought. It is a largely working class community that has been a rural, agricultural based economy. It is being transformed due to the introduction of manufacturing, most notably the opening of a Toyota plant in the late 1980's.

The technology operating in the district is not exceptional (in most cases) and its utilization is not glamorous — this is not a district that presents at national conferences or that is known nationally for producing exemplary projects that deploy technology. Nor are the reforms that have been implemented exceptional or revolutionary. For the most part, they are attempts to follow both the letter and the spirit of the state-fostered restructuring agenda. However, even a short visit to this district reveals that a profound change in attitude and in practice has taken hold here and not just in a few classrooms or in a single school with an ardent leader. It is the sense that technology is norm and its use as a tool by teachers and students alike is the accepted practice, not the unusual event. The technology is not isolated and apart: it is blended into the district-wide emphasis on writing and on building student portfolios.

It is not that everyone is techno-savvy or 100% behind the educational reforms; there are plenty of teachers who are resistant to both. And like most other sites we visited, Scott County is preparing for, and anticipating, a sea change when full networking in all buildings is achieved later this year. Everyone considers what they have now to be the start, not complete in any sense. But it appears that the balance has tipped here, critical mass has been reached, and what other districts are striving for is now firmly rooted here.

The means by which this was accomplished is not a technology implementation story: it is one of savvy leadership, long-range planning around identification of individual staff (and community member) talents, and subsequent careful nurturing of those talents toward a larger purpose that has at its core student learning. Scott County demonstrates the benefits of fostering a human infrastructure around technology in the explicit service of a reform agenda.

The Context

Scott County School District serves an agricultural community that is rapidly becoming an area of scattered subdivisions and significant industry which lies about 20 miles northeast of Lexington. It is an area of horse farms and automobile plants; transient farm workers and workers on assembly lines. The district centers around Georgetown (approx. 25,000 people). The district serves approx. 5000 students in 6 elementary schools, 2 middle schools, and one high school. A new high school is just being completed.

The story of its construction is indicative of a somewhat unusual financing situation. Although the public voted down a bond issue, the local Toyota plant provided the necessary funding. Toyota was given very attractive tax abatements to locate in the area but since then has voluntarily made significant contributions to help both general school funding in Scott County and to support specific projects (such as the district school to community newspaper).

Other funding sources beyond local appropriations include the Kentucky Education Technology System (KETS) which is an adjunct to the state-wide KERA program. This program provides matching funds to school districts, along with explicit requirements in terms of annual district and building-level plans, to “deploy voice, video, and data technology in ways that will raise student achievement and increase school success”. What is somewhat unique about KETS is that it attempts, by providing both carrots and sticks, to ensure that technology deployment is really in the service of student achievement.

Key Observations

- *Grow facilitators*. Scott County has become quite sophisticated in developing the human infrastructure necessary to support technology implementation. Leslie Flanders, the district technology coordinator is a case in point. She started work in the district as a parent volunteer in one of the computer labs. This model, which is still in place today (six years later) uses volunteers from the community to help staff the labs, freeing up technology coordinators or resource teachers to work directly in the classrooms with teachers on project-based work and ensure that technology introduction is closely linked with curriculum reform. Leslie now actively selects teachers and grows them into resource experts who work directly with novice teachers. In other districts, these may be called “master teachers” but here technology is used almost as a Trojan horse to mask curriculum support and teaching practice guidance within a more (locally) acceptable framework of technology support. In this district, the growing of people is done in what appears to be an informal, personal way. It is actually well thought out and the expectations for individual development span several years. This building of the human infrastructure goes way beyond teacher training and providing workshops, to include continuing support for and guidance of individuals to assume increasing responsibilities and initiative. To a certain extent, this is a function of Leslie's personality and an outgrowth of her own long range planning for the district. But it is also an element that we have seen mirrored in the other districts that are successful at leveraging technology for school reform.

- *Focus on writing*. The district adopted a strong focus on writing and using the technology as a tool to facilitate the writing process. This is due, in part, to KERA's mandated writing portfolio assessment for all fourth graders and all sixth graders. However, Scott County had already focused its utilization of elementary computer labs around the writing process by the time of KERA's implementation.

- *Use of students.* Scott County uses students in several ways to support technology diffusion out to the teaching staff. Students are trained, first through voluntary after-school computer clubs in the elementary schools, then through a formal technology training program in the middle schools combined with a voluntary student technology leadership program after school (that receives directed state funds of $1,000 per school per year). These students begin providing classroom support for technology (fixing printers, quick network troubleshooting). By the time they reach high school, some can handle more in-depth support work, including installations, repairs and cabling. Students are also used to provide training to other students, to teachers and to administrators. In one example, students were paired with administrators, and given the explicit task of getting this person up on the Internet and using e-mail on a regular basis. While the students helped them with technology, the administrators were also mentoring the students in other ways. In other cases, students with technical facility are placed in classes where the teacher may not yet be completely comfortable with the technology and help "push the envelope".

- *Reforms in lower grades push expectations into the high school.* Scott County worked extensively with the elementary and middle school students initially. High school faculty are now experiencing increased pressure for reforms of practices because of these well-developed student skills and expectations. This strategy for reforming high schools, which historically are the most difficult to change, is a strategy that we saw many of the districts in the study consciously adopting.

- *Use of a networking engineer.* The district hired a networking engineer on staff to help design and implement the district-wide networking now underway. This helped ensure that the networking was adapted to the schools' need rather than a generic, purely technical implementation.

- *Use of motivating applications to get non-technical teachers using computers.* Programs such as a Report Card writer, Hypercard for classroom presentations, and Accelerated Reader have proven to be popular ways to get somewhat resistant teachers to begin using computers.

Mendocino Unified School District

Mendocino is the smallest, most rural district included in this study. It also is the district that is furthest along on bringing networking into all schools and classrooms. Technology here has definitely been introduced within a larger framework of ongoing reform. Despite its small size, the district's commitment to student-centered achievement is evidenced by three separate high school programs housed in separate facilities: a traditional high school; an alternative community high school; and the Academy, a newly created endeavor designed to help students focus on a purpose or core that keeps them involved in education. Several teachers in the lower school teach multigraded classes or who stay with the same group of students for two years. Project oriented curriculum abounds and students build portfolios of their work starting in the early grades. Throughout the grade levels, development of strong communication skills in writing, in oral presentations and through technologies (audio, video and hypermedia technologies such as hypercard, hyperstudio and more recently HTML) is emphasized.

There is little turnover among the teaching staff; most of the staff we talked to were veterans of 16 years or more. Even with such an experienced staff, the district's commitment to professional development, ongoing teacher development of curriculum, and preparation was exceptional. The district provides the equivalent of a day and a half per week of preparation time for teachers! The results of this investment were clear. The projects we saw underway in the classrooms were all developed locally or heavily adapted; there were few off-the-shelf packages or projects. The projects had been honed over several years of experimentation and revision. The fact that the teaching staff seemed intimately familiar with each other's work demonstrates the impact of the district's designs for high level of sharing and use of critical friends around teachers' work.

This visit was the one in which we spent the most time directly interacting with the students. The quality of their work at all grade levels indicates that something is definitely working in this district. Community support is high and despite the economic climate of California in general and state funding for education in particular, teacher moral and commitment was high. (This year was the first in five in which teachers got even cost of living raises). Several teachers told us they came here and stayed because they wanted their own children to be schooled in this district.

The Context

Mendocino is located several hours north of San Francisco directly on the Pacific coast. Seventy five teachers serve about 1,000 students in 7 schools: a main elementary school (grades 1-5); two small satellite schools in outlying areas; one middle school (grades 6,7, and 8), and one main high school (with two alternative programs housed separately). The catchment area served by the district is 450 square miles of rural agricultural and forestry-related communities. It is not a wealthy area. Many of the residents are characterized as working poor with an average per capita income of $15,808. 16.7% of the area's children classified as living below poverty level, although the average educational level for adults is significantly higher than the state average.

Large scale restructuring began in Mendocino in 1984 when the curriculum was reformulated by the teachers and administrators around active learning. As with other districts we visited that had made a commitment to restructuring before introducing technology, technology is now seen as integral part of the work of teachers and students rather than as an add-on.

This is supported by the community at large which generally agrees with the district staff's belief that mastery of both technology-related and information-acquisition skills are essential to students' future job success, and one of the few hopes for students to remain in the area after graduation or college. This is not just a nice statement taken from the district technology plan — it is tangible in every school and most classrooms we visited.

Key Observations

- *Savvy (and successful) grant writing to fund technology.* The district leveraged its early commitment to curriculum reform and project orientation into a number of grants and business partnerships. It worked with NASA and with the Autodesk Foundation. These early investments were used to build new curriculum and create internal expertise. A major source of funding was the state education department's funding for vocational and community education -ROP funds. Mendocino leveraged this program by utilizing it as a mechanism for giving every student experience with communications technologies while setting up a facility that continued to build its base with the broader community. This work has more recently been capitalized on to develop a community network, which now helps pay for Internet connectivity that was previously subsidized by NASA Ames. While the grant and business funding has been opportunistic, the individual programs are not isolated endeavors that only exist for the life of the grant — they are part of a larger vision and each serves to move the actual implementation of technology and level of resource availability further along.
- *Real experimentation focused on learning.* The product of the experimentation and awards is new ways of using technology. For instance, as part of Pac-Bell's 18 school program using ISDN-based video conferencing, Mendocino pushed the envelope beyond the typical distance learning applications. Partner classrooms are helping to jury presentations and performances by peer students. The students were learning to run the equipment, host the events, and plan its use. One classroom used it almost continuously — the videoconference monitor was like another student in their class. This joint experimentation by staff and students characterizes much of what goes on with technology. It is not just dabbling — it is experimentation, critique and revision to find out how best to use something.
- *Educational leadership.* Throughout the district, Ken Matheson, the Superintendent, was seen as the instructional leader, not as a remote administrator.

He wrote most of the grants and fostered the climate that encouraged experimentation along with high standards. People told us that they gave up more lucrative or higher status positions elsewhere to come work with Ken.

- *A sense of time*. As in many of the districts we visited, there was a long range sense of time needed for change and development. People took a long term, more realistic view. A single workshop in the summer wasn't expected to lead to dramatic change in the fall. The emphasis was not on program adoption — instead the focus was on professional growth. Individuals learning about something, trying it out, reflecting on their experience and continually honing it into something better. Teaching as craft was understood and respected.

Boulder Valley School District

Boulder Valley School District, 30 miles northwest of Denver, is spread over 583 square miles. The district serves nine communities, including four small mountain communities, and has 47 schools, 36,000 students, and approximately 1600 teaching staff. The population is quite mixed demographically, including communities that are quite affluent and "high tech", and communities that are rural, working class and poor (some houses, for example, have no plumbing). Every school in the district serves some children who receive Chapter 1/Title 1 funds. The educational and political priorities of citizens also range widely, including both very liberal and very conservative constituencies.

Boulder Valley's involvement with technology began a number of years ago, focusing first on administrative needs. Until the mid 1980's, computational capacity was relatively centralized. At that time, schools began to express dissatisfaction with access, and began to ask for more flexibility and more support. Schools wanted to undertake their own report writing, maintenance of student records and schedules and the like. A consulting firm was hired to develop a long range technology plan (1987-88), which specified a more decentralized approach, allowing schools to do much of their own work but coordinating well with the district's need to aggregate information. In 1990, the district began the development of networking technology in earnest for the decentralization of student information in support of site-based decision making. The district underwrote software adaptation to meet the district's requirements.

The plans also included getting computational and communications technologies into all schools for instructional purposes. In 1992, the district began major efforts to introduce Internet technologies for instructional needs, including extensive efforts at professional development and technical support.

Key Observations

Planning. The technology program was designed to support both decentralized decision-making in schools, and efforts to change teaching and learning in the schools. The technology program was enabled by passage of a bond (see below) that focused on getting computational and communications technologies into all schools, initially with the goal of supporting more effective writing instruction. The bond was supplemented by external funding (National Science Foundation and Annenberg/CPB) which focused on Internet technologies (Boulder Valley Internet Project), and included substantial attention to professional development of teaching staff, and ongoing technical support. Program staff paid particular attention to what they called "innernet" — they believe people's first inclination is to reach out for distant resources, but that a major value of telecommunications is enabling richer local communication between and among schools, students, families, administrators. An advisory board on "innernet" was created to help teachers within the district to talk to each other more, to create local mailing lists and discussion groups, to get local teachers to moderate special interest groups.

Leadership. The superintendents of Boulder Valley (Rich Anderson with a tenure of 24 years, succeeded by the current superintendent, Dean Damon), recognized the importance of technology, and that it needed to be well-supported by district efforts. Rich Anderson was described by district staff as a "techie", doing his own spreadsheets and the like. He required the district to focus on technology, and encouraged more distribution to and control by "user groups". He went to the University and asked for e-mail connections through the Chancellor's Office (not the Education School), and the University was pleased to participate in an educational outreach program. This collaboration led to a successful National Science Foundation proposal (see below). When Dean Damon arrived, there was thus a foundation of committed technology use in the district. Dean began a focus on site-based management, and the distribution of technology to schools to support site-based decision making was thus a natural complement to overall district efforts.

Initially, the management (MIS) and curriculum/ instructional components of technology in the district were quite separate, which resulted in lack of coordination and some tensions. Under the latter superintendent and his staff, these two functions have become much more coordinated. At first, an internal committee was created, the "computer cabinet", as a formal mechanism for coordination. This gradually withered away as the functions began to naturally collaborate; evolution of this aspect of leadership was aided by physical proximity (they are both housed in the same building), and the personalities of the coordinators who preferred collaborative working styles. Thus, instructional and administrative goals are pursued in tandem, with sufficient coordination of planning and decisions about technologies. The technology leaders of the district also view their jobs primarily as supporting schools and teachers to use technologies well, rather than delivering plans or models. Thus, they focus a great deal of their thought and effort on professional development, and support for teaching staff.

The leadership vision puts great emphasis on school-level control and decision making. The district encourages support teams at the school level rather than the "guru" model which often leads to burnout and/or over-control. The district thus actively supports "group development", to discourage the development of a district-wide corps of technology "power people". Schools must develop their own technology plans (some require considerable support from district staff to do so at the moment), including how they want to use professional development funds.

In addition, Boulder is home to a significant number of high-tech industries, and thus many citizens support the use of technologies in the schools and throughout the region. The district has adopted a benchmarking approach to accountability to the community, tying technology investment to achievement of curriculum benchmarks.

Integration with curriculum and reform. Technology planning and implementation is very consciously being discussed in relation to the teaching and learning initiatives in the district. This has meant the eradication of the previous approach, which was a separate “computer curriculum”. This has been replaced with an approach that focuses on curriculum integration, emphasizing content-oriented goals, projects and products.

With respect to educational change in the district, one staff member said that she “was not sure you would find the word ‘reform’ in any public materials”. The district emphasizes doing a better job teaching students, preparing them for the workforce, the need to change because of the changing economy. Staff members who participate in some statewide committees report that many think that technology *is* reform. But, as a deliberate approach, BV has put curriculum first.

In Colorado, all districts must develop their own standards. Many wait for others to develop drafts, and then use them for models; at the time of our visit, BV was engaged in this process. Technology is seen as a means to “get at” the standards, subsumed as a supporting framework for achieving content standards.

As noted, the technology bond featured support for students’ writing as a key goal for technology integration, and that has served as a foundation for physical space design and curriculum support. This also includes the district’s goals for better meeting the needs of students for whom English is not a first language. Additionally, research from the Internet project shows that technology interacts with curriculum in five different ways for the district’s teachers: access to information resources and support services for teachers; information for classroom projects and topics; expand projects to include others nationally; transforming the curriculum by more research and collaborative project. This latter use is the ultimate goal for staff, and is yet attained by relatively few teachers.

Professional development. BV has put considerable emphasis on professional development to use technology well in the curriculum, and consequently has experimented with a variety of approaches. Their ideal model is intensive training (the “power workshop”, from one-half to three days), followed by short sessions at intervals. Given practical constraints, they also use “progressive workshops”, which are relatively short sessions spread over time with opportunities to practice skills in between sessions. The overall goal is to give teachers enough knowledge and support to confidently continue to explore on their own, with assured backup. BV wants a workforce of fully prepared teachers, teachers who can walk into a classroom knowing how to use these tools to help children learn better, who are prepared to select materials, able to evaluate specific programs, know when to use them and when not to.

Workshop protocol requires work in pairs, providing network accounts for all participants, and providing all with names and phone numbers of “humans” who can be called subsequently for support. They try to maintain a 1:12 ratio of instruction. They believe that district-wide training is both the most efficient and most effective approach, favored over school-based courses because this expands training options, regularity, and allows teachers to expand their network of colleagues. The workshops are now focused by a design approach to all material: “make it, take it, teach it”, rather than the past skills-based emphasis. They found that if just skills were taught, only about 10% of teachers would actually use them; now, the goal is to provide technology knowledge as part of a toolkit for new strategies for teaching. They also found that teachers needed to use the technology at home (about 70% do)

BV protocol also is based on the idea that teachers learn best from other teachers, rather than from a dedicated trainer — teachers have experiences of classroom trials, can share curriculum strategies, etc. Thus, considerable effort is put into training teachers who can then become the workshop leaders. In addition, building communities of capacity in each school is primary — the goal is 2-6 teachers per school who have Internet expertise, with an emphasis on content expertise rather than only skills expertise. Teachers come to workshop in teams/partners. For some workshops, teachers are encouraged to bring a student or a parent as their partner in order to develop student back-up expertise. BV staff also offer frequent short (20-60 minutes) introductory presentations about technology integration for teachers and parents at faculty and PTO meetings to motivate interest.

Finance. There have been two major components in the finance of the technology implementation in recent years. First, an $89 million bond was passed in 1993 which was a split initiative to finance the construction of three new schools, and to finance the creation of a district-wide technology infrastructure ($10 million, which includes a trunk telecommunications line to all schools, modernizing computers, standardizing some software, staff development, automating libraries, and adding video equipment to each school). The bond passed by 53% of the vote. District staff emphasized the amount of planning that went into the development of the bond initiative. Learning from failures of surrounding districts, they decided not to “sell” the bond to the public through emphasizing the technology itself (“people won’t buy wires”), but by emphasizing what the technology can do for teaching and learning. They undertook a public survey and discovered that one of the chief concerns of their constituents was students’ writing skill. They thus devised the technology proposal to first emphasize technology for the improvement of writing instruction. The deployment of the technology emphasized technology design that would support students’ writing (e.g. computer “gardens” — groups of 3-5 computers distributed throughout classrooms for ubiquitous access to writing and mathematics tools), and required schools to develop technology plans that demonstrated their thinking about this functional goal.

The second source of funds has been successful external fund raising. In 1992 the district received a grant from the National Science Foundation ($427,000) supplemented by funds from the University of Colorado ($10,000) and the district ($40,000) to support the development of the Internet aspects of the district's infrastructure. They also received a grant from Annenberg/CPB, supplemented by USWest to create a national program called "Creating Connections" to train rural teachers in the use of telecommunications. This added to the professional development experience and capacity of the district (13 local teachers became the core trainers for 450 teachers nationally at 21 sites; local BV teachers also received training through this program).

District staff argue for the importance of strong district-level technology effort and support: economic advantages of using the existing telephony structure; pricing structures favor large scale purchasers of technologies and connectivity; router configurations favor district structures; staff development economies of scale (time, courses, specialists); efficiency of equipment installation and support. Possible weaknesses, however, include: larger scale coordination is needed to leverage beneficial state policies; equity concerns (given large funding inequities presently among communities); success requires the coordination of many persons which may frustrate eager individuals.

Technology infrastructure. The district uses both ISDN and T1 lines for connectivity. As of 1994, 7 schools were connected, and the bond supported the high speed connection of the remaining 40 (T1 level). The infrastructure supports evening and weekend access. In addition, high speed LANs are required, and color monitors are important for desired applications, like use of real time weather data.

The district has thought carefully about the ongoing technical support issue, and has developed a multi-prong approach: (a) MIS staff responsibilities include installation and operation; (b) extensive teacher training, included a teacher designated as Internet contact at each school who is give a "short course" (simple installation, maintenance, network operations at schools level) and functions as first line of support for teachers and students; (c) student assistants who are trained to assist in management, on-line user support, troubleshooting for teachers and students; (d) efforts to recruit volunteers from the community (would like to have a volunteer corps of 400; as of visit, 15 are active).

Community . BV staff have developed a thoughtful and multi-pronged effort to reach the community about the technology initiative. This has included; (a) as noted above, a community survey helped to guide the development of the bond that financed the current infrastructure, shaping the program to the education priorities of the citizens; (b) community members were recruited to the planning teams, including technology advisory groups and software standards groups, taking advantage of the technical expertise of many citizens. While staff reports that this collaboration can take a lot of time, the time is necessary to reach consensus on strategy — working too quickly can alienate people; (c) involving parents in technology training (as teachers' partners), and as technology volunteers in schools. This latter group is carefully briefed about the local technical setup and constraints; (d) the development of a community wide network to connect the community more closely to schools, but also to provide telecommunications capacity for other community needs. Staff report, however, that they need to develop more effective ways of recruiting community volunteers. They also believe that they need to figure out ways to keep schools open at night for parents to explore and use the resources; they believe that this strategy is necessary to get sufficient community support for expansion of the network.

In addition, BV has developed substantial relationships with the University of Colorado at Boulder (their original Internet provider). At the time of our last visit, BV and the School of Education were also planning joint courses to improve the technology and education offerings of the university.

Union City, New Jersey School District

Like many urban school districts, Union City has faced numerous educational challenges. In 1989, under guidelines established by New Jersey's State Education Department, the Union City School District received a rating that prompted the state to consider takeover. Out of 52 areas that the state investigated, Union City was found to be failing in 40. Student attendance, drop-out and transfer rates, as well as scores on standardized tests, were below state averages. The state gave the Union City school district a five year window of time in which to improve the educational climate dramatically. The district was required to develop a Corrective Action Plan (CAP) that would address the 40 problem areas systematically.

The reform coincided with a large field trial of technologies for education that has been a collaboration of Bell Atlantic, Union City Board of Education, and the Center for Children and Technology. The project has provided hardware and connectivity to a middle school and to families of one middle school grade level. This has supplemented and been incorporated into the district’s own investments in technologies. These resources have been used as a part of the overall plan for reform.

In 1989 the district implemented a five year plan to bring about substantive changes in their educational system. The planning team, headed by the Executive Director of Academic Programs, Fred Carrigg, recommended that the district adopt a whole language approach to learning, and in January of 1990 the school board passed a resolution to implement this approach. There were three main objectives that were central to the district's new educational agenda:

- to create a print-rich environment;
- to recognize and promote reading and writing as integral to all subject areas;
- to encourage students and teachers to explore new ways of learning.

The district's goal was to create a curriculum that supports the development of thinking, reasoning and collaboration skills throughout the disciplines rather than emphasizing rote learning and whole group/lecture modes of education. Under the new plan, students are expected to learn by doing, demonstrating their proficiencies through writing research papers and carrying out projects.

Teams of teachers have come together during each of the last six summers to develop the curriculum. The design of the new curriculum is supervised by the Executive Director of Academic Programs and the administration has been extremely successful in motivating and supporting teachers to develop new skills and improve their teaching practices. Curriculum reform is an ongoing process in the school district, and the district has consistently budgeted resources to ensure that the curriculum is reviewed and revised on an annual basis. Teachers work in teams each summer to identify new resources, including texts, multimedia applications, and World Wide Web sites that are relevant to the curriculum.

The district's approach is highly interdisciplinary; themes that emerge as part of a historical period of study are studied also in literature, the arts and sciences. For example, students learning about the Civil War study not only historical material about the political and social issues that faced the nation and the lives of ordinary people of the time, they also read novels and study art from this period and enrich their understanding of the human experience.

In addition to changes in the curriculum, the planning committee recommended a number of additional reforms:

- Schools would no longer only buy textbooks for individual students. Instead, class and school libraries would be established and given purchasing preference.
- All pull-out programs were eliminated (prior to the reforms, approximately 80% of the students were in pull-out programs). In the reformed environment resource teachers come to classrooms providing teachers with extra help. This effort also helped to end years of labeling students as "remedial."
- The number of teacher in-service training hours was increased from less than eight hours a year to 40 hours a year, with many more opportunities available for voluntary staff development.
- Major scheduling changes were implemented. English, reading, writing, and spelling were combined into a single 111 minute communications period. Whenever possible, communications classes were to be preceded or followed by social studies to create a 148 minute block of time. Math was extended to 74 minutes and whenever possible combined with a 37 minute period of science, to create a 111 minute math/science block.
- The superintendent agreed to suspend analysis of teacher performance based on student test scores for the first two years of the reform efforts.

Key Observations

As the district's technology supervisor noted, one of the most notable consequences to result from the technology trial has been a growth in understanding district-wide regarding the importance of networking resources and tools for the community as a whole. Due in large part to the success of the trial, the district has committed substantial resources to building a comprehensive and scaleable networking infrastructure that will link the schools, city offices and public libraries to a central server at the board office. Beginning in July of 1996, the district will invest 1.2 million dollars in hardware and networking solutions to build this district-wide *Intranet*. Combined with the resources from the NSF-funded "Union City Online" project the district will be investing nearly three million dollars over the next two years to build the technical infrastructure and develop the human expertise necessary to support, maintain, and effectively integrate the technology with the curriculum.

Currently there are over 2000 computers (Mac-based) located in classrooms, computer, labs and library media centers distributed throughout the district's 11 schools. Over 50% of the classrooms have 4 or more Macs in them networked to a printer. The district's goal over the next several years is to increase this number to 6 machines per classroom.

The Board will run a BBN Internet server that has a direct T-1 connection to the Internet. Each school will be outfitted with a comprehensive and scaleable networking "backbone" which will enable classroom, lab, and media center computers to be connected to the district's Intranet, as well as out to the Internet. The schools will be connected to the district office through T-1 lines. The district anticipates that by September of 1997 all Union City schools and the city's libraries will be on-line.

The program involves a large effort to train teachers and students. This local body of expertise will ensure that the network remains technically robust and that networking resources become an integral part of the K-12 curriculum.

- <u>Community-based authoring course</u>. This is offered as a for-credit summer course to 25 high school students. Students carry out research projects in collaboration with local community-based organization and business and design Web pages based on their projects.
- <u>Technical training seminars</u>. Teachers and students are trained in the basics of technical trouble-shooting and repair.
- <u>Cultivate local technology experts</u>. Interested teachers from each school work with CCT and district staff on developing school-based plans for providing technology training and ongoing support in the schools.
- <u>Development of Union City Online Web Site</u>. Teachers, students, parents and administrators contribute content resources to the Web site shell. District-wide review procedures will be established to ensure that content resources are relevant to district and community goals.

- Online Curriculum. The district's curriculum will be mounted on the Web and will contain links to additional Web resources. Teams of teachers will work with district and CCT staff to accomplish this.
- Collaborations with New Jersey State Systemic Initiative, Steven's Institute, and the Online Internet Institute. District teachers and administrators are drawing on the training resources offered in these three federally funded efforts.

The Union City school district has completed its fifth year of reform and restructuring and thus far, even by traditional measures, students are showing remarkable improvement in learning in a very short period of time. When compared to state averages, Union City students in grades K-8, where the curricular reforms have been in place the longest, are "systematically performing in the average to best range in reading and language arts, and in the above average to best range in mathematics."

Similarly, 1995 scores on New Jersey's Early Warning Test, which measures eighth graders' knowledge and skills in three subject areas (reading, mathematics, and writing), indicate that students in the Union City school district are consistently out-performing other special needs districts in the state by an average of 27 percentage points in each subject area, and are outperforming New Jersey's big city districts by an average of nearly 30 percentage points. Eighty-seven percent of the Union City eighth-graders passed reading, 84.7% passed writing, and 79.2% passed mathematics.

These figures take on even more significance when looking back over the four year period when the middle school curriculum was first restructured. For reading, scores between 1992-95 have improved by 53.6 percentage points; for writing by 42.9 percentage points; and for math by 29%.

Between 1994 and 1995 Union City posted an 18.8% jump in the number of students passing all three sections of the EWT. By comparison New Jersey special needs districts posted an increase in student passing of only 4.3%, and the big city districts posted an increase of only 4%.

Union City scores on the EWT are rapidly approaching average scores for the state; in 1995 the state average was 76.9, Union City's was 69.2% Most importantly, however, students' mean scores are on the rise indicating that not only are students passing, but they are passing with higher scores.

In addition, attendance for both students and teachers are above the state average, and in the five years that the reforms have been underway the annual student-mobility rate has dropped from 44% in 1989, to 22% in 1994.

This remarkable success prompted the New Jersey State Department of Education in 1995 to end its monitoring procedures and fully certify the school district. These scores strongly suggest that the reformed curriculum, operational for five years in grades K-8, is making a significant contribution to student performance, particularly in the areas of reading and writing.