CENTER FOR Children & Technology

Union City Interactive
Multimedia
Education Trial

1993 - 1995 Summary Report

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Executive Summary

"The rebirth of Union City and your schools reminds us that we do live in an age of great possibility if people are willing to work together to make the most of it."

> President William Clinton
> *Address to Union City Schools*
> *February 15, 1996*

In February of 1996, Union City — a predominantly Latino, inner city community — received national recognition when the President and Vice President of the United States came to acknowledge the extraordinary accomplishments of this urban school district. The unique blending of comprehensive school reform, technological innovation, and corporate sponsorship was cited by the President as a model for educational excellence and national inspiration.

Like many urban school districts, Union City has faced serious educational challenges. In 1989, it was placed among New Jersey's special needs districts. The district developed a five-year improvement plan. Its goal: produce a curriculum that supports the development of thinking, reasoning and collaboration skills throughout the disciplines. Students would learn by doing — demonstrating their proficiencies through writing research papers and carrying out projects. The district also made an investment in upgrading buildings and purchasing additional educational tools, such as books, multimedia resources and computers.

Union City's need to implement a plan for systematic improvement surfaced at the same time Bell Atlantic-New Jersey began implementing its advanced network plan, Opportunity New Jersey. In 1992 Bell Atlantic established a partnership with the Union City Board of Education in conjunction with the Education Development Center's (EDC) Center for Children and Technology (CCT).

The technology trial was first implemented in September of 1993. Computers were supplied at school and at the homes of all 135 seventh-grade students and their teachers at the Christopher Columbus School. The students are now ninth graders at Emerson High School and Bell Atlantic has committed to continuing the home/school connections through their sophomore year of high school.

Students throughout the district, especially those involved in the Bell Atlantic Union City trial, have made positive strides. Progress

includes a marked improvement in standardized test scores and writing skills, significant declines in absenteeism, an increase in students transferring in, and a decrease in students transferring out.

In grades where curricular reforms were established, students are systematically performing at or above national averages. Reading and language arts are in the average to best range. Mathematics is in the above average to best range. Union City students are consistently out-performing other urban and special needs districts in the state by approximately 27 percentage points in reading, math and writing scores on the New Jersey's Early Warning Test. This strongly suggests that the new curriculum, coupled with well-supported and judiciously integrated technologies, is making a significant contribution to student performance.

Parents, administrators, teachers and students are using electronic mail to build bridges and break down walls. Teachers see extensive use of this medium playing an important role in supporting the development of student writing and research skills. The trial also has furthered the research orientation of the district's curriculum, prompting students to seek more information and to use resources not readily available in the past.

In 1995 the unique efforts underway in Union City were recognized with a $1.5 million grant from the National Science Foundation to fund *Union City Online: An Architecture for Networking and Reform.* In partnership with the Education Development Center and Bell Atlantic this grant will enable the district to extend the technical infrastructure and develop the human infrastructure to build a comprehensive and sustainable model for school networking.

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Introduction

For the past four years Bell Atlantic has worked with the Union City, New Jersey Board of Education and the Education Development Center's (EDC) Center for Children and Technology (CCT) to carry out an innovative technology trial that provides new means for teachers, administrators, students, and parents to communicate with each other inside and outside of school. The trial is being carried out in the midst of substantial educational reforms that have been underway in Union City schools since 1990. Bell Atlantic, in conjunction with CCT, has worked closely with administrators and teachers in the district to foster effective ways of embedding the technology to support and enhance the district's curriculum reform efforts. This report presents an overview of the first three phases of the technology trial, discusses the community and educational contexts, presents findings derived from district and state measures of educational progress and interviews with the school community, and discusses the district's plan to grow the technology trial into a comprehensive school and community network known as *Union City Online*.

Background Information: *The History of the Project*

The project was conceived in 1991 as a technology trial to test the technical feasibility of offering interactive multimedia on-demand applications over the public switched telephone network. Central to this effort was an exploration of the potential benefits students and teachers might experience when given access to technology from both home and school. Since the initiative was announced publicly, the trial has been positioned as the primary example of what Bell Atlantic-New Jersey's groundbreaking network modernization plan, Opportunity New Jersey, means to the delivery of educational information throughout the state. The trial, which officially began in September 1993, focuses on the use of high speed networking resources delivering interactive on-demand educational information, including access to the Internet and a CD-ROM resource library.

Phase 1 of the trial began in September 1993 at the Christopher Columbus Middle School in Union City, New Jersey. At the outset of the school year 135 students and 20 teachers were supplied with computers and the telecommunications capabilities at home and at school. In addition to the 44 workstations distributed throughout the school's classrooms, each family and teacher in the trial received a 486-level computer equipped with graphics and voice capabilities that connected to the trial's networking capacities in their homes. During this phase of the trial, participants were able to communicate between home and school and use basic software tools (Microsoft Works and

Publisher) to carry out a wide-range of curriculum activities. In addition, the district supplied a 30-station computer lab of 575 Macintosh computers with CD-ROM and an additional 40 computers which were distibuted to classrooms and offices

Phase 2 (1994-95 school year) focused on the integration of very high bit rate digital subscriber lines (T-1) and CD-ROM audio/video server technology and Internet access into the trial. Much of the work that took place during the first phase of the trial laid the ground work for the integration of additional multimedia resources into the school and its curriculum, and the broader community: completing the development of the technical infrastructure; distributing the technology to the community; procuring the resources for the multimedia library; conducting staff development for the educators; and gathering baseline data for studies of implementation and effectiveness.

Phase 3 began in September of 1995 and followed the original cohort of Columbus students into their freshman classrooms at the district's Emerson High School. Sixteen freshman teachers agreed to participate in the trial and were given access to the network from home and from their classrooms.

Phase 3 also coincided with the National Science Foundation grant to build *Union City Online: An Architecture for Networking and Reform* (rec. #9554327). This grant is enabling transfer of the technical infrastructure from Bell Atlantic to the school district. The district is establishing its own Internet server and is extending the networking infrastructure to the remaining nine schools. Achieving this involves two central tasks: first, developing a district-wide technical infrastructure that is affordable, scalable, and potentially ubiquitous; and second, developing the necessary human infrastructure by creating:

- novel and scalable approaches to teacher training and ongoing staff development.

- a core set of applications that support district-wide reform efforts.

- opportunities to involve the community, including teachers, parents and students in a wide range of authoring projects.

Union City Timeline

Early 1992	Initial Planning of Bell Atlantic Technology Trial
Summer 1993	Phase 1: Installation & Teacher Training
September 1994	Phase 2: Integration of T-1, testing of CD-ROM server technology
Spring 1995	CD-ROM server and Internet access
September 1995	Phase 3: Expansion of project to Emerson High School
October 1995	NSF award for "Union City Online: An Architecture for Networking and Reform"
March 1996	Union City Board of Education approves 1.2. million for FY 1996-97 for expansion of networking infrastructure
May 1996	Installation of Board of Education Internet server

Union City

Union City was selected as the demonstration and research site for the trial because it is a community of ethnic and cultural diversity. The schools and families in this community represent populations that typically do not have access to the types of services offered through this new technology.

Union City, located in northern New Jersey's Hudson County, is situated directly across the Hudson river from Manhattan. One mile long and a quarter mile wide, it is the most densely populated city in the United States (approximately 60,000 residents), with a student population that is 92% Spanish speaking.

Union City has a rich and varied immigrant history. It was originally settled by Germans in 1851 who left Manhattan and moved across the Hudson River in search of affordable land and open space. At the turn of the century, the city became home to many Irish and Italian Immigrants, and Italians were the dominant population until the late 1960's.

In the 1940's Union City attracted the first Cuban immigrants from a small town in central Cuba called Formento. These early Cubans learned of Union City's famed embroidery factories and came in search of work. In the mid-50's Fidel Castro, aware of the Cuban presence in this town, traveled to Union City to recruit fighters and raise money. He held meetings in a downtown bar on Bergenline

Avenue, and local legend has it that Castro was arrested one night in a scuffle with supporters of General Fulgencio Batista.

By the time Castro came to power in 1959, 2000 Formenteros were living in Union City, making the city an attractive port-of-entry for Cubans wishing to immigrate. Union City continues to have the largest concentration of Cuban-Americans outside of Miami, hence its nickname, "Havana on the Hudson." Once a day a bus, known locally as "La Cubana," leaves the city and makes the long journey to Miami.

In recent years, the city's Latino population has diversified. The city has become home to immigrants from the Dominican Republic, El Salvador, Guatemala, Honduras, Mexico, Peru, and Puerto Rico. Families who make the long journey to Union City come with the intent of giving their children a better way of life. Many adults arrive with limited formal education (according to the 1990 census, about half of the officially reported adult population has completed high school). Schooling is important for this community precisely because it represents an opportunity for a better way of life.

The Board of Education serves 9,017 students in eleven schools (three elementary, five K-8, one middle, two high schools). Approximately 92% of the students are Latino, 75% of whom do not speak English at home. Thirty-four percent of the students are enrolled in the District's bilingual program and over half of the District's teachers are certified ESL or bilingual. The majority of residents are of low or moderate income, and 14% of the District's students have been in the country less than three years. The Brookings Institute classified Union City as one of the 92 most impoverished communities in the U.S. with 27.5% of all children living below the poverty line. Eighty percent of the District's students receive free or reduced price lunches — a figure that is more than twice that of the national average of 36.4% (National Center for Education Statistics, 1995).

District Reform Initiatives

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. Of 52 areas 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 in which to dramatically improve the educational climate. The district was

required to develop a Corrective Action Plan (CAP) that would address the 40 problem areas systematically.

As a result, in March of 1990 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, recommended the district adopt a whole language approach to learning. 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. The administration has been extremely successful in motivating and supporting teachers to develop new skills and improve their teaching practices. The first year of the plan focused on developing the CAP, the second year on implementingthe new K-3 curriculum; the third year on 4-6; the fourth year on pilots and reorganizing grades 7-8; and the fifth year on implementing the new curriculum for grades 7-8, piloting reforms and developing new curricula for grades 9-10. A second five year planning process was begun in 1994 and will continue through 1999. The plan focuses on comprehensive reform at the high school level.

Curriculum reform is an ongoing process, 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 WWW 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 elementary students were in pull-out programs). In the reformed environment resource and support teachers come to classrooms providing teachers with extra help and creating a team teaching environment. 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 a high of 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.

Union City Public Schools Restructuring, 1989-1994

Curriculum and Methodology

Before	After
Skill-based	Whole Language
Basal Readers, Single Text	Authentic Literature, Multi-Texts
Memorization, Cumulative Knowledge	How to Learn, Research-based
Vertical, Lecture Format	Horizontal, Cooperative Learning

Time, Classroom Management, and Physical Layout

Before	After
Single, Isolated Periods of 37 Minutes (Reading, Language Arts, Spelling)	Blocks of Time, 74-111 Minutes (Communications/Social Studies)
Teacher Centered	Student Centered

Staff Development

Before	After
Limited: 4 Half Day Sessions, 2 Hours Each, Some After School	Five Levels of Training, Half Days, Saturdays, On-Going

Management and Budget

Before	After
Centralized	Shared with School-based Improvement Teams (SITs)
$$$ on Consumables (Workbooks, etc.)	Non-consumable Big Books, CD-ROMs, Computers

Technology

Before	After
Labs with "Experts"	Labs with "Experts" and Classroom Computer Centers
Occasional Use	Daily Use
Separate Curriculum	Total Integration into All Curricula

Parental Involvement

Before	After
Two Parent Nights	Two Parent Nights, Board Notes, Parent University

Results

Before	After
Failing District	Urban Model
Threatened with State Takeover (May 1989)	Awarded State Certification (August 1995)
Passing Rates for Elementary Grades: 30-35%	Passing Rates for Elementary Grades: 70-80%

Source: Union City Board of Education, 1995

Significant changes also were made to the physical school environments. A bond initiative issued to Union City residents helped the district refurbish all of the schools and many individual classrooms. The buildings are graffiti free and freshly painted, and the hallways are filled with displays of students' projects.

With additional monies from New Jersey's Quality in Education Act, the District has made a significant investment in technology resources to support their curriculum reform goals. During the last five years, approximately 1300 computers have been installed in the District, establishing an 8-to-1 ratio of students to computers. Each of the District's 11 schools has a lab with approximately 25 student machines (Macintosh 520's or 575's with 8 mgs of RAM and CD-ROM's) networked through Ethernet. More than 50% of the District's classrooms have one to four student Macintosh machines. In addition, the Central Office is now fully networked, and all Board personnel have access to both local and Internet e-mail. The District's technology mission statement reflects a commitment to integrating technology throughout the educational spectrum, including students, staff, administration, and the community.[1]

District-Wide Measures of Progress

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.[2] Eighty-seven percent of the Union City eighth-graders passed reading, 84.7% passed writing, and 79.2% passed mathematics.

EWT 1994 and 1995 Results:
Percentage Passing All Three Sections

Legend:
- Special Needs
- DFG (A) Big Cities
- Union City
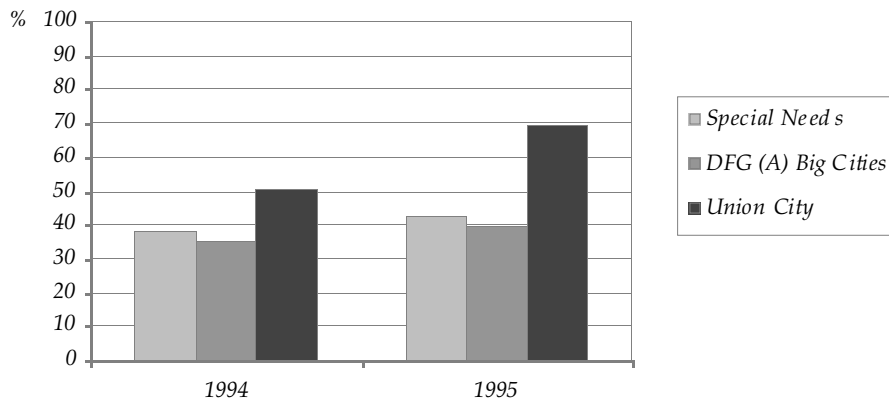
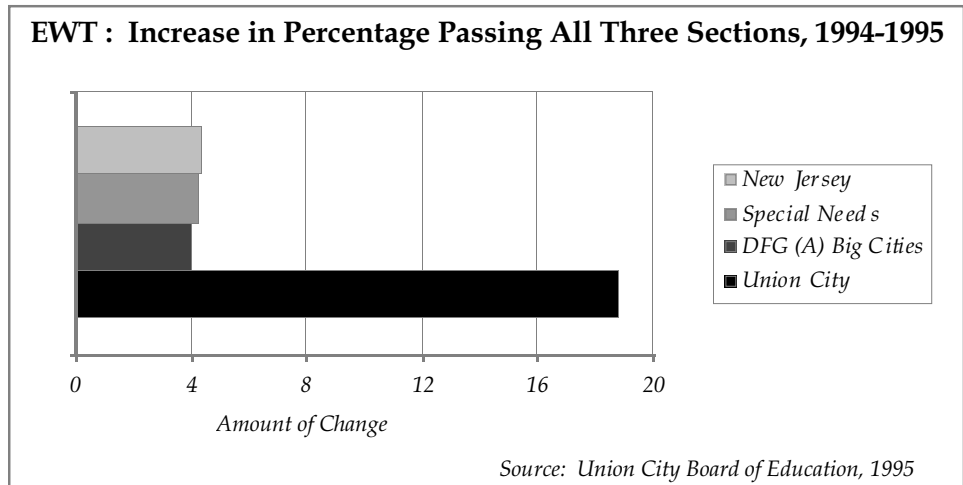*Source: Union City Board of Education, 1995*

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

Union City EWT 1992-1995 Results:
Percentage of 8th Grade Students Passing by Subject

Legend:
- 1992
- 1993
- 1994
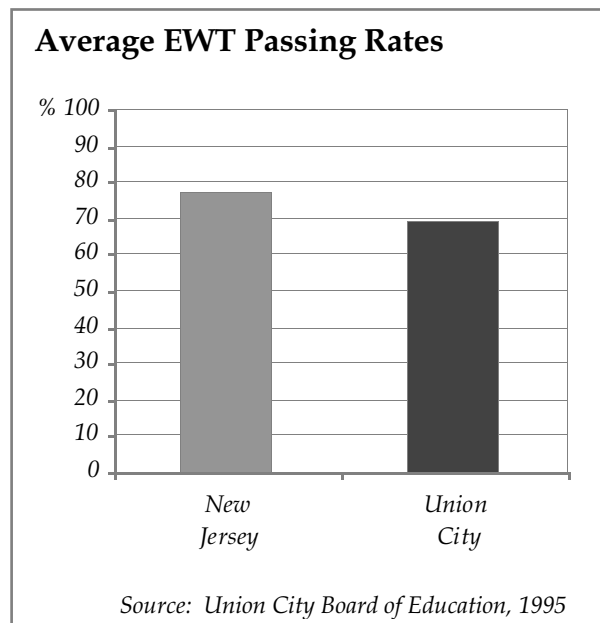- 1995

Categories: Reading, Writing, Math
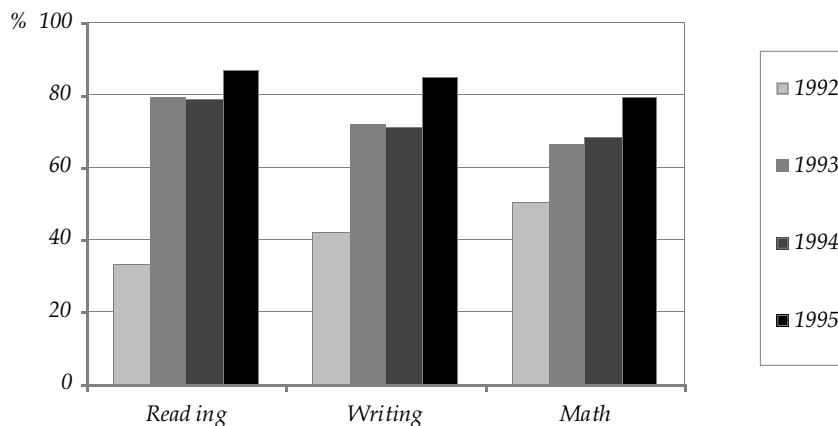
*Source: Union City Board of Education, 1995*

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%.

EWT : Increase in Percentage Passing All Three Sections, 1994-1995

Legend:
- New Jersey
- Special Needs
- DFG (A) Big Cities
- Union City

Amount of Change

Source: Union City Board of Education, 1995

The Union City student body is rapidly approaching state passing rates on the EWT. In 1995 the average state passing rate was 76.9%; Union City's was 69.2%. Most importantly, however, students' mean scores are on the rise indicating that not only is a larger group of students passing, but they are passing with higher scores.

Average EWT Passing Rates

New Jersey   Union City

Source: Union City Board of Education, 1995

In addition, attendance for both students and teachers is above the state average, and in the five years the reforms have been underway the annual student-mobility rate has dropped from 44% in 1989 to 22% in 1995.

Annual Student-Mobility Rate

Source: Union City Board of Education, 1995
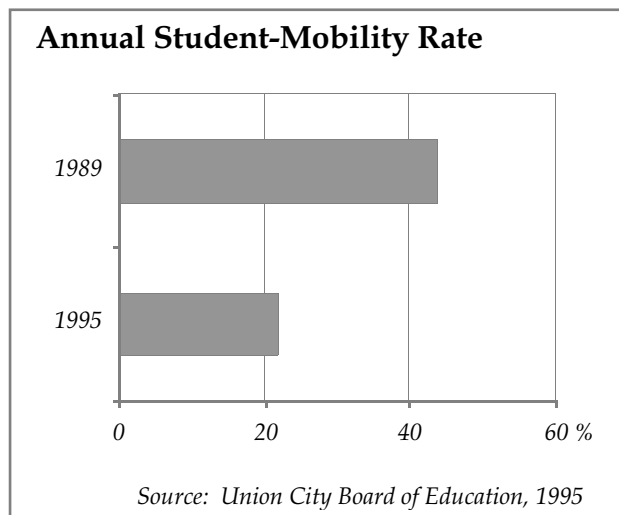
This remarkable success prompted the New Jersey State Department of Education in 1995 to end its monitoring procedures and fully certify the school district.[3] These scores strongly suggest that the reformed curriculum, operational for up to five years in grades K-8, is making a significant contribution to student performance, particularly in the areas of reading and writing.

The introduction of the technology trial into the middle school curriculum coincided with broad curricular changes that use the technological resources to great advantage. Between 1993 and 1995 the context for the trial was the new Christopher Columbus Intermediate School, which opened during the 1993-1994 school year as the first middle school in Union City. Combining middle school-aged students from two previously K-8 schools, the Columbus School has a student population of 296.[4]

In addition to the school principal, there are 17 teachers at the Christopher Columbus school, a guidance counselor, a resource room teacher, a library media specialist, a computer teacher, and a nurse. The teaching staff consists of 10 general program teachers who teach science, math, social studies and communications. Two Port-of-Entry teachers are responsible for non-English speaking students who are the district's most recent immigrants. Four additional teachers represent the district's Basic Skills Improvement Program and work with the general program teachers to provide additional instruction to students who are considered to be academically at-risk. The resource room teacher also provides additional instruction to special education students, and the computer teacher provides instructional support for the further integration of technology resources into the curriculum.

The Multimedia Education Trial: *Christopher Columbus and Emerson Schools*

All of the teachers and administrators at Christopher Columbus wear multiple hats and represent a highly dedicated professional community.

The roles of the library media specialist and the computer teacher are essential to the successful implementation of Union City's curriculum focus on research. In addition to the 44 trial computers, the library media specialist and computer teacher have 66 Macintosh computers available for student and teacher use. These are distributed throughout the school building. Each classroom has two Macintosh computers, the computer lab has 35 machines, and the media resource room has four. There are a variety of ways in which students can conduct their investigations including online research and an extensive CD-ROM library. Students also have access, through the trial machines, to the Internet and to a virtual CD-ROM library.

During 1995-1996 the technology trial was extended to follow the original cohort of students into the ninth grade at the Emerson High School. The Emerson school is in many respects a typical inner-city high school. The school has a student population of 1180 students and reflects the ethnic make-up of Union City at large. Twenty-four percent of the students are enrolled in the ESL program, and 71% speak Spanish as their primary language at home.

1995 was the first year of the curriculum reforms at the high school level, with an emphasis placed on adopting the whole language philosophy as an integral part of the 9th and 10th grade curriculum. While this program of innovation has been embraced with varying degrees of support by Emerson teachers, a prerequisite for participation in the multimedia education trial was a commitment to implement whole language teaching methods in one's classroom. A group of 14 freshman and sophomore teachers and two administrators were selected to participate in the technology trial. The teachers are currently involved in all core subject areas including, math, science, history, and English, as well as special education.

The Columbus and Emerson schools are models of what urban education can be. Both schools have an abundance of technology resources including, classroom computers, library media centers and computer labs. Both schools also have dedicated principals, administrators and teachers that have played key roles in supporting the technology initiatives and curriculum reforms.

At the outset of the project, Bell Atlantic recognized the need to provide the school community with additional training and support in the use of the trial technology. The teachers and administrators involved in the trial had varying amounts of experience with computers. Bell Atlantic, in collaboration with the Union City school district, made a number of provisions to train the teachers throughout the trial. Training objectives of Phase 1 were aimed at introducing teachers to basic computer applications and to working in a networked environment.[5]

Training objectives of Phase 2 focused on the integration of multimedia and Internet resources into the curriculum. CCT staff were available on a weekly basis during the school day to support teachers in their efforts.

With the expansion of the multimedia demonstration project into Emerson High School, technology integration workshops were offered during the fall and winter of 1995-96 to all interested Emerson faculty. In addition, in preparation for the expansion of networking resources into Union Hill High School, a comparable set of workshops was offered there.[6] A combination of district staff and CCT personnel conducted 24 workshops with 120 teachers participated.

The first three workshops focused on the use of basic communication tools, including how to use Lotus Notes and America Online.[7] The final three workshops focused on the integration of World Wide Web resources into the classroom and introduced interested teachers to HTML programming (Hypertext Mark-Up Language) and the design of personal home pages.

As part of its district-wide program of reform Union City created "Parent University." This program offers a broad range of services to parents including, family math and science programs, ESL courses, expert advise on parenting skills, as well as cultural events. Beginning in the spring of 1994, two Columbus teachers decided to offer computer literacy classes to parents as an additional component of Parent University. The classes, which have continued into the 1995-96 school year, meet two afternoons a week, and are designed to introduce parents to a broad-range of computer applications.

Approximately 174 parents have attended the courses, including parents who are not part of the technology trial. Parents have learned

the basics of computer use, including how to use a mouse, navigate menus, access applications, and create and save files. Once trained in the basics, participants go on to learn how to use a variety of tools including, word processing software, graphics programs, spreadsheets, and databases.

The program has been remarkably successful and other district schools are now beginning to emulate it, offering their own versions for the parent populations they serve.

Parents have benefited in several notable ways. They are beginning to look at their children's productions with a more critical eye. As one of the instructors noted, "Parents, through our program, have become aware of the technology resources that students have at school for accessing and presenting information. As a result, they are making more demands on their children, mindful of the wealth of facilitating materials that are at their disposal."

Learning new technology skills has also resulted in concrete benefits for parents' professional lives. Several parent participants have acquired better jobs, and as their instructor noted, "these are positions they would never have applied for had they not attended our classes."

"Right now we have a housewife, mother of three, who has just announced her acceptance in a sophisticated training program which guarantees her a good job upon completion. We have a parent who works at a hospital and has just had published and gotten credit and payment for a manual which she translated and was able to format with our training. We had a parent who broke his leg and during the time he was in a cast trained with us. Those skills prepared him for the better job he now has."

The benefits of this program extend to the teachers as well. They are enthusiastic about their "students'" accomplishments and believe that the courses are making a significant contribution to the Union City community.

"Time flies in our class and we find ourselves pulling people away from computers and shooing them out the door. It's a great job!"

There are a number of factors that indicate that the intensive and ongoing access to technology is having an important effect on students' learning and teachers' professional accomplishments. Union City administrators firmly believe, however, that without the district's comprehensive program of reform and restructuring gains in student learning within the technology-enriched cohort of students would not be so notable. Indeed, the improvement in student performance seen throughout the district is testimony to this point.

This section of the report summarizes several traditional measures of student achievement including standardized test scores, attendance, and dropout rates and presents a range of trial-specific findings.

Educational Implications

1993-1994

If test scores for the district as a whole indicate that the curricular reforms are making a substantial difference in student progress, measures of student achievement during Phase 1 of the trial are even more encouraging. During the 1993-1994 academic year the eighth grade students at the Columbus school were the only students in the district to meet state standards on New Jersey's Early Warning Test (EWT). To meet state requirements, 75% of the students must pass in each of the three subject areas (reading, math, writing). In 1994 Columbus students exceeded those requirements with 87.5% passing reading, 78.9% passing math, and 86.5% passing writing.

Measures of Student Achievement: The Christopher Columbus School

**Percentage of Eighth Grade Students Passing
All Three EWT Sections, 1994**
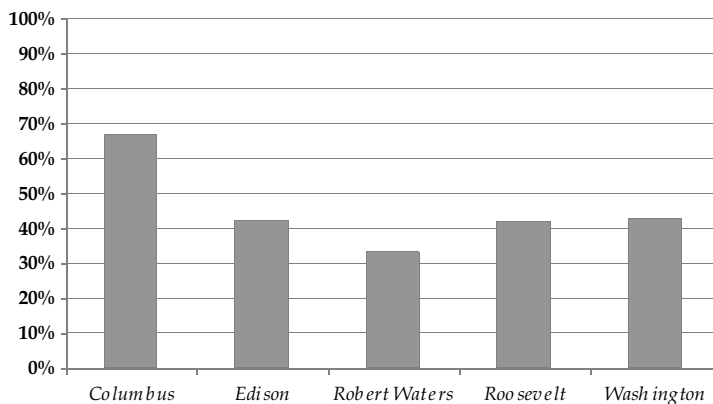
Source: Union City Board of Education, 1995

In a practice Early Warning Test administered to all Union City seventh graders in 1994, the technology-enriched cohort of Columbus students had the highest overall scores.[8] They had the highest pass rate in math (58.6%) and writing (69.3%), and finished third among five schools in reading (65.8%).

Percentage of Seventh Grade Students Passing Each EWT Section, 1994

Source: Union City Board of Education, 1994
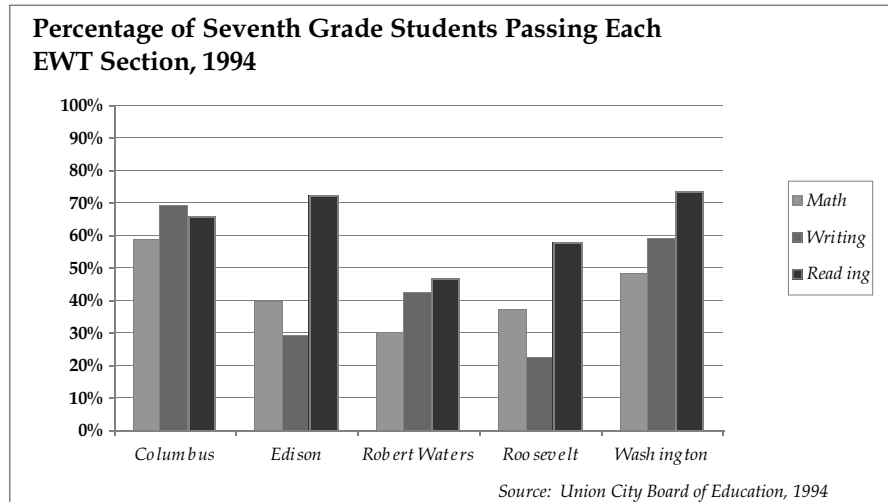
1994-1995

Results from the 1995 EWT test indicate that this technology-enriched cohort of students is continuing to outperform their peers in other district schools. They had the highest district pass rate in reading (91.3%) and writing (89.2%) and the second highest pass rate in math (87.4%). In addition, Columbus students' mean scores on the EWT were the highest in the district for reading and writing, indicating that not only are more Columbus students passing the EWT, but they are passing with higher scores compared to their cohort in other district schools

Eighth Graders' Mean EWT Scores: 1995

Source: Union City Board of Education,
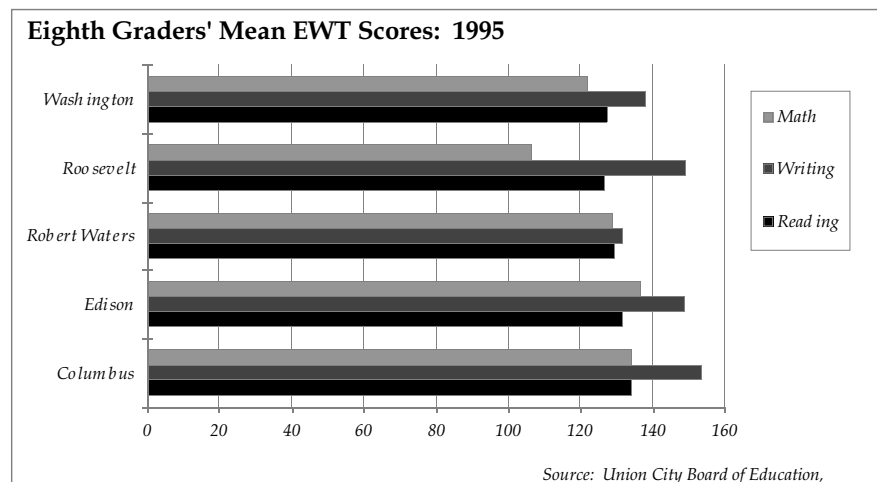
When looking at the percentage of students passing all three sections of the EWT, Columbus students (78.8%) out-performed students in other district schools (64.5%) and scored slightly higher than the state average of 76.9%.

**Percentage of Eighth Grade Students Passing
All Three EWT Sections, 1995**

Source: Union City Board of Education, 1995
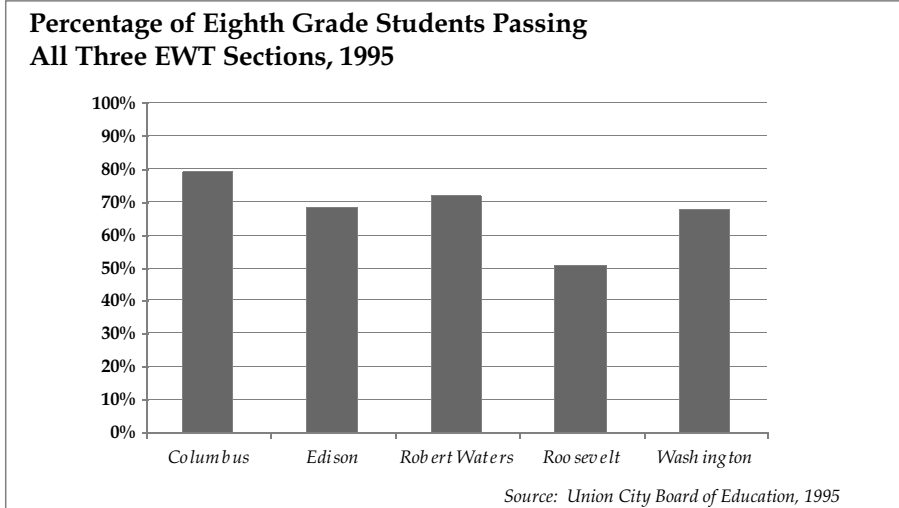
According to the Executive Director of Academic Programs, the impressive writing and reading scores seen in this cohort can partially be attributed to the amount of writing and editing that students are doing with the technology at home and at school.

In addition to Columbus students' significant accomplishments on the standardized EWT test, more Columbus students qualified for the ninth grade honors program than other eighth-grade Union City students. For the first time in many years, an additional honors class was added to the high school program at Emerson to accommodate the influx of Christopher Columbus honors students.

Honors Eligibility: Union City Eighth Graders

Source: Union City Board of Education, 1995
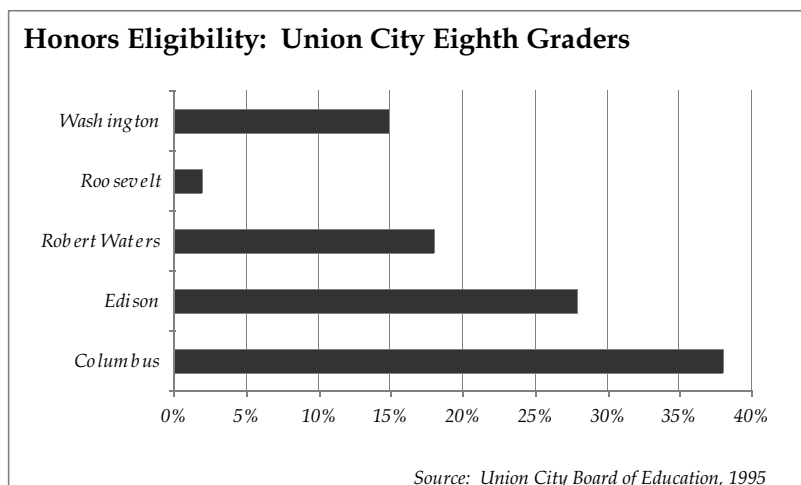
For the past two years the Columbus School has held the district's best attendance record for both students and faculty. The school has also had the fewest number of students transfer out and the highest number transfer in between 1993 and 1995.

In any substantial technology integration effort it takes time for the teachers to learn how to use new resources effectively. While basic technical competence can be acquired quite readily (e.g., saving and retrieving files, printing, using e-mail), the more difficult challenge is making technology resources an integral and seamless part of the curriculum so that substantial learning can take place. By all accounts, the teachers have made significant progress during the past two years, incorporating technology resources into their daily routines, using the computers to support student writing, enhance the project-based nature of the curriculum, support collaboration, and build stronger relationships among students, teachers, and administrators. While all students in the district have made substantial progress, learning outcomes among the technology-enriched cohort suggest that ongoing access to communications and information resources has contributed to their success.

Perceived Benefits: The Columbus Teachers

The following section summarizes end-of-the-year interviews that took place during June, 1994 with teachers at the Columbus School. The teachers were selected to represent a range of disciplines including math, English, history, English as a Second Language (ESL), and science. In addition to the classroom teachers, the media resource specialist was interviewed along with one of the Port of Entry teachers. The interview asked teachers how the technology has affected their work with students, their students' learning, and their use of the technology to support the Union City curriculum.

Improvement in Student Writing

Teachers who worked closely with students on their writing skills saw a marked improvement in students' ability to write. There is little doubt that availability of the technology, at school and at home, played an important role in supporting the development of students' writing abilities.

"It has been an invaluable tool in my classroom — I find that my children want to write more, and they are reading more because they are using the computer — and it is very patient. They are corresponding with each other, and they are corresponding with me

through e-mail. And they are writing a lot of their reports on the computer. They are doing this in classes and at home."

"Writing skills [have improved] particularly, [there has been] improvement in their spelling skills. I notice that they are more concerned about what they are writing and how they are writing. They are concerned about making sure that the spelling is correct and making sure that the grammar is correct. I've noticed that students will go to the dictionary and look up the words they are writing, because they know that if they are sending it to another class other students will read it. They don't want any spelling errors."

"In communications it helps a lot with just the writing part. Kids like to write a little better because they have a machine they can play around with, and they see their work up on the screen. They can correct it a lot more easily and move it around if they make a mistake. Before, they had to rewrite everything if they made a mistake — now they just need to move things around, which is a lot easier for them. It is more like a game, and its a lot neater, so they can read it. And we do a lot of group work in the classroom, so when they are switching off their work they can read it. And it is easier for me because I can read it. Before it was hard — you had to tell them to rewrite it because of the penmanship, but now that is alleviated because of the technology."

Communications and resource room teachers reported that students made use of Microsoft Works and Microsoft Publisher to do much more writing and publishing in the classroom than had been true of students in previous years. They noted that students' interest in writing projects increased over time, with many students spending their lunch period in the media resource room working on reports.

Support for Whole Language Approach to Learning and Project-based Work

The teachers we interviewed spoke definitively about the ways in which the technology was used to support and further the goals and objectives of the Union City approach to learning. Written records, produced and developed over time, are an important indicator of a student's developing understanding, as is the ability to carry out research and collect information in an informed and thoughtful manner. The teachers had to plan and think through the ways in which they would integrate the technology into the curriculum. As one teacher noted, the availability of the technology "affects what I

plan because I try to integrate the computer as much as possible throughout communications and social studies. For example, when students worked on New Deal legislation, I set up a database." All of the technology resources, including the machines supplied by Bell Atlantic and those purchased by the district for the media resource room, played an important role in motivating and facilitating student learning. The teachers, as interpreters and implementers of the technology resources, were essential to this process.

"They are gathering more information than usual and they rely on that rather than going to a library or taking out a text book. They are getting information from the newspaper and from Proquest and other CD-ROMs. They like that more than going to the library. They like the technology because of the easier access. It gives them a broad range of information."

"Let me give you an example from my 8th grade communications class. They don't have PCs at home, but they are very creative in how we implement our curriculum. One of the things that we did was a book survey, where the kids asked the teacher and other kids questions about their favorite books. They worked in groups and it was a really great lesson using the technology. In general, they have really had innovative and creative ways of thinking."

"As opposed to hearing groans about an assignment, they are excited about 'where we are going to find it,' and 'if it's not here let's try down at the media center.' There is a sense of anticipation about how to go about researching."

Increased Collaboration

Teachers reported using the network to communicate with each other and with school administrators on a regular basis. Conversations took place about curriculum issues and ideas for collaborative projects. Some of the younger teachers reported using the network to seek advice from their more experienced colleagues. Teachers who were absent were able to communicate with their substitutes, a process that was important to maintaining continuity in the curriculum. And finally, teachers reported using the network to plan a series of workshops they conducted for parents on how to use electronic mail.

"I have to know what is going on with students and with regular classroom teachers. And I communicate using the network quite regularly to find out which themes they are working on, so that I can then provide reinforcement by supporting their instruction with my

students. If I am providing replacement instruction, it is even more important for my students, because I need to know exactly where the regular classroom teacher is. It has definitely become an invaluable tool that way."

"As a first year teacher I have used the network to ask some of the more experienced teachers: 'What did you do with this?' or 'How about an idea for this?' 'How do you think I can introduce this topic?' and 'What do you do about vocabulary?'"

"We planned the Saturday workshops over e-mail. We didn't have time to meet during the school day. The other teachers I did this with are on the third floor, and I am on the second floor. We used e-mail to write about ideas that we were going to present at the workshop. We would send each other ideas, and revise the ideas over e-mail and then we would coordinate our lessons that way. I even printed, as part of the lessons, some of the instructions we wrote online."

Effects on Administrator, Student and Parent Relationships

Teachers also used the network to communicate regularly with the school principal as well as with students and parents. Many of the decisions that affect the operation of the school are made at the school level. Teachers and administrators, with parents and students, make relevant decisions about goals, the curriculum and their own professional development. Through the use of the networked technology, Christopher Columbus' administrators, teachers and parents are working toward creating a unique school-based planning unit, and by all accounts they are making significant progress in this direction. Teachers are communicating regularly with the school principal. Students are using the network to ask for clarification on conceptual problems, and also to discuss matters that are of personal concern to them. Parents are communicating with teachers about their children's progress and most importantly, raising questions about issues that are a source of concern.

"When we have questions or ideas we always use the network to send them to the principal. And he gets back to us about this and that. [The principal] and I have been communicating a lot about organizing the new group of kids that are coming into the school. It has been really helpful."

"Certain kids are using the network to send messages like, 'Hi, how are you doing?' But other kids are sending messages like, 'I didn't understand a certain part, do I have to do it this way or that way?'

Three or four were parents writing, 'Do I have to come into that meeting?' 'Thank you very much for helping my daughter,' or 'Thank you for putting together this group or that group.' A lot of communication is taking place."

"There is communication I would have never had unless I had e-mail. One of my students, for example, is very quiet in class, but she is always e-mailing me. If you show interest in a kid, then things happen."

Perceived Benefits: The Emerson Teachers

Early in the winter of 1995-1996, CCT researchers asked participating Emerson School teachers to share their thoughts on the benefits and challenges of using technology. Although they have had the technology in place for only a few months, these teachers are taking full advantage of the Internet and multimedia resources.

Increased Collaboration

Like the Columbus school teachers, Emerson teachers noted the benefits of the technology as a tool for collaboration:

"Project-based work has become something that my students look forward to rather than a chore. I find that students are drawn together in an atmosphere of cooperation that is a valuable lesson for later life. It is great to see how the dynamics of a group brings out the leadership qualities in some students who otherwise would never have had the opportunity simply because of their expertise in the use of the computer and their ability to work with the Internet to find and contribute the research material that the group needs. I find that student collaboration is working well because they are able to contact each other through e-mail with ideas and information that might not have been shared without the use of technology."

Research and Writing

Teachers also spoke about improvements in students' written work as well as their motivation to undertake research and writing projects:

"Students are certainly more likely to edit their work since it doesn't entail complete rewriting. They are more motivated to write since their audience can be very real and specific. Last week the students wrote opinion letters to the Chatter column in the New Jersey section of the New York Times. We e-mailed the letters in. Although they were not published in this Sunday's paper, the students were very

interested in reading what other people had to say on the same topic. The issue was a ban in Bernards Township schools on carrying backpacks to class. My students had very strong opinions on this issue, as you might imagine. The lesson was very successful."

"In my Honors U.S. 1 class, I developed a unit on the Bill of Rights using the Internet. Each group was given a specific Amendment and had to report back to the class on certain Supreme Court cases that impacted that amendment. I suggested certain sites on the Internet where information could be located and asked that students work-up an oral presentation with one student presenting the arguments for the defendant and another the arguments for the State or plaintiff. They then presented the Supreme Court decision showing how the constitutionality of the law was upheld or not. My students could never have gotten such an opportunity to "invade" the minds of law professors, and others who had interests in these matters without the availability of the Internet."

"My inner city freshmen have been 'talking' to a group of kids from a small town in Wisconsin. They are fascinated by the ability to do so and by the kinds of things they are learning from each other. This contact was made through DoDDs. One of the kids came in one day and told me how she had contacted a class in Wisconsin. Excitement was generated and other students asked if they could use class time because there were only a few kids who had PCs at home. Of course we started the connection and it has been one of the reasons why I find less students being out of class. They look forward to coming in and seeing what has been written that day."

Support for Whole Language

Like the Columbus teachers, the Emerson faculty have found that the technology can be used to facilitate the goals and objectives of a whole language approach to learning.

"The technology helps the whole language approach to learning. I find that many times we are searching the Internet to find relevant information which is not necessarily math related. For example, just yesterday, we were working on finding sales tax information. I thought it would be fun for them to find what the rate of sales tax is in other states. They enjoyed researching this and many of them did not know that the sales tax rate is different in other states and that some states don't even have a sales tax."

Communication with Colleagues

Emerson teachers also talked about the importance of being able to communicate with colleagues.

"I know that the ability to e-mail other teachers after hours has helped tremendously to allow us to collaborate with each other. We are constantly sending each other new Web sites and communicating with each other on the events of the day, taking care of problems that would otherwise have fallen by the wayside."

"I have never had as much collaboration with other teachers as I have now. When we find sites of interest on the Internet, especially something that can be used in the classroom, we share the information with each other. And through e-mail this becomes so easy. We don't have to look for each other in school, or wait until we have free time together."

Home Access

Finally, Emerson teachers commented on the benefits of being able to communicate with students at home.

"An example of how I have been able to communicate with my students was during the recent blizzard last week. My freshmen have been working on term papers that involve an interdisciplinary project between the history and English departments. The history teacher suggests topics to coincide with what we are studying in history and the English teacher concentrates on the mechanics of the research paper form. Well, while we were stuck at home one of the girls e-mailed me in a panic because she was unsure of some of the specifics of what she was supposed to be doing. We had many talks that week in order to clear up those points in question and I was able to tell her how to contact her English teacher through e-mail. The problem was solved!"

"I also found it most helpful to contact a girl who was home sick and was worried that she would be left out of information she needed to take her Comprehensive exam the following week."

Year-end interviews were also conducted with administrators in the district, including: the principal of the Columbus School, the director of academic programs, and the assistant superintendent. The administrators were asked to talk about how the technology affected the attitudes of the teachers and students, how the administrators worked and communicated with teachers, and the challenges of implementing the trial. The administrators perceived many of the same benefits as the teachers, noting that the technology helped to enrich the whole language approach to learning and improve students' writing.

"A lot of our curriculum is research-based — therefore, the technology is a great support to the curriculum. "

"I went and observed two teachers. I would say that the technology is used as an integral part of their instruction and I have seen work products that exemplify the children's use of it."

The principal of Columbus school spoke about the effect of the network technology on opportunities to communicate with students. Students have been writing to him regularly, sharing problems that they confront in their home lives and asking for advice and solutions. In his own words:

"There is no question about it. I have met more beautiful children through the e-mail. There are three specific students that I think of that have made lasting relationships with me. Because they e-mailed me so much, I called them into my office because I wanted to know who they were. And they are dynamite kids. These kids do everything for me in the school — everything from soup to nuts. They want to be accepted by me. They like the fact that they can hang out with their principal. This would have never happened, if not for the technology."

Administrators also spoke about the positive effect the technology appears to have on teachers' attitudes and commitments towards their work.

"It has affected them in a very positive way. I find the teachers' attitudes to be positive because they now have this tool, and they are able to work with it. I think it has been a real positive thing for teachers."

"I believe they are more dedicated and more enthusiastic. There are a lot of peripheral issues associated — e.g., people coming in after school, and on weekends. They are still getting paid, but the number of participants compared to other schools has greatly increased."

In the fall of 1995, the principal of the Columbus School shared the following thoughts with CCT researchers:

"I am very proud to be the principal of Christopher Columbus School. This unique institution of learning exemplifies the future school. The technology trial continues to have a major impact in students' accessibility to knowledge. It is truly a school without walls. Accessing the Internet permits the acquisition of global knowledge. Students learn before, during and after school. Reform has and continues to evolve here. The technology which exists at Columbus allows everyone to have a chance to learn. The formula exists for success — teamwork, excellence, motivation, creativity and technology."

In addition, the Executive Director of Academic Programs firmly believes that communication between him and the teachers — particularly those at the Emerson school — has increased dramatically.

"Communication among the teachers and myself is much better than when the project was only at the Columbus School. Emersonians are using e-mail extensively, perhaps because it is a large school and they are less likely to have personal contact during the day. Peer sharing and assistance are happening on a regular basis at the Emerson School."

Finally, the district's supervisor of computer operations commented that:

"The project has been a catalyst for the district's journey on the information superhighway. The multimedia education trial made teachers, students and the community aware that technology integration into the curriculum can be a powerful tool in the learning process."

Perceived Difficulties: The Teachers' Viewpoints

No technology integration effort, particularly one of this magnitude, is without problems. There are approximately 200 computers that are being used in the project, and with the amount of machines in use there are bound to be breakdowns. At the beginning of the project

Bell Atlantic established an 800 number help-line, which was open six days a week from 8 a.m. to 10 p.m. The majority of problems were handled over the phone. However, in the early months of the trial, before regular on-site technical support was available, there were approximately 30 machines a week that required maintenance. When a technician was brought onto the trial working every other week, this number dropped to 15. The project now has one and a half full-time technicians who service machines in the schools and in homes. This has significantly decreased the number of machines requiring maintenance at any given time.

In addition to technical problems, the lack of software available for the trial machines was a problem for the teachers we interviewed. While the Microsoft applications and the Lotus Notes communications software were used extensively by the teachers and their students, the teachers expressed an interest in software that would support students in developing basic skills. One teacher commented, "I would like to see some other programs that are given with the IBM for the student to utilize and learn certain skills, or to enhance language, grammar, and composition-if there are programs available." Other teachers expressed an interest in obtaining bilingual software, "I'd like to have access to programs that are in Spanish for my Port of Entry students. I have children that are willing and motivated to learn. They use different programs, but I do not have one program in Spanish."

The introduction of the Internet in the Fall of 1994 has helped to alleviate this problem. Teachers and their students have identified many useful resources and CCT staff have assembled a comprehensive list of exemplary educational sites that are particularly relevant to the Union City curriculum.[9]

While technical difficulties and the availability of content resources have largely disappeared from teachers' list of concerns, other issues surface as the trial matures. First and foremost among these is time. The task of finding and identifying Internet sites is time-consuming, as is the task of how to practically use new information resources as part of the classroom curriculum. While the availability of the technology in teachers homes enables them to spend real time exploring and investigating the Internet, how to use such resources as an integral part of instruction is a challenge many teachers feel requires additional staff development. In addition, as new teachers come on board and as the technology changes there is a constant need for training.

Perceived Difficulties: The Administrators' Viewpoints

At the outset of the project, the administrators, like the teachers, were frustrated that the computers did not always function smoothly and that the network was not always up and running. They also voiced concerns about bringing more DOS-based software resources into the schools. While they recognized that much of the emphasis in the first phase of the trial centered around building and maintaining the network and the computers in the school and in students' homesthe administrators — like the teachers — wanted more emphasis placed on content. "So much of the emphasis has been, and I know there has to be, put on the wiring and working through telephone lines, but then there also has to be content."

Many of these concerns have been addressed in subsequent phases of the project. Because there is now on-site technical support, machines are repaired with greater speed than was the case in the past. In addition, access to the Internet and to resources available on the Web has brought a wealth of additional content resources into the district.

In addition, in the early phases of the project administrators spoke about the need for better channels of communication between the district, Bell Atlantic and the Center for Children and Technology. The complexity and magnitude of the trial, as well as differences between educational and corporate cultures, necessitate regular and open communication between all concerned parties. During fall, 1995, bi-weekly project meetings were held among all participants. Improved communication enabled the project team to move ahead with a comprehensive networking infrastructure plan for wiring the district's other schools.

Plans for the Future

One of the most notable consequences to result from the technology trial has been the rapid 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 scalable 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 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 $3 million over the next two years to build the technical infrastructure

and develop the human expertise necessary to support, maintain, and effectively integrate the technology into the curriculum.

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 libraries will be online. (See Appendix A.)

In collaboration with the EDC Center for Children and Technology and Bell Atlantic, the district will undertake a number of initiatives to develop teacher and student expertise. 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. Specifically, the following programmatic efforts will be implemented:

- **Community-based authoring course.**
  This will be offered as a for-credit summer course to 25 high school students during July of 1996. Students will carry out research projects in collaboration with local community-based organizations and business and design Web pages based on their projects.

- **Technical training seminars.**
  Teachers and students will be trained in the basics of technical trouble-shooting and repair. This course will be piloted during the summer of 1996 and implemented during the 1996-1997 school year.

- **Cultivate local technology experts.**
  Interested teachers from each school will work with CCT and district staff on developing and implementing school-based plans for providing technology training and ongoing support in the schools.

- **Development of Union City Online Web Site.**
  Teachers, students, parents and administrators will contribute content resources to the Web site shell that has been developed by CCT. 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 results of this technology trial strongly suggest that substantial and ongoing access to technology, coupled with a comprehensive program of educational reform, can lead to positive outcomes in students' learning and teachers' professional development. The trial has also provided an opportunity for the district to gain a sophisticated understanding of the resources that are required to sustain and grow this initiative. Bell Atlantic's investment in this trial is now being substantially extended through the school board's investment in Union City Online. In turn, Bell Atlantic has developed new expertise in partnering with public educational institutions in the development and implementation of innovative networking projects. As evidenced by the widespread public interest in this project, Union City serves as a promising exemplar of the potential of long-term school-corporate partnerships to support systematic and comprehensive educational reform.

Endnotes

[1] URL: http://www.edc.org/CCT/union_city/

[2] In 1988, the New Jersey State Legislature passed a law that requires that an early warning test be given to all eighth grade students in public schools in New Jersey in order to assess their progress toward mastery of the essential skills in reading, mathematics and writing.

[3] In the State of New Jersey Level 3 is the last stage of State monitoring prior to state takeover of the district. This is the level that the Union City District was placed in by the State. After State review in the fall of 1995, the district was taken out of Level 3.

[4] See 1993-1994 Summary Report: Union City Interactive Multimedia Education Trial for a comprehensive description of the Columbus School.

[5] See 1993-1994 Summary Report: Union City Interactive Multimedia Education Trial for a comprehensive description of the 1993-1994 training.

[6] The wiring of the Union Hill High School is being made possible through National Science Foundation funds.

[7] America Online is currently being used by the district to ensure that there is equity in access, across district schools, to the Internet. As the district expands the networking infrastructure to all schools, AoL accounts will be replaced with direct access to the Internet.

[8] Practice Early Warning Tests are not required by the state of New Jersey. It is Union City's policy to administer practice EWT's to their seventh grade students as a way of identifying the strengths and weaknesses in student knowledge and skills in preparation for the official EWT.

[9] URL: http://www.edc.org/CCT/ccthome/links/

Appendix A

Founding Project Team Leaders

John Grady — Formerly, Bell Atlantic Video Services

Ellen Dotto — Bell Atlantic, New Jersey

Jan Hawkins — Education Development Center
  Center for Children and Technology

Marc Clark — Formerly, Bell Atlantic Video Services

Bell Atlantic

Kathy Tully — Project Manager, 1995-1996

Rahman Karriem — Project Manager, 1994-1995

Rod Bowers — Project Manager, 1993-1994

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Union City Board of Education

Tom Highton — Superintendent

Frank Vaccarino — Assistant Superintendent

Carl Johnson — Secretary

Fred Carrigg — Executive Director of Academic Programs

Gary Ramella — Supervisor of Computer Operations

Robert Fazio — Principal of Christopher Columbus School

Al Higuera — Principal of Emerson High School

William Dorsett — Assistant Principal of Emerson High School