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ABSTRACT

This report examines the impact of the Utah Educational Technology Initiative (ETI) on student performance and student access to computers during the initial year of implementation in the 1990-91 school year. Chapter 1 describes ETI goals, the goals of the evaluation report, the concept of portfolio analysis, and organization of the report. An overview of school district ETI proposals is provided in Chapter 2, including details on goals, dates of operation, and funding levels. Chapter 3 discusses the impact of the ETI on student performance, including statewide testing results, ETI coordinators' reports, principals' reports, results of a Salt Lake City evaluation of district ETI projects, and school administrator and teacher perceptions. The impact of the ETI on student computer use is discussed in Chapter 4, including changes between 1990 and 1991 in the number of computers available to students, the computer/student ratio, the amount of time students use computers, and the number of schools using computers in instruction. Chapter 5 presents a case study of the Salt Lake City School District that addresses ETI planning, project descriptions, constraints, and evaluation. Recommendations related to teacher training/support and computer use policies are offered. The appendixes include student performance goals for reading, writing, language arts, mathematics, and science; examples of students writing; and examples of writing assignments. (MES)

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ED 370 527

BERYL BUCK INSTITUTE FOR EDUCATION

"Knowledge exists to be imparted" Ralph Waldo Emerson

A Portfolio-Based Evaluation of Utah's Education Technology Initiative

1990-1991 School Year

by

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EXECUTIVE SUMMARY

Since 1990, the Utah Educational Technology Initiative (ETI) has made available approximately 28.9 million dollars to Utah school districts and colleges of education. In addition, school districts and colleges of education have matched this funding with one dollar of their own funds for every three dollars they have received from ETI. Utah businesses and technology vendors have also contributed to the Utah Educational Technology Initiative by selling hardware and services at discounts or by providing staff training. In total, the resources that have been devoted to educational technology approximate 37 million dollars during the 1989-90 and 1990-91 school years.

This document examines the impact of ETI on student performance and student access to computers during the initial year of implementation in the 1990-91 school year. Key findings include:

- Elementary schools scoring below the mathematics and reading scores predicted for them on the Utah Statewide Testing Program in 1990 were more likely to score above their predicted mathematics and reading scores in 1991 if they had ETI projects operating for at least one semester;
- School district personnel believe they have seen important changes in student learning, motivation, and performance as a result of ETI projects;
- Teachers are extremely enthusiastic about the instructional opportunities ETI funding has provided them;
- In elementary schools receiving funding during the initial year of ETI, the average computer to student ratio has declined from 22 to 1 during the 1989-90 school year to 11 to 1 during the 1990-91 school year, although this varies widely from school to school;
- In high schools receiving funding during the initial year of ETI, the average computer to student ratio has declined from 10 to 1 during the 1989-90 school year to 7 to 1 during the 1990-91 school year, although this varies widely from school to school;
- Most of the time students spend on a computer is directed by a teacher rather than managed by an Integrated Learning System;
- In elementary schools receiving funding during the initial year of ETI, the average student spends approximately 60 minutes a week using a computer, although this varies widely from school to school;
- In high schools receiving funding during the initial year of ETI, the average student spends approximately 135 minutes a week using a computer, although this varies widely from school to school.

Further evaluation reports will examine teachers' reports of the impact of ETI on their instruction, and the role of ETI in school improvement efforts.

ACKNOWLEDGEMENTS

This document is the product of the work and good will of a number of different individuals, and I would like to thank them for their contributions. Special thanks go to the Utah Educational Technology Initiative staff, Dr. Curtis Fawson, Project Director and Nedra Kissling, Administrative Assistant. Their help has been invaluable. In addition, district ETI Coordinators, school administrators and classroom teachers have given of their time, invited us into their schools, and completed our questionnaires. Without their cooperation, the evaluation team would have little to report. We are grateful for their consistent willingness to sandwich our requests for information into already stretched and burdened schedules.

The members of the Beryl Buck Institute for Education evaluation team deserve particular recognition. Dr. Trish Stoddart, Assistant Professor of Educational Studies at the University of Utah, made major contributions to the design of this evaluation, conducted the case studies, and has been invaluable as field coordinator and liaison with Utah schools. Dr. Stoddart is the principal author of chapter 5. Dean Bradshaw was responsible for the analysis of school district ETI proposals, and for collecting general information about the impact of ETI on schools. He has also played a key role in the graphic design and presentation of the evaluation findings. As data manager and analyst, Dale Niederhauser earned the respect (if not the enmity) of the post office, as boxes upon boxes of teacher and administrator surveys arrived at his home. Two additional capable individuals contributed to the data analysis. Dr. Colin Sacks conducted the analysis of Utah Statewide Testing Program Data, and Dr. Andrea Lash served as the project's statistical consultant. Dr. Carolyn Horan, the Executive Director of the Beryl Buck Institute for Education, was responsible for the overall management of the project, and made important contributions to the evaluation plan. Without Marie Kanarr, this evaluation would be unreadable. Marie transcribed interviews, prepared tables and text, and made untold contributions to the evaluation team.

To all, thank you.

John Mergendoller
Novato, California
January 30, 1992

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CHAPTER 1:
The Utah Educational Technology Initiative and This Evaluation

The State of Utah has made significant and substantial investments in educational technology. Beginning with the Productivity Grants in 1981, money has been made available to school districts for technology procurement and implementation, and has been used to initiate numerous technology projects. With the passage of the Utah Educational Technology Initiative (H. B. 468) in 1990 and its modification in 1991 (H. B. 344), the Utah Legislature has demonstrated its commitment to strengthening and modernizing Utah education, believing that educational technology has the potential to increase student achievement, improve school functioning, influence curriculum change, contribute to teachers' professional growth, and help create an informed, capable, and productive work force.

Since 1990, the Utah Educational Technology Initiative (ETI) has made approximately 28.9 million dollars available to Utah school districts and colleges of education for the purchase of educational technology and the training of teachers to use this technology. In addition, it has required school districts and colleges of education to match the Utah Educational Technology Initiative funds they receive on a 1 to 3 basis with their own locally generated funds or through in-kind services, including the establishment of necessary infrastructure, planner services, training services, maintenance or technical assistance. Utah businesses and technology vendors have also contributed to the Utah Educational Technology Initiative through grants and by selling hardware and installation services to school districts and colleges at discounts or by providing staff training and other support services. In total, the resources that have been devoted to educational technology is approximately 37 million dollars.

This document is the first in a series of evaluation reports that seek to describe how the Utah Educational Technology Initiative has been implemented in Utah school districts and its impact on teachers and students.

What were the Goals of the Utah Educational Technology Initiative?

The goals of the Utah Educational Technology Initiative were diverse and are displayed on Table 1.1. As can be seen, these goals are far reaching and involve all parties connected with Utah education. The projects implemented to reach these goals are diverse. They differ in areas of emphases, the grade levels and types of schools in which they function, and the technology they provide to teachers and students. This evaluation is sensitive to differences among each project's goals and functioning, without losing sight of the common evaluation criteria specified in the legislation. Its analysis will be useful to educational policymakers, in the school house as well as the State House, and its conclusions must help the diverse parties interested in Utah education understand and appreciate the contributions that educational technology can make to the process of education.

What are the Goals of This Evaluation Report?

At this stage in the implementation of a complex educational program, a formative emphasis is entirely appropriate: most educators feel an innovative project must be operational for several years before all of the "bugs" are worked out, and it begins to have full impact on students and teachers. The first goal of this evaluation, then, is to:

- provide information about the progress made and problems encountered by schools, school districts, and colleges of education during the initial year (1990 - 1991) of the Utah Educational Technology Initiative.

It is hoped that this information will help school personnel fine-tune their own projects, and learn from the accomplishments and impediments of their colleagues.

In addition, we will provide more detailed information about the impact of the Utah Educational Technology Initiative on:

- *student performance* and *student access* to educational technology, Goals numbered 3, 2, and 8 on Table 1.1.

Table 1.1: Goals of the Utah Educational Telchnology Initiative

1. Stimulate economic development through an improved educational system, thereby enhancing equal access to a quality education for all.

2. Provide greater access to technology resources by teachers and students.

3. Use technology effectively to increase student competencies in reading, math, and language arts.

4. Strengthen the quality of technology in-service and pre-service teacher training programs.

5. Bring together the resources of government education, and private business into a partnership providing quality education for schools through technology.

6. Identify ways technology applications can be used to upgrade the basic skills of students entering the work force.

7. Enhance teacher effectiveness through increased opportunities for personalization, remediation, and personal involvement.

8. Increase student motivation and active involvement in learning.

ETI Evaluation RFP, October 1991

Future reports, including the Year End Report due June 30, 1992 will fill in details and provide additional information about the impact of the Utah Educational Technology Initiative on Utah's schools and colleges of education.

What is Portfolio Analysis?

The Utah Educational Technology Initiative Evaluation is built around the central concept of *portfolio analysis*, an evaluation method that incorporates collection of diverse types of data and enables a number of types of evidence to be used to gauge accomplishments. Although portfolio assessment is a relatively recent innovation in the field of evaluation, the general model derives from other situations where complex activities and performances are appraised from a variety of perspectives. For example:

- An investment portfolio may be assembled using a variety of financial instruments such as certificates of deposit, stocks, and bonds. Portfolios will differ in composition because they are created to reach differing goals, but they can be evaluated according to common criteria such as yield, stability or ease of access.

A portfolio implies a collection. In the example above, it is a collection of financial instruments. In the Utah Educational Technology Initiative, it is a collection of projects. In this evaluation, it is also intended to imply a collection of different types of evidence about project accomplishments. As we examine the success of ETI in meeting its goals, we will rely upon a number of types of data -- reports from principals, analyses of student achievement scores, examples of student work, and the testimonies of those closest to the projects -- the teachers, principals, and students whose access to Educational Technology has been greatly enhanced by ETI. After considering each type of data individually for evidence of impact, we will consider them collectively, and attempt to clarify commonalities and contradictions.

There is another evaluation implication in the word, portfolio, an implication that can be illustrated using the example of the financial investment portfolio described above. Just as one would not expect stock performance to be measured against Moody's Corporate Bond Averages, or criticize a portfolio of certificates of deposit because it is difficult to get ready access to capital, we would not expect a school-based project that first emphasized automating teachers' daily record keeping and planning chores to have an immediate or direct impact on student outcomes. Evaluation criteria must be sensitive to and appropriate for the goals of the projects implemented.

How is the Report Organized?

The remainder of this report contains six chapters. In Chapter 2 we will describe in general terms the projects implemented by Utah school districts, discuss briefly the obstacles many of the districts encountered in implementing their ETI Proposals, and examine the funding made available to each district. Chapter 3 focuses on the initial impact of the Utah Educational Technology Initiative on student performance. Chapter 4 examines the initial impact ETI has had on student access to Technology. Chapter 5 is a case study of how the Salt Lake City School District responded to the opportunity afforded by the ETI legislation. This case study emphasizes how the district made decisions about the apportionment of ETI money, and how the ETI funds fit with ongoing district technology plans. Chapter 6 summarizes the progress of the Utah Educational Technology Initiative during the 1990-1991 school year and makes a recommendation for future program direction.

Where is the Methodology Section?

To make this evaluation report more accessible, we have included minimal methodological details in each chapter. Readers will find more information about how the evaluation has been conducted in the section entitled "Methodological Notes" following Chapter 6.

CHAPTER 2:
An Overview of School District ETI Proposals

The preparation and passage of HB 468 impelled Utah school districts and colleges of education to begin planning the implementation of Educational Technology Projects. These projects were generally far-reaching in scope, and complex in their design. Many districts focused their planning efforts at the site level. Other, often smaller districts, carried out their planning activities in the district office. Some districts included both centrally- and site-planned activities in the same project.

Although proposal specifications had been developed by the ETI Steering Committee, these were meant more as basic guidelines than rigid requirements. Both the legislation and the ETI Steering Committee sought to give districts the freedom they needed to implement ETI projects that would best serve their individual needs. Once a district's ETI proposal was complete, it was reviewed by the ETI Technical Review Committee, a subcommittee of the ETI Steering Committee. The Review Committee approved some plans as submitted. Others were returned for revision, and received approval once appropriate changes had been made.

Within this environment school districts developed forty different plans. While no set of district goals can be labeled as "a typical example", the Technology Goals from the Logan City School District ETI plan are representative.

1. *Utilize technology as an effective tool for teaching, learning, and management in the classroom, and in the media centers.*
2. *Integrate the use of technology with the school curriculum, especially in the areas of mathematics, reading and language arts, including identification of supporting hardware and software.*
3. *Identify technology components and configurations that will support identified instructional goals.*
4. *Increase learning opportunities and outcomes for students in the areas of mathematics, reading and language arts, by utilizing curriculum supported by technology.*

5. *Provide inservice for professional educators in utilizing technology.*
6. *Evaluate the uses of technology as implemented under this technology initiative.*

Like other districts, Logan emphasized the curricular areas designated in HB 468, and stressed the importance of integrating educational technology within subject areas. The proposal recognized the importance of preparing teachers to use educational technology to make their work lives more efficient and to use computers in their daily instruction. The proposal acknowledged the important role the district office plays in supporting the teachers and students who use educational technology each day.

What were the Goals of School District ETI Projects?

The goals[1] listed by each Utah school district in its ETI Proposal are displayed on Table 2.1. It is interesting to note differences in the number of goals specified by each District. Districts such as Logan, Nebo, South Summit, Wayne, and Weber prepared proposals that were quite comprehensive in their aspirations, including 75 percent or more of the goals listed on Table 2.1. Districts such as Box Elder, Duschene, Park City, Provo, and Uintah were more focused in their approach, including no more than 35 percent of the goals on Table 2.1. The 30 remaining Utah school districts fell between these extremes, with the average school district proposal enumerating approximately 11 goals. The frequency with which the different goals are represented in the proposals is displayed on Figure 2.1. As can be seen, all districts noted that teacher inservice was a key part of their ETI plan. In addition, the intention to increase student performance in elementary math, secondary math, elementary reading, and secondary reading was found in nearly all proposals. These areas were specified for emphasis in the initial ETI legislation.

Seventy-two percent of the districts listed increasing student access to computers as a goal, and 70 percent indicated they would provide necessary technical support to schools. Almost two-thirds of the districts said they intended to enable teachers to have easier access to computers. In contrast, goals such as vocational training, developing partnerships, improving thinking skills, and elementary science were mentioned in a minority of proposals.

Table 2.1 School District ETI Project Goals

	Improve Reading		Improve Writing		Improve Language Arts		Improve Math		Improve Science		Improve Computer Skills	Improve Vocational Training	Improve Thinking Skills	Improve Other Curriculum	Increase Technology Access		Provide Teacher Inservice	Provide Technical Support	Increase Central Services	Develop Technology Partnerships
District	E*	S*	E	S	E	S	E	S	E	S					Student	Teacher				
Alpine	■	■	■	■	■	■	■	■							■	■	■		■	■
Beaver	■	■	■	■	■	■	■	■						■			■			
Box Elder	■				■	■	■	■									■			
Cache			■	■	■	■	■	■	■	■	■		■	■			■			■
Carbon	■		■			■	■	■						■		■	■	■		
Daggett	■	■	■	■	■	■	■	■	■	■							■			
Davis	■	■	■	■	■	■	■	■							■	■	■	■		■
Duchesne	■	■					■	■					■		■		■			
Emery	■	■					■	■							■	■	■	■	■	
Garfield	■	■					■	■							■		■			
Grand	■	■	■	■	■	■	■	■							■	■	■	■	■	
Granite					■	■	■	■							■	■	■	■	■	
Iron	■	■			■	■	■	■							■		■	■	■	■
Jordan	■	■			■	■	■	■			■		■	■	■	■	■	■	■	
Juab	■	■	■	■			■	■			■		■		■		■	■		
Kane	■	■	■	■		■	■			■	■		■			■	■			
Logan	■	■	■	■	■	■	■	■	■	■		■		■	■	■	■	■		
Millard	■	■	■	■			■	■					■		■	■	■	■	■	■
Morgan	■	■			■	■		■			■				■	■	■			
Murray	■	■	■	■			■	■	■	■					■	■	■	■	■	■
Nebo	■	■	■	■	■	■	■	■			■	■		■	■	■	■	■		■
N Sanpete	■	■	■	■			■	■							■	■	■	■		

Note: *E = Elementary; S = Secondary*

Table 2.1 School District ETI Project Goals
(Continued)

	Improve Reading		Improve Writing		Improve Language Arts		Improve Math		Improve Science		Improve Computer Skills	Improve Vocational Training	Improve Thinking Skills	Improve Other Curriculum	Increase Technology Access		Provide Teacher Inservice	Provide Technical Support	Increase Central Services	Develop Technology Partnerships
District	E*	S*	E	S	E	S	E	S	E	S					Student	Teacher				
N Summit	■	■	■	■	■	■	■	■							■	■	■	■		
Ogden	■	■					■	■	■	■		■					■	■		
Park City	■	■					■	■			■		■				■			
Piute	■	■					■	■			■			■			■	■		
Provo	■						■							■	■		■			■
Rich	■	■	■	■			■	■	■	■	■	■				■	■	■	■	
Salt Lake City	■	■	■	■			■	■							■	■	■	■		
San Juan	■	■	■	■			■	■					■		■	■	■	■	■	
Sevier	■	■			■	■	■	■									■	■		
S Sanpete	■	■					■	■							■	■	■	■	■	
S Summit	■	■	■	■	■	■	■	■	■	■	■				■	■	■	■		
Tintic	■	■	■	■			■	■							■		■	■		
Tooele	■	■			■	■	■	■	■	■				■	■	■	■	■		
Uintah	■	■					■	■							■	■	■			
Wasatch	■	■					■	■							■	■	■	■		
Washington	■	■					■	■					■	■	■	■	■	■		
Wayne	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■		
Weber	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■		■

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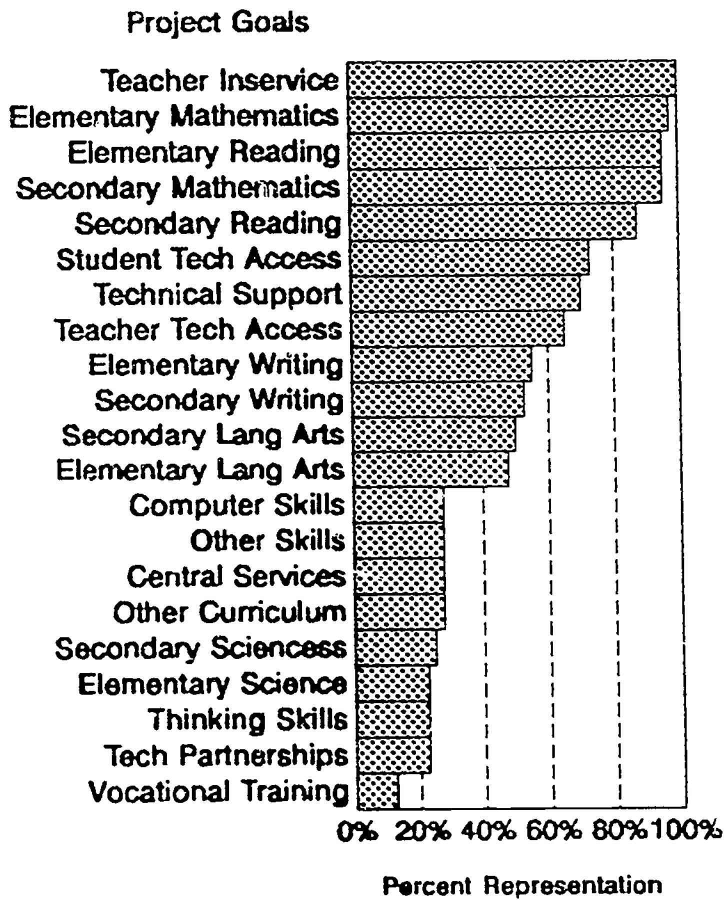
Note: *E = Elementary; S = Secondary*

Figure 2.1: Representation of ETI Project Goals Across 40 School Districts



Data from Project Proposals

Of the districts that wrote student performance goals in reading, math, writing, language arts, and science, 33 listed specific student gains that they intended to achieve for one or more of the five above-mentioned curricula. These goals are summarized in Appendix A: Student Performance Goals for District Educational Technology Initiative Project.

Districts used a number of strategies to address their goals. Many schools, both elementary and secondary, installed or augmented computer labs. Others placed computers in classrooms for both teacher and student use. Some districts networked their computers to a central file server. Others relied on independent machines. Some districts purchased Integrated Learning Systems in which the software -- rather than a teacher -- manages student instruction. Others relied on teachers -- rather than technology -- to engage students with the computer. Some schools installed computer labs that were largely dedicated to a single subject such as mathematics or writing. Others purchased graphing calculators for use in geometry and advanced mathematics classes. Many supplemented the traditional instructional resources of textbook and blackboard with video disk players and large format monitors. Presentation devices that work with overhead projectors to display what is happening on the computer screen were also popular purchases, especially in schools that established central computer labs. One district, Duchesne, elected to use the ETI funding to expand its distance learning capability using two-way interactive television technology.

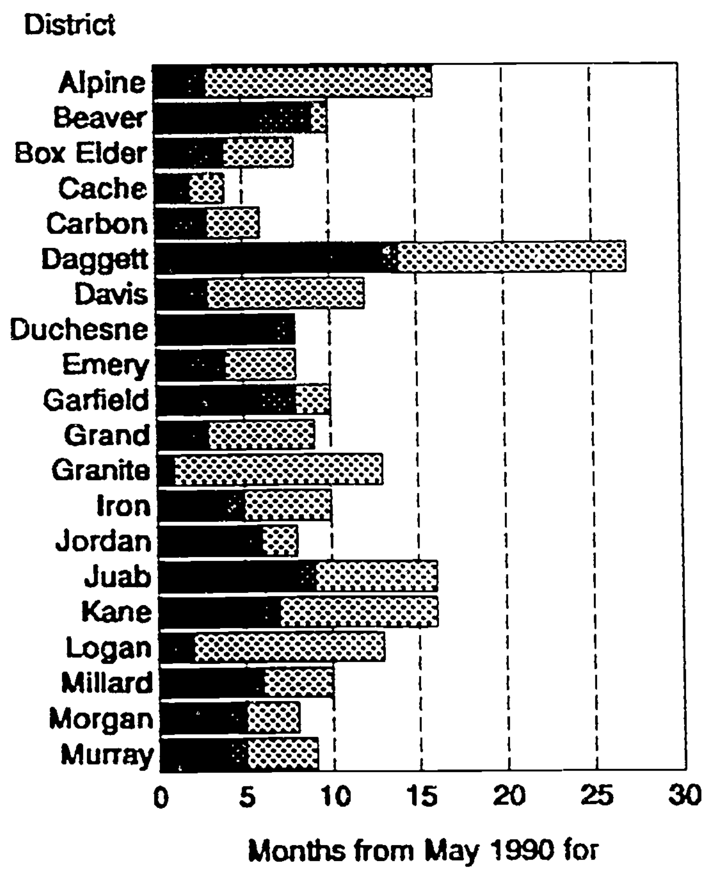
When were School District ETI Projects Operational?

Although some school districts had received approval for their ETI Proposals during the summer of 1990, many continued to develop their plans in the course of the 1990 - 1991 school year[2]. Plan development and implementation required setting goals, choosing the technology that would allow them to reach their goals, procuring the equipment, making the necessary site modifications that would allow the equipment to be installed, and installing the cabling and/or software programs needed to make the technology operational. Many school districts experienced vexing, unexpected delays in implementing their plans. Alpine School District, for example, had to delay equipment purchase several months because a new generation of computers, with increased capabilities and more attractive power/price ratios, was about to released. Once these new machines were available, demand exceed supply, and the equipment was placed on back order for several months. Several districts had to do major construction or remodeling of their already overcrowded schools to create a lab for the new computers. Many schools were disappointed by the service they received from network vendors who were not familiar with the specific demands of educational networks. Numerous educators experienced networks that "crashed," and then were unable to receive prompt or effective service. The Educational Technology Coordinators in some of the larger Utah school districts often found themselves overwhelmed by the questions and requests for assistance with the arrival of the new technology. Other ETI Coordinators found they had to do major parts of the equipment installations themselves, and they sandwiched these new tasks in the midst of their already full schedules as district computer or media specialists.

There were also districts where the plan was swiftly completed and approved by the Board, approved by the ETI Steering Committee, and where equipment arrived and was installed without delay. These districts, as Figure 2.2 demonstrates, were in a minority. It took the average Utah school district 11 months to fully implement the activities originally planned for the 1990 - 1991 school year. In other words, the average district technology project was fully functional in April, 1991, with two months remaining in the school year. No district implemented their project in less than four months, and some districts are still in the process of fulfilling the plans they made for the first year.

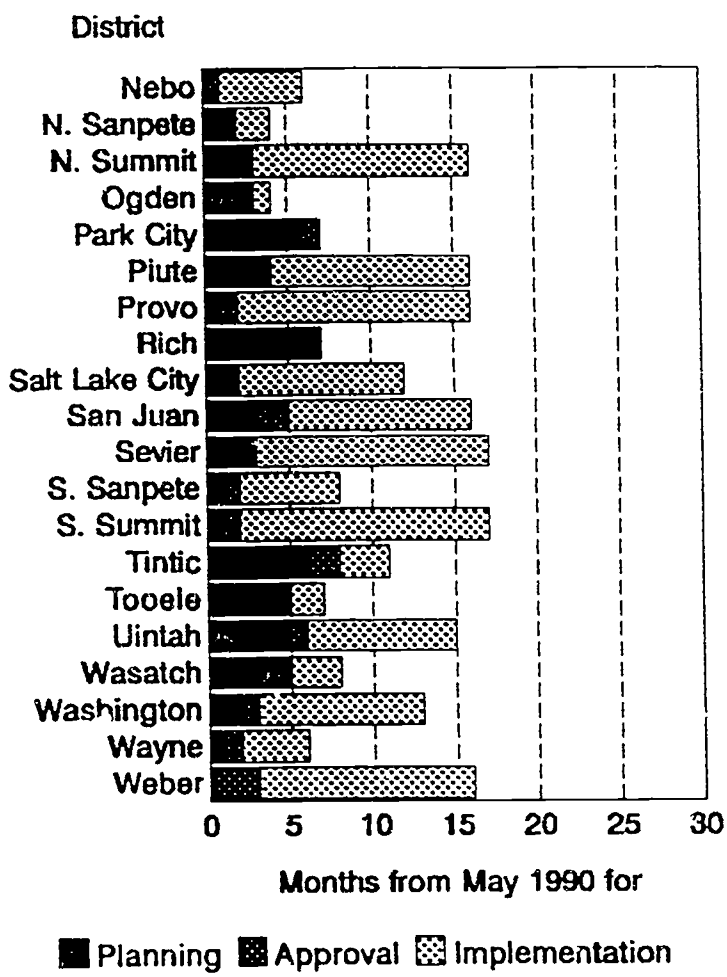
Many districts planned to implement their ETI projects in phases, thinking that it was better to install complete computer facilities in a small group of schools, than to install incomplete computer facilities in all schools. This approach ensured hardware compatibility, since at least one new generation of computers will be introduced during the expected four-year funding of the Utah Educational Technology Initiative. These new computers may not be entirely compatible with the current generation. In addition, this strategy provided some schools with the critical mass of computers and other educational technology needed to be immediately usable. Thus, districts with phased plans intentionally did not address the needs of all of their schools in the 1990 - 1991 school year, and scheduled other schools for attention in subsequent funding years. This must be borne in mind when reading this evaluation which only considers schools benefiting from ETI funding during the 1990 - 1991 school year.

Figure 2.2: Implementation Timeline



Data From ETI Coordinators

Figure 2.2: Implementation Timeline (continued)



Data from EII Coordinators

How much did ETI Projects Cost?

According to HB 468, 25 percent of the $13,365,000 allocated to Utah school districts was to be divided equally across all districts. This provided a funding floor, and ensured that all districts, regardless of their enrollment, would receive adequate resources to undertake a significant technology project. The remaining 75% of the ETI money allocated to school districts was divided based on the ratio of each district's estimated average daily membership to the Utah total average daily membership for 1989 - 1990 school year. In addition, districts were expected to match this appropriation with one dollar in local resources for every three dollars of state funding. Local resources could include in-kind services as well as donations from individuals and partnerships with local businesses.

The 1990 - 1991 ETI funding made available to districts, the matching funds generated by each district, each district's 1990 - 1991 average daily membership, and the total dollars (including both ETI and local matching funds) allocated on a per student basis are displayed on Table 2.2[3].

The largest ETI allocation ($1,857,247) went to Granite School District which enrolled almost 18 percent of Utah's students. The smallest allocation ($87,664) went to Daggett School District with less than 0.05% of Utah's students. Looking across all districts, the average allocation was $334,125, or $30 per student. When the matching funds raised by each district are added to the ETI allocation, the total becomes $28,650,664 or $65 per Utah student.

A district's average daily membership significantly affected the resources available for technology expenditures. Rural districts with small enrollments benefited the most on a per-pupil basis, given the legislative funding formula and match requirements. Looking only at ETI allocations, Daggett and Tintic School Districts each received approximately $700 per student – enough to buy a computer, monitor and hard drive for every student. Piute School District received over $200 dollars per student. In contrast, Jordan, Granite, and Davis School Districts received less than $50 dollars per student – enough to buy floppy disks for each student in two elementary classrooms.

Table 2.2 District ETI Funding Levels - 1990-1991 School Year

Districts	ETI Dollars	Matching Dollars	Student Enrollment	Dollars Per Student
	1990-1991	1990-1991	1990-1991	1990-1991
Alpine	964,513	3,156,993	38,853	106
Beaver	114,609	37,821	1,369	111
Box Elder	331,623	230,984	10,942	51
Cache	364,342	578,051	12,429	76
Carbon	205,330	101,777	5,232	59
Daggett	87,664	35,363	184	669
Davis	1,312,141	5,038,218	54,558	116
Duchesne	178,808	75,187	4,191	61
Emery	166,606	144,824	3,525	88
Garfield	109,228	50,200	1,103	145
Grand	118,069	67,130	1,440	129
Granite	1,857,247	1,060,977	78,554	37
Iron	202,958	210,000	5,144	80
Jordan	1,545,897	634,442	64,964	34
Juab	119,579	41,000	1,581	102
Kane	116,470	67,834	1,408	131
Logan	207,810	91,354	5,704	52
Millard	170,461	44,535	3,747	57
Morgan	123,866	116,212	1,794	134
Murray	228,115	95,000	6,475	50
Nebo	459,716	258,442	16,393	44
N. Sanpete	135,883	65,629	2,280	88
N. Summit	104,183	52,433	906	173
Ogden	350,284	453,799	12,109	66

Table 2.2 District ETI Funding Levels - 1990-1991 School Year
(Continued)

Districts	ETI Dollars	Matching Dollars	Student Enrollment	Dollars Per Student
	1990-1991	1990-1991	1990-1991	1990-1991
Park City	123,309	46,537	1,983	86
Piute	92,169	30,445	363	338
Provo	381,542	353,733	13,564	54
Rich	95,895	175,239	542	500
Salt Lake City	632,559	674,514	24,766	53
San Juan	162,263	98,711	3,447	76
Sevier	192,340	119,775	4,746	66
S. Sanpete	144,317	62,780	2,708	76
S. Summit	107,462	35,821	1,030	139
Tintic	88,651	73,191	231	701
Tooele	246,955	182,000	7,172	60
Uintah	228,545	230,000	6,580	70
Wasatch	151,441	179,059	2,980	111
Washington	375,978	165,723	13,277	41
Wayne	98,249	32,750	619	212
Weber	667,923	265,997	25,859	36
Total Across All Districts	13,365,000	15,434,480	444,752	NA
Average Across All Districts	334,125	385,862	11,119	65

Table 2.2 also demonstrates the power of match dollars to amplify the funds available for ETI Projects. Alpine School District received more than three match dollars for every one dollar of ETI funds.

Summary

Utah school districts generally sought to address a substantial number of goals in their ETI proposals. They encountered a number of problems and delays in making their plans operational, and most were unable to actually initiate their projects before the end of the 1990 - 1991 school year. The combination of ETI and matching funds contributed by local school districts equaled approximately $65 for each Utah student.

CHAPTER 3:
The Initial Impact of the Utah Educational Technology Initiative on Student Performance

Portfolio analysis is a methodology that considers a number of different types of information regarding a single outcome before reaching a conclusion. This chapter considers the following evidence about the impact of the Utah Educational Technology Initiative on student performance:

- Results from the 1990 and 1991 Utah Statewide Testing Program;
- Reports from ETI Coordinators;
- Reports from Principals in schools receiving ETI funding;
- An evaluation conducted by Salt Lake City School District of local ETI Projects; and
- Data collected in interviews and site visits to schools receiving ETI funding.

Following a review of these data, we will draw some initial conclusions about the impact of the Utah Educational Technology Initiative on student performance.

Can the Impact of ETI Projects Be Seen in Utah Statewide Testing Results?

Since the Utah Educational Technology Initiative emphasized the subject areas of reading and mathematics, we focused on these two areas in the analysis of Utah Statewide Testing Program results. We tailored our analyses to take into account a number of program implementation problems and technical concerns regarding the nature of the data available for analysis. At the outset, we did not expect to find evidence that ETI projects had an impact on standardized achievement scores. There were two reasons for this. First, the projects have not been in operation long enough for initial bugs and inevitable startup problems to be resolved. Secondly, there is often a poor match between the specific skills measured by standardized tests and the actual implementation of the project by specific schools. We found, however, credible evidence that ETI projects can affect student achievement as measured by standardized achievement tests. In the sections below we describe how we conducted the analysis and our findings.

Background: How are school test scores calculated? The Utah Statewide Testing Program requires that the Stanford Achievement Test be given to all Utah students enrolled in grades 5, 8 and 11. Following this administration, scores for individual schools are calculated by combining the results from all students at a single grade level. School scores are not based on the achievement of all students in the school, but only on the achievement of students in a single grade.

Whatever the grade level, the school score represents the achievement of the median student in that grade in that school. In other words, if 101 fifth graders in a single school took the SAT, and the students were ordered on the basis of their scores from lowest to highest, the median score would be that attained by the 51st child.

How do students' family backgrounds affect school test scores? It is well known that, in general, students who come from less advantaged backgrounds score lower than their wealthier peers. Differences between the test scores of two schools may reflect differences in the background of the students who attend the school, rather than how well the schools are educating children. Consequently one must be careful when comparing schools enrolling a higher proportion of affluent students with schools enrolling a higher proportion of less affluent students.

To account for this, the Utah Statewide Testing Program predicts the median score that can be expected of each school based on the relative income of the students that attend the school. This predicted median score represents what the average school with similar students would be expected to attain. Like all mathematical predictions, the predicted median is that of a hypothetical, "average" school. In reality, many schools perform better or worse than would be predicted on the basis of their students' backgrounds alone.

To better estimate how well schools are performing relative to the score predicted for them on the basis of their student population alone, the Utah Statewide Testing Program also calculates an expected range of performance. This expected range contains approximately 67 percent of the schools with similar types of students. One half of the schools in the expected range (33.5% of all schools) can be expected to have achievement scores that place them above the predicted median. The remaining one-half of these schools (33.5% of all schools) are expected to have achievement scores that place them below the predicted median.

What schools were included in the analysis of Utah Statewide Testing Program results? As noted in Chapter 2, there were many unavoidable delays in Districts' implementations of Educational Technology Projects. If one is to evaluate the impact of the ETI on student performance, one must be sure that students have had the opportunity to be adequately exposed to ETI projects. Moreover, the ETI project should emphasize reading or mathematics. With the help of the ETI Coordinators we distinguished schools that met the following criteria:

- The ETI project was fully operational no later that January 1991, and had functioned without problem from at least January to June 1991;
- The ETI project focused on grades 5, 8 or 11 -- the grade levels assessed by the Utah Statewide Testing Program; and
- The ETI project concentrated on the areas of Mathematics and Reading -- two subject areas assessed by the Utah Statewide Testing Program.

From these conversations we identified a sample of 64 schools in 16 school districts -- 43 elementary schools, 11 junior high or middle schools, and 10 high schools. We considered these schools the "ETI treatment group."[4] Schools not included in the treatment group were part of the "control group." The control group included 409 elementary schools, 137 junior high or middle schools, and 107 high schools.

How were the test scores of schools in the ETI treatment group and the control group analyzed? Given the relatively small number of junior high/middle schools and high schools in the ETI treatment group, we omitted them from further analysis, and focused on the 43 elementary schools.

Our first step was to classify schools' 1990 and 1991 SAT scores for mathematics and reading as falling into one of four achievement groups shown on Figures 3.1, 3.2, 3.4, 3.5:

- Above the expected range of achievement predicted on the basis of student composition alone (labeled "Above Expected Range");
- Between the score predicted on the basis of student composition alone and the upper bound of the expected achievement range (labeled "Pred Score to Uppr Bnd";
- Between the lower bound of the expected achievement range and the

score predicted on the basis of student composition alone (labeled "Lowr Bnd to Pred Score"); and

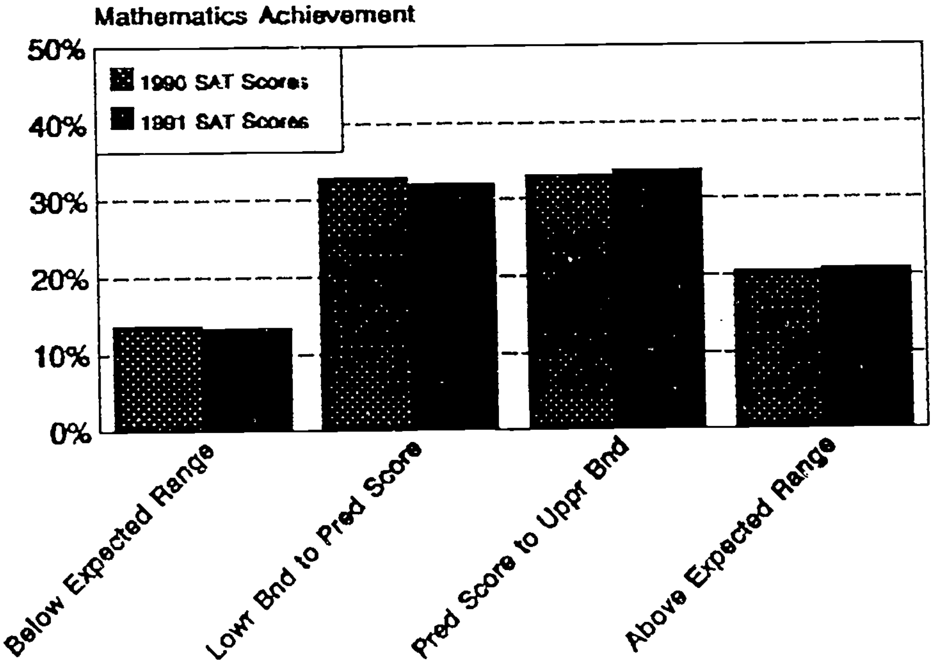
- Below the expected range of achievement predicted on the basis of their student composition alone (labeled "Below Expected Range").

Did the ETI have an impact on mathematics achievement? We indentified 409 elementary schools that did not meet the criteria established for the ETI treatment group. These 409 elementary schools provide a control group for the schools in the ETI treatment group. The relative mathematics performance of these control schools on the 1990 and 1991 Utah Statewide Testing Program is dispalyed on Figure 3.1. The height of the bars on Figure 3.1 shows the percent of control schools falling into each of the above four categories of mathematics achievement on the 1990 (white-dotted black bar) and 1991 (completely black bar) Stanford Achievement Test. As expected, about one-third of the schools scored between the lower bound of the expected range and the predicted score, and one-third scored between the predicted value and the upper bound of the expected range. For the purpose of this analysis, the important point demonstrated by the height of the bars on Figure 3.1 is that there was hardly any change in the percent of control schools represented in each of the four achievement categories in 1990 and 1991.

Figure 3.2 displays the same information for elementary schools in the ETI treatment group. Unlike the control schools, between the 1990 and the 1991 test administrations, the percent of schools falling into the upper three achievement groups changed. Looking first at the ETI elementary schools whose scores fell below the lower bound of the expected range, it is evident that there has been no change. In both 1990 and 1991, nine percent of the schools are found in this group. When one looks at the next group of ETI schools, those scoring between the lower bound of the expected achievement range and the predicted score, significant change is apparent. In 1990, 34 percent of the ETI schools were in this achievement group. In 1991, there was only 18 percent of the ETI schools in this group. Consequently, in 1991 a higher proportion of ETI schools are represented in the two achievement groups above the predicted score.

To determine whether this change was statistically significant, we collapsed achievement categories above and below the predicted score. These data are displayed on Figure 3.3.

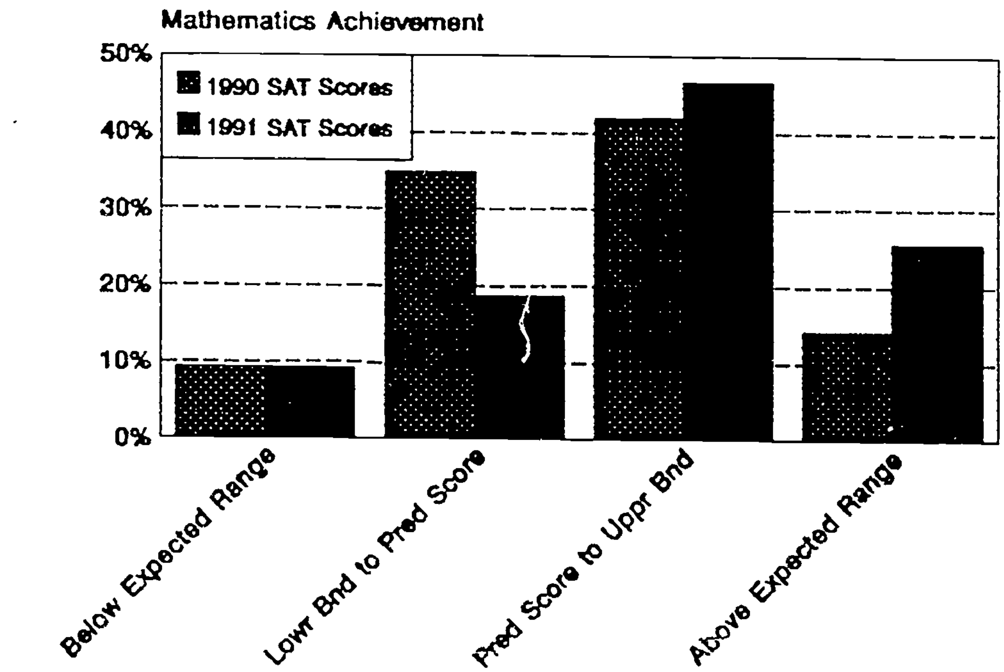
Figure 3.1: Percent of Control Group Elementary Schools Represented in Four Achievement Groups



N = 409 Schools

Data from Utah Statewide Testing Program

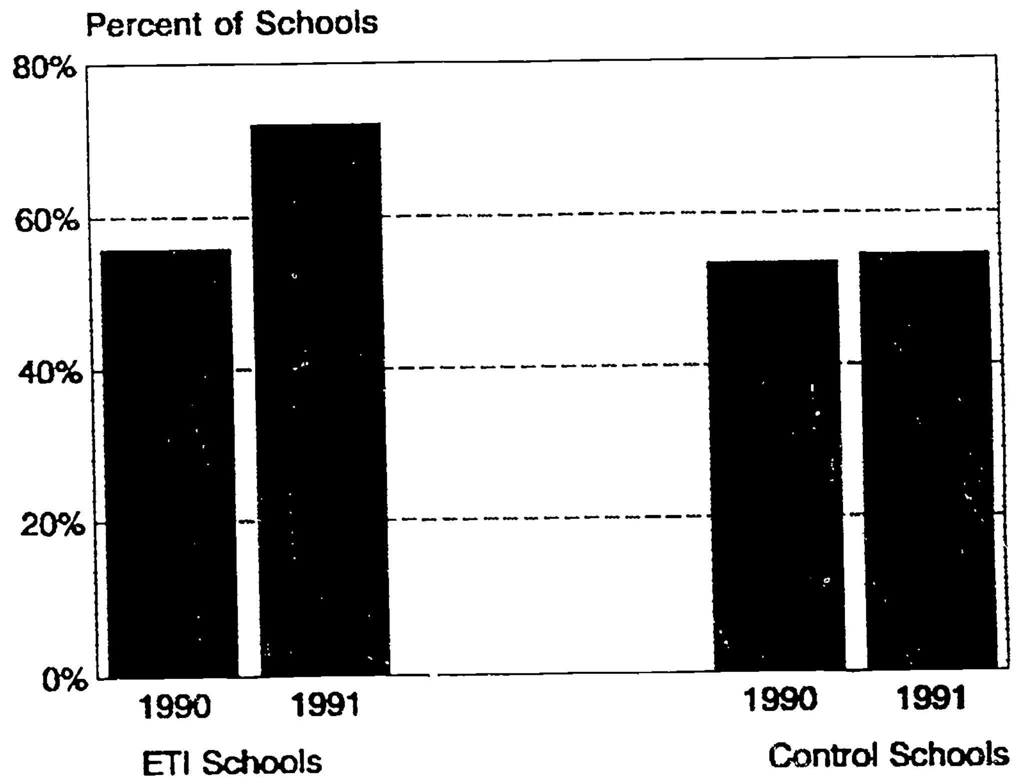
Figure 3.2: Percent of ETI Elementary Schools Represented in Four Achievement Groups



N = 43 Schools

Data from Utah Statewide Testing Program

Figure 3.3: Percent of Schools Scoring Above Predicted Mathematics Scores in ETI Treatment and Control Groups



N_{ETI} = 43; $N_{Control}$ = 409

The height of the bars represent the percent of ETI and control schools scoring above their predicted math scores in 1990 and 1991. As can be seen, the percent of the control schools scoring above their predicted math sores remained basically the same from 1990 to 1991. In contrast the percent of ETI schools above their predicted mathematics score increased from 56 percent in 1990 to 76 percent in 1991.

To test for the statistical significance of these changes we used McNemar's chi square test for significance of change, obtaining the following results: McNemar's chi square (1*df*) = 3.267, $p = 0.07$.[5] This indicates there are approximately 7 chances in 100 that the movement of ETI schools between achievement categories would be this large or larger as a result of chance alone. Consequently, there is sound reason to believe that the changes shown on Figure 3.3 are not merely random, year to year variations.

We used the same approach to analyze change among the control schools. We found, however, that roughly the same number of schools moved up from below the predicted score in 1990 to above the predicted score in 1991 as moved in the opposite direction. Consequently, there was no net movement in either direction. McNemar's chi square for significance of change was calculated to be (1*df*) = 0.131, $p = 0.72$. This indicates that the difference in the number of schools moving in one direction or the other was attributable to chance alone at least 72 times out of 100.

These analyses of elementary schools with ETI projects meeting the previously specified criteria demonstrate that these schools' test scores on the Stanford Achievement mathematics test are more likely to increase above the value predicted on the basis of the background of students enrolled in the school than are the control schools. In addition, the probability of this change being due to chance variation is quite small.

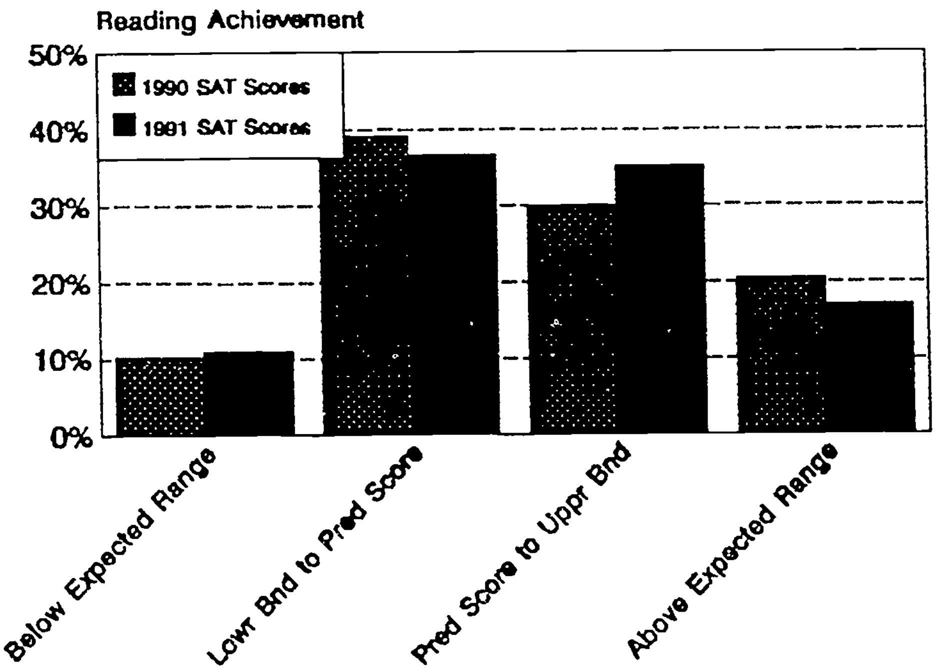
Did the ETI have an impact on reading achievement? The percent of control elementary schools falling into the achievement groups defined above for reading achievement on the 1990 and 1991 Stanford Achievement Test is displayed on Figure 3.4. Unlike the mathematics test results displayed on Figure 3.1, there is some evidence of a slight trend toward improvement. Comparing the 1990 and 1991 results, it can be seen that in 1991 proportionately fewer control schools are represented within the expected range below their predicted scores, and proportionately more control schools are represented within the expected range above their predicted scores. At the same time, there is a slight decrease in the percent of control schools falling above the expected range.

The same information for schools in the ETI treatment group is displayed on Figure 3.5. Here, the same trend seen with the control schools falling within the predicted range is evident for ETI schools. When 1991 and 1990 SAT scores are compared, proportionately fewer ETI schools are represented below their predicted scores in 1991, and proportionately more ETI schools score above their predicted score. In addition, there is a slight decrease in the percent of ETI schools scoring below their expected range in 1991, and a slight increase in the percent of schools scoring above their expected range.

To determine whether these changes were statistically significant, we again collapsed achievement categories above and below the predicted score. These data are displayed on Figure 3.6. As before, the height of the bars indicate the percent of schools with reading scores above that predicted for them on the basis of student composition alone. In 1990, 51 percent of the control elementary schools scored above their predicted reading scores, compared with 53 percent in 1991. Although this represents a slight trend toward improvement, it is of small magnitude. The change in the percent of ETI elementary schools scoring above their predicted reading in 1990 and 1991 is considerably greater. In 1990, 56 percent of the ETI schools scored above their predicted reading score, compared with 67 percent in 1991.

To test for the statistical significance of these changes, we again conducted McNemar's chi square test for significance of change. For schools in the ETI treatment group, we obtained results similar to that obtained for mathematics: McNemar's chi square ($1df$) = 2.273, p = 0.13. This indicates there are approximately 13 chances in 100 that the movement of schools from achievement categories below their predicted scores to achievement categories above their predicted scores could be explained by chance alone. When the statistical significance of changes in the position of control schools is tested using the same statistic, we find their movement could be explained by chance 53 times out of 100.

Figure 3.4: Percent of Control Group Elementary Represented in Four Achievement Groups

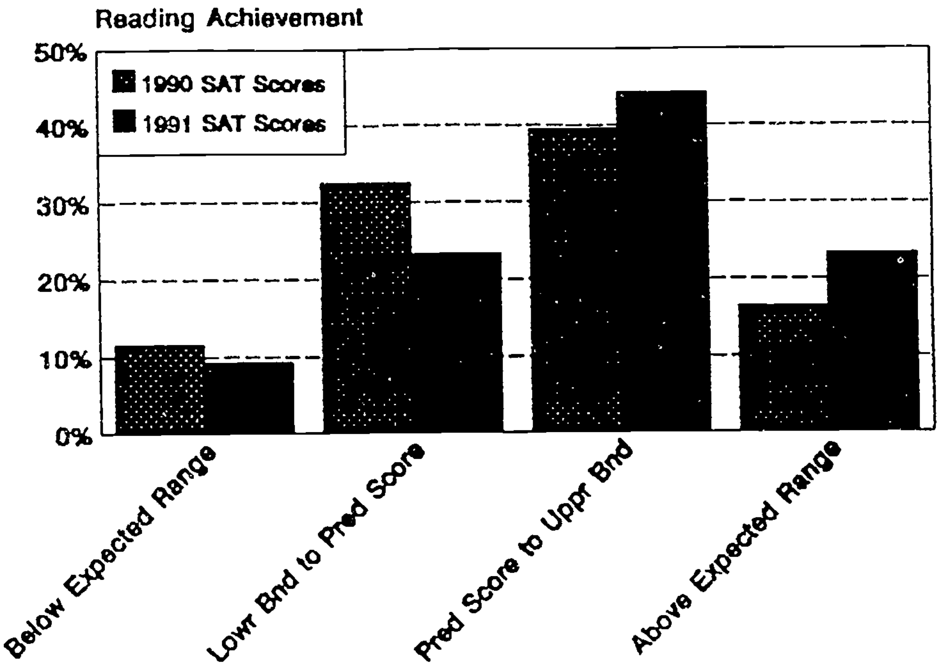


N = 409 Schools

Data from Utah Statewide Testing Program

3.10

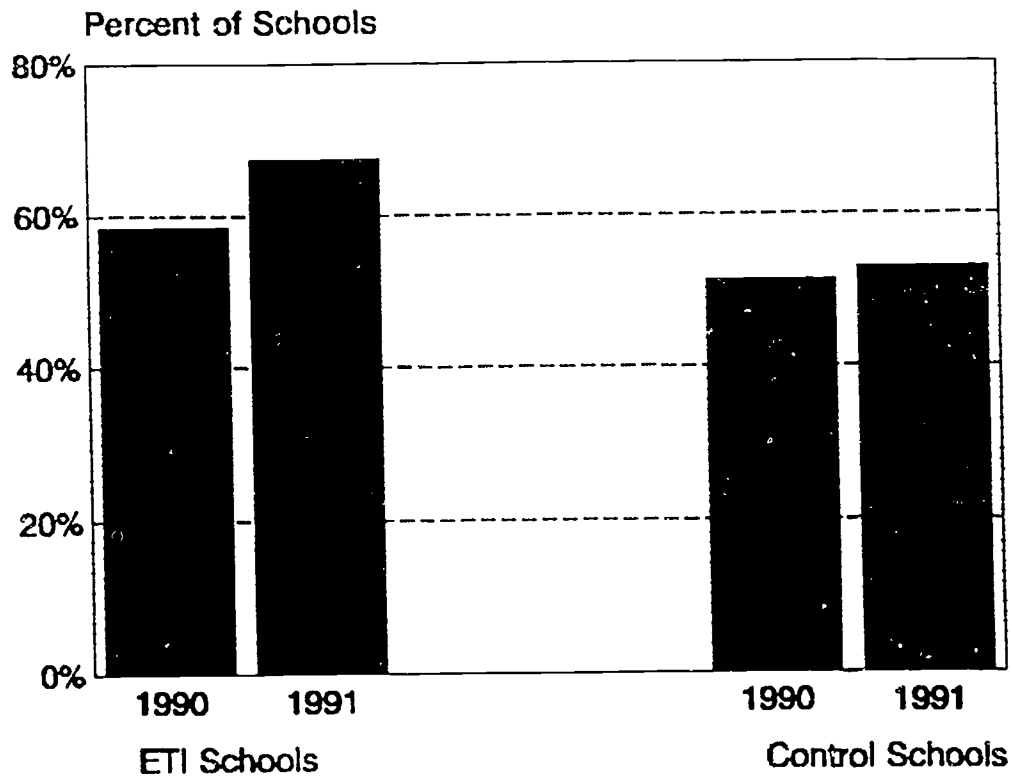
Figure 3.5: Percent of ETI Elementary Schools Represented in Four Achievement Groups



N = 43 Schools

Data from Utah Statewide Testing Program

Figure 3.6: Percent of Schools Scoring Above Predicted Reading Scores in ETI Treatment and Control Groups



N_{ETI} = 43; $N_{Control}$ = 409

These analyses of changes in the percent of ETI elementary schools represented in different reading score achievement categories for the 1990 and 1991 Stanford Achievement Test reveal the same pattern found in the analyses of mathematics test scores, although with smaller magnitude. The Stanford Achievement Test reading scores of elementary schools with ETI projects meeting the previously specified criteria were more likely to increase from 1990 to 1991 than could be reasonably expected by chance alone. Consequently, there is sound evidence that the changes shown on Figure 3.6 are not merely random, year to year variations.

Why did this happen? It is impossible to say with certainty that ETI projects were responsible for changes in achievement among the elementary schools in the ETI treatment group. No educational program operates in a vacuum. There are always concurrent changes in staffing, enrollment patterns, site priorities, funding levels, and the like. Still, the pattern of change is striking and broad-based. The same achievement trend is found for both mathematics and reading, although it is stronger for mathematics. Elementary schools located in sixteen separate school districts were part of the analysis, and as far as we know, all they had in common were their grade levels and ETI projects.

Although the following thoughts are speculative, we do not find it surprising that if ETI projects had an impact, test score changes would be greater in mathematics than in reading. Mathematical skills taught in elementary school using drill-and-practice computer software and the skills tested by the Stanford Achievement Test are generally congruent. Most group-administered achievement tests consider the mathematics curriculum to consist of a series of discrete, masterable skills. Computers can be efficient in teaching students those skills. Results can be seen in a single semester.

The match between reading comprehension as defined by the Stanford Achievement Test and the use of computers to encourage students' skills in language arts may be more dissimilar. Teachers, by and large, use computers more frequently for word processing than for lessons in reading comprehension. This usage pattern has been recently encouraged by the rise of the "whole language" movement, which does not separate learning to read from expressing oneself in writing. It may take longer to see the impact of computer-aided instruction on reading skills.

The data on which this report is based did not allow us to examine subtle differences in the "treatment" students received at ETI elementary schools. We do not know, for example, how many ETI schools were using integrated learning systems in computer labs, nor how many had distributed computer terminals throughout classrooms for student use. We do not know the extent to which teachers at these schools used software targeted toward basic skill acquisition or higher-order thinking. Future reports will draw on additional data in order to examine these factors more closely. We will attempt to identify the key ingredients that make ETI projects effective within individual schools. In addition, as more secondary schools have the opportunity to fully implement their projects, we will be able to examine the impact of ETI projects on secondary students' achievement.

What did ETI Coordinators Report about the Impact of ETI Projects on Student Performance?

Although standardized test scores are a common way of assessing the impact of educational programs, to rely on this measure alone would neglect important information and ignore the perceptions of those closer to the projects. These individuals are in a position to observe and describe some of the more subtle effects that ETI projects might have on student performance -- such as motivation to learn. In addition, they may be knowledgeable about areas not considered by the standardized test -- such as work force skills. Since the ETI Coordinators are familiar with all ETI projects in their districts, they have a broad perspective on project functioning and impact, and their observations can provide valuable insights.

Was there agreement among ETI Coordinators about the Impact of ETI projects on students? We surveyed the ETI Coordinators about their perceptions of ETI project impact on different aspects of student learning. In general, they were quite positive in their responses. Table 3.1 displays the degree to which Coordinators agreed that the ETI had improved different types of competencies including subject area skills, work force skills, and student involvement in learning. Although sometimes unsure about the impact of ETI on students, only one Coordinator expressed the opinion that ETI did not always have a positive impact on student performance.

Table 3.1: ETI Coordinator Reports of the Impact of the Educational Technology Initiative on Student Performance

The ETI has improved students'	# of ETI Coordinators Responding	Percent Response in Each Category					% of ETI Coordinators Citing Evidence of Impact
		Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree	
Reading skills	30	50%	37%	13%			31%
Mathematics skills	29	17%	48%	34%			54%
Writing skills	30	33%	50%	13%	3%		65%
Skills in other subjects	29	17%	35%	48%			45%
Basic skills	30	30%	47%	23%			60%
Higher order skills	30	13%	37%	50%			21%
Work force skills	30	43%	40%	17%			62%
Personal involvement in learning	29	10%	38%	52%			35%
Motivation to learn	30	30%	50%	20%			68%
Average across all student performance areas		23%	42%	30%			49%

The vast majority of Coordinators agreed that ETI was having a positive impact on students' reading and mathematics skills, two subject areas emphasized in the legislation. Eighty percent believed it was enabling students to improve their reading achievement; 65 percent thought it was having a positive impact on mathematics achievement. Coordinator responses in other areas are similar: between 52 and 83 percent agreed that ETI projects were having a positive impact on students, depending upon the specific area in question. A majority of the Coordinators (83%) agreed that writing and work force skills were positively affected by ETI projects. They were in somewhat less agreement about the impact of ETI projects in the areas of personal involvement in learning, higher order skills, and skills in other subjects.

When asked if they had seen evidence that ETI projects were making a difference in student performance, between 21 percent and 68 percent of the Coordinators responded affirmatively, depending upon the outcome in question. A majority of the Coordinators noted that they had evidence of the ETI projects affecting students' motivation to learn, writing skills, work force skills, basic skills and mathematics performance. A minority of the Coordinators reported an increase in higher order skills, and personal involvement in learning as a result of the Utah Educational Technology Initiative. In general, there was a relationship between the strength of their agreement regarding the impact of the ETI in the different student performance areas and their reports that they had evidence of student performance in each area.[6] This gives credence to the Coordinator responses.

What comments did ETI Coordinators make? The survey included considerable space for Coordinator's comments about the program and the evaluation, and we have reproduced some of their comments below.

There was widespread agreement that it was too early to assess the impact of the Initiative on students, since projects were still becoming operational. Typical comments included:

> We have only recently obtained equipment and software. Ours is a four-year plan and results will depend upon completion of the project after all of the hardware and software is in place and being utilized;
>
> Individual students may show progress, but the entire project is not in place; and

Teachers say they are noticing a difference. It is a bit early for such evidence to be available.

Some Coordinators, however, described specific student accomplishments they felt were the result of ETI projects:

Math scores on Utah Core have risen in Year Two of ETI, but the most dramatic has been the SAT scores. (The high school math SAT's went from the mid 50's to low 70's percentile.);

Teachers' say that it really helps. They comment that they can cover material faster because of the software;

Many students with limited skills are doing much more writing than they had done without the computers. The same is true with students at all ability levels;

With the writing lab at the high school, all English classes have shown improvement on informal tests;

Teachers report higher quality of papers from students in the high school language arts. Synthesis and evaluation skills are necessary. Calculator and math software technology has helped increase math scores and encouraged higher-order thinking;

We are just beginning the data analysis to support this. Where writing has been the main focus, teachers have taken training in the writing process and have implemented that process through a whole language approach. We will be doing holistic scoring in many schools to support the feeling among teachers that writing is much better than it ever has been;

Math basic skill software (CNS) is helping some gain basic skills. Criterion test on the computer so indicates.

The evidence we have so far is from teachers who tell us how much easier it has been to teach such things as time and money with the computer;

I have visited [computer] labs all over the district at various times. In all instances I have observed absolute and unwavering involvement of all students when they were in the computer lab or at a stand-alone computer. This is a phenomenon that is unmatched by any other teaching aid;

It is early yet. A district study showed improvement in math and reading skills in experimental ETI sites; and

Software is providing a wider variety of materials on many different levels, some that the students can access that are outside the teachers' field of expertise.

Taken together, the Coordinators' comments show a realistic concern that it is still too early to rigorously evaluate the impact of ETI projects on students. At the same time, they recount some intriguing examples of student accomplishment being furthered by the Utah Educational Technology Initiative.

What did Principals Report about the Impact of ETI Projects on Student Performance?

Although principals do not have the district-wide knowledge of the ETI Coordinators, they are generally more familiar with the impact ETI has had on students in their own schools. We surveyed principals in schools implementing ETI projects during the 1990 - 1991 school year and asked them whether these projects had affected student learning, motivation to learn, or satisfaction with school.[7] Table 3.2 displays principals' reports of the impact of ETI projects on students. Like the ETI Coordinators, they were quite positive about the program's impact. Across the grade levels, principals typically reported that the ETI had "substantially" improved student learning, motivation to learn, and satisfaction with school.

What Were the Results of Salt Lake City School District's Evaluation of District ETI Projects?

Four Utah school districts (Box Elder, Logan City, Morgan, and Salt Lake City) submitted evaluations of their own ETI projects. Only the Salt Lake City evaluation, however, provided information regarding the impact of ETI projects on student performance. We will briefly review the results of this evaluation below.

Table 3.2: Principals' Reports of the Impact of the Educational Technology Initiative on Student Performance

To What Degree Has the ETI Improved	# of Principals Responding	Response Categories				
		Exceptionally	Substantially	Moderately	Slightly	Not at All
Elementary Students'						
Learning	272	23%	47%	18%	9%	3%
Motivation to learn	271	26%	46%	21%	4%	3%
Satisfaction with school	263	18%	45%	27%	8%	2%
Junior High/Middle School Students'						
Learning	60	20%	45%	23%	10%	2%
Motivation to learn	60	20%	40%	28%	8%	3%
Satisfaction with school	60	5%	45%	31%	14%	5%
High School Students'						
Learning	56	16%	48%	29%	4%	4%
Motivation to learn	55	18%	46%	26%	7%	4%
Satisfaction with school	56	5%	32%	36%	23%	4%
Average Across All Grade Levels						
Learning	388	22%	47%	20%	8%	3%
Motivation to learn	386	24%	45%	23%	5%	3%
Satisfaction with school	379	14%	43%	29%	11%	3%

As noted in the case study appearing in Chapter 5 of this report, Salt Lake's ETI plan called for district schools to submit individual plans to the district office. In addition to the general goals of reading and math improvement, schools were expected to address specific local needs.

The District Technology Committee approved implementation of computer instructional programs at four elementary schools for 1990-1991. These schools were to pilot programs that would be evaluated, improved and eventually replicated in other Salt Lake schools. The nature of the programs varied considerably. Some schools installed a computer laboratory, others placed computers in the classrooms. Different amounts of in-service training were provided teachers at the different schools.

What was the impact of Salt Lake City School District ETI projects on student achievement? The District Department of Evaluation and Program Audit conducted an evaluation of ETI projects at four schools. ETI schools were matched on language arts and math results with control schools of similar achievement levels. The Utah Core tests were used to measure reading performance and a District Criterion Referenced Test was used to assess math achievement. Where possible, means were adjusted to allow differences to be attributed to instructional treatment and not to a pre-existing disparity between groups. Fourth and sixth grade students participated in this part of the evaluation, and responded to a questionnaire.

The results of this analysis present a mixed picture. Of the 16 comparisons made between ETI and contrast schools (2 grade levels X 2 subject areas X 4 schools), 8 favored the ETI schools, and 8 favored the contrast schools. The author of the evaluation report explains this result as follows:

> The diversity of the achievement results is a product of the struggles accompanying the implementation of a program of this scope and sophistication rather than the characteristic of the program itself. It is only natural that some schools struggled harder than others.

Looking across all of the comparisons, the author identifies two schools that differ greatly in comparative performance and reflects on the nature of the ETI projects at the two schools:

> [The school where the improvement in test scores surpassed that of the comparison school] uses a carefully crafted and adapted program in scope and sequence which has been tailored to state and district instructional goals. [It] employs a full-time qualified computer lab facilitator who guides and advises teachers and students in lab work and

> responds to needs of a technical nature. [The school where test scores improved less than the comparison school] uses a potpourri of programs which have not been adapted to the school instructional program nor do they follow an identifiable scope and sequence. The computer laboratory . . . is directed by a third-grade teacher who handles the duties of lab director in addition to a full-time teaching schedule.

These differences, contends the author of the evaluation, explain the differences in student outcomes. The superior school "broached the problem of computer instruction with a more intensive analytical approach," and is working to fit the computer curriculum to both the school curriculum and the individual child:

> Teachers have discovered that computer instruction is not a panacea. Some students benefit from it more than others. The differentiation must not only be made with students of diverse learning levels (slow, average, fast), but also in regard to subject matter and sections within the subject matter.

The author concludes, noting that a well-articulated computer program:

> is much more than a flirtation with technology . . . it is a profound change in curriculum and instructional methodology. Its ultimate success hinges on an investment in people who are as important as the hardware and software.

Accordingly, for computer instruction to benefit students, teachers must receive the training and help necessary to integrate technology into their daily curriculum. This requires intensive and extensive inservice training and ongoing support.

What was the reaction of students, teachers and parents to the ETI projects? Student responses to the ETI projects were very positive. Approximately 70 percent reported they enjoyed computerized instruction in math and reading. Over 60 percent said that computer instruction promoted their math and reading skills. Seventy-one percent thought computers were a lot of fun.

Teachers' and parents' perceptions were:

> . . . highly supportive of the computer programs and would have them continue and expand. Teachers in particular, in spite of sacrifices in time, energy and effort, would willingly continue to make sacrifices... In conclusion, the computer program has had promising beginnings and its potential justifies further investment.

How do School Administrators and Teachers Perceive ETI Projects?

We observed and interviewed school and district personnel in four school districts: Salt Lake City, Alpine, Morgan, and North Summit. During these visits we asked whether they had evidence that school ETI projects were making a difference in student performance. The consistent, resounding response was, "Yes!"

English teachers spoke gratefully about ETI, noting that they had observed significant gains in students' writing skills when students used computers for word processing and editing. (An example of two students' progress through the writing and editing process is included in Appendix B.) One high school English teacher commented:

> The ETI was a tremendous opportunity. We would not have had any other way to do what we needed to do. . . Now, every student in class does the assignment because it is fun to do it on the computer. There is no group in the back of the room who never turn anything in. . . The number of words in students' writing has increased dramatically. This is very important: you have to have written fluency before you can improve your writing. . . ETI has made all the difference in the world.

An elementary teacher spoke of how their school computer lab, purchased with ETI funds, has helped them to establish writing portfolios for all students. Once students begin to use the computers for word processing, they are given a floppy disk of their own. They save all of their writing on that disk, and each year, they archive a certain number of writing projects. The disk is theirs to keep as they move through the grades. At any time students can look back and see examples of their writing and observe their writing development from the beginning.

A high school mathematics teacher talked about his use of programmed instruction with students in pre-algebra classes. Although he noted that he was not a "techie," he was very enthusiastic about the impact the computer instruction was having on students' math skills:

> The software teaches them skills that they miss when we go through the book. This way, everybody can be brought up to the same level. Those that need more help and tutoring can get it from the computer.

Another high school English teacher described how students use computers for both word processing and style checking. (Typical writing assignments using these tools are included in Appendix C: Examples of Writing Assignments Facilitated by Word Processing and Style Checking Software.) The high school initiated the program began because:

> English teachers felt they were working at their limit. There just was not enough time to assign and correct any more papers, and still students were not making the changes in their writing they needed to make. Now, students can check spelling, analyze sentence length and complexity, look for passive voice, check subject-verb agreement, and the like. This has made so much difference in the quality of the writing of our students. The difference between the way they can write at tenth grade and at twelfth grade is amazing.

Summary: The Impact of the Utah Educational Technology Initiative on Student Performance

This chapter has considered a number of different types of data concerning the impact of the Utah Educational Technology Initiative on student performance during the 1990-1991 school year. Although it is too soon to draw firm conclusions about the effectiveness of ETI projects in increasing measurable student performance, the available evidence is extremely promising. The changes in school performance for the ETI treatment schools in elementary Mathematics and Reading on the Utah Statewide Testing Program were positive. ETI Coordinators, principals and teachers are very enthusiastic about the ETI projects, and believe they see changes in student performance in the classroom. The comments cited earlier, and the examples of student work appearing in Appendix B, demonstrate how computers can facilitate the development of student writing skills.

Based on this collection of evidence, it appears that some ETI projects are having an impact on student outcomes. During our school visits, it became obvious that these impacts are not caused by technology alone, but by the capable use of technology by teachers. Morever, the Utah Educational Technology Initiative is likely to have maximum impact on students and schools, when it is not treated merely as an opportunity to purchase hardware, but as a facilitator and catalyst in the school improvement process. One ETI Coordinator noted:

> What the process [of developing ETI proposals] did was to cause school committees to look critically at their students' academic abilities as

> measured on the SAT and the state CRT. Through that evaluative process schools identified low score areas and sought low score trends to address with technology . . . I feel confident . . . that the process school ETI committees went through initiated the positive changes we have seen [in student test scores].

In the process of preparing school and district ETI plans, and in implementing the ETI projects once planning was completed, teachers and administrators were given new opportunities to work together and monitor their progress toward shared achievement goals. Beyond the hardware it makes available, an important legacy of the Utah Educational Technology Initiative is the impetus it provides to focus on student learning and initiate projects targeted directly toward improvement.

CHAPTER 4:
The Initial Impact of the Utah Educational Technology Initiative on Student Computer Use

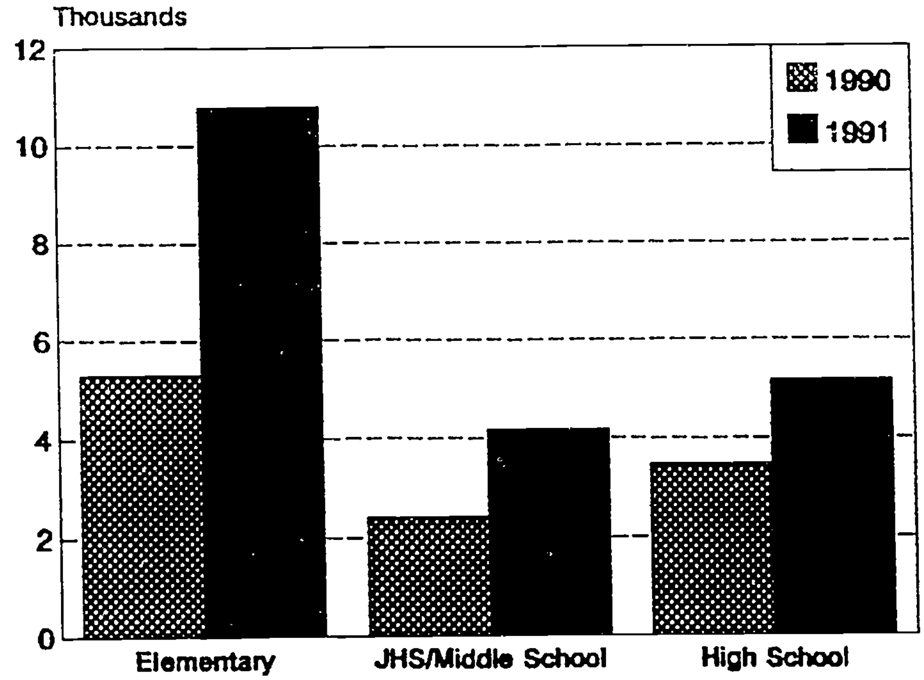
One goal of the Utah Educational Technology Initiative was to increase students' opportunities to use computers and other educational technology as tools for learning. Although the effective use of educational technology requires careful and thorough integration of the hardware into an overall curricular and instructional context, if the equipment is not available, integration is not an issue. This chapter examines the impact of the initial year of the Utah Educational Technology Initiative on students' accessibility to and use of computers. We will discuss the number of computers purchased with ETI funding as well as the impact these purchases have had on the average student/computer ratio in Utah schools. We will also consider the amount of time the average Utah student spends using a computer in school.

How did the Number of Computers Available to Students Change Between 1990 and 1991?

The number of computers available for student use in 1990 and 1991 is displayed on Figure 4.1. We do not distinguish the number of computers acquired with ETI funds from the computers purchased with district money, but report the total pool of computers available to students in schools. This probably *underestimates* the actual amount of computers currently in schools since we did not receive information from 164 schools reported as participating in the ETI initiative during 1990 - 1991.[8]

These problems notwithstanding, the change in the number of computers available to students in classrooms and computer labs is substantial. In elementary schools, the number of instructional computers more than doubled from 5,308 to 10,786. In the secondary grades, the number of computers available to students similarly increased, but not at the rate found in elementary schools.

Figure 4.1: Change Between 1990 and 1991 in the Number of Computers in Classrooms and Computer Labs



$N_{Elem} = 276$, $N_{JHS/MS} = 62$, $N_{HS} = 55$

Data from Principal Reports

4.2

Schools also acquired computers for the office, the media center, and placed computers in other locations like the faculty room. Table 4.1 includes the information appearing in Figure 4.1, but includes information about schools with grade configurations different from those found in typical elementary, middle/junior high, or high schools.[9] Table 4.1 also displays data about changes in the number of computers available in schools outside the classroom or computer lab.

Looking across all the grades, we find that from 1990 to 1991, the number of computers in classrooms increased 83 percent from 3,218 to 5,893. There was a 79 percent rise in the number of computers found in computer labs. In 1990 there were 8,161 computers in labs; this rose to 14,569 computers in 1991. In media centers, there was a 62 percent increase (from 501 to 813) in the number of computers available, while in school offices the number of computers increased 23 percent (from 1,102 to 1,357). Finally, an additional 204 computers were placed in other locations within school buildings.

How did the Computer/Student Ratio Change Between 1990 and 1991?

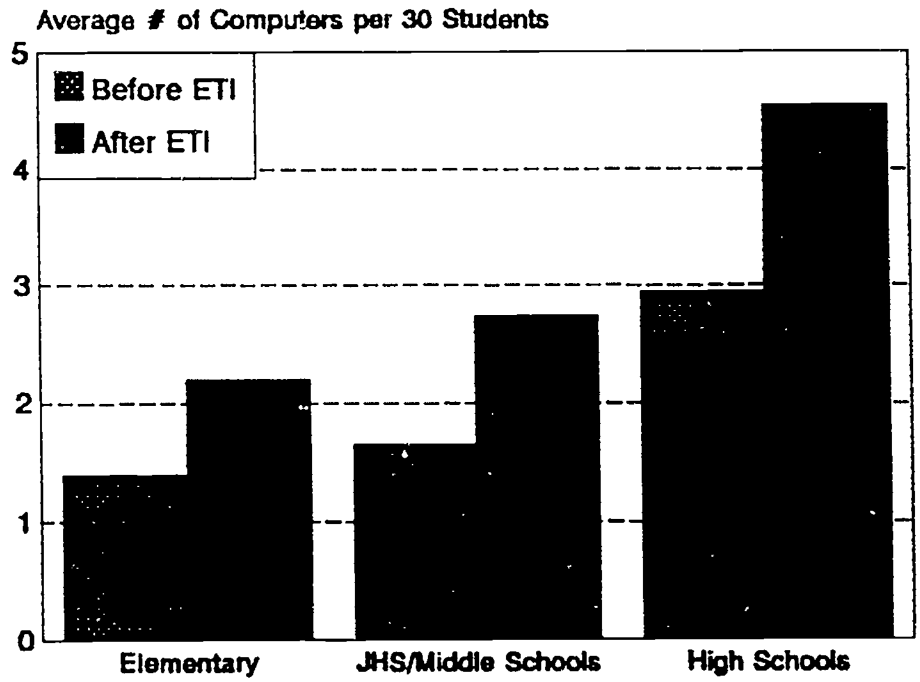
Figure 4.2 displays the average number of computers available in the classroom or computer lab for every 30 students. We chose this way of expressing information about computer/student ratios since 30 students are often found in an average-sized class. The difference in the heights of the bars representing the 1990 (white-dotted bar) and 1991 (completely black bar) school years demonstrate the increase in computers available to students during the first year of the Utah Educational Technology Initiative.

Some historical figures put this information in perspective. In the fall of 1989, the Utah State Office of Education surveyed school districts to determine how technology was being used in Utah's schools. Of particular interest for the current report was the availability within schools of computer terminals for teaching and learning. At that time, the average computer/student ratio in elementary schools across the state was approximately 1 to 27.[10] This indicates that there was, on average, one computer available for every 27 elementary students. For secondary schools, the average student/computer ratio was 1 to 14.

Table 4.1: Change in the Total Number of Available Computers Between 1990 and 1991

School Level and Year	# of Schools Reporting	Number of computers in				
		School Offices	Classrooms	Computer Labs	Media Centers	Other Locations
Elementary Schools	276					
1990 (before ETI)		523	1,527	3,781	300	322
1991		629	3,157	7,629	436	412
Change		+20%	+107%	+102%	+45%	+28%
Middle/Junior High Schools	62					
1990 (before ETI)		223	863	1,536	98	97
1991		288	1,378	2,814	188	119
Change		+29%	+60%	+83%	+92%	+23%
High Schools	55					
1990 (before ETI)		321	747	2,719	92	224
1991		399	1,241	3,941	171	316
Change		+24%	+66%	+45%	+85%	+41%
Other Grade Configurations	15					
1990 (before ETI)		35	81	125	11	
1991		41	117	185	18	
Change		+17%	+44%	+48%	+64%	
All Schools	408					
1990 (before ETI)		1,102	3,218	8,161	501	643
1991		1,357	5,893	14,569	813	847
Change		+23%	+83%	+79%	+62%	+32%

Figure 4.2: Changes Between 1990 and 1991 in Computer Accessibility



$N_{Elem} = 273$, $N_{JHS/MS} = 61$, $N_{HS} = 54$

Data from Principal Reports

Information about the average student/computer ratios in 1990 and 1991 appears on Table 4.2. For each level of schooling, the student/computer ratio decreases between 1990 and 1991, again indicating there are more computers available to students. In 1989, 27 elementary students had to share each instructional computer. Our data suggest that in 1990, the situation had improved, and 22 students shared each computer. In 1991, the ratio dropped to 11 students for each computer.[11] Although the USOE 1989 data for secondary schools does not separate high schools from middle/junior high schools, the overall secondary student/computer ratio of 1 to 14 makes sense given the figures reported on Table 4.2. In 1990, 18 middle/junior high school students had to share one computer. In 1991, the ratio dropped to 11 to 1. Our high school data suggest that computer accessibility was somewhat better in high school than it was in middle/junior high schools. In 1990 10 high school students shared each computer; in 1991 that number dropped to 6.

The standard deviations reported on Table 4.3 exceed the average student/computer ratios. This indicates that there is a good deal of variability in actual schools regarding the number of computers actually available for students. At some elementary schools, for example, the actual computer/student ratio will be 1 to 5 or 1 to 40.

How Much Time do Students Use Computers Each Week?

The amount of time the average student uses a computer each week is displayed on Figure 4.3. According to principal reports, the average child in all grades spends between 34 and 142 minutes a week using a computer, depending upon the grade.[12] There is a general pattern of the average child in the lower grades spending less time on the computers than the average child in the upper grades. In this sample, the instruction of the average child is carried out by a teacher considerably more frequently than by Integrated Learning System software.[13] In high school, the difference is striking. In the tenth grade, for example, the average student is reported to spend roughly two and one-half times as much time using a computer under the direction of a teacher than he or she spends logged on to an Integrated Learning System.

Table 4.2: Changes from 1990-1991 in Average Student to Computer Ratio

School Level and Year	# of Schools Reporting	Average Number of Students per Instructional Computer	Standard Deviation
Elementary Schools			
1990 (before ETI)	282	21.58	22.9
1991	287	11.03	13.58
Change		-49%	
Middle/Junior High Schools			
1990 (before ETI)	64	18.18	28.30
1991	65	10.95	17.14
Change		-40%	
High Schools			
1990 (before ETI)	54	10.17	11.19
1991	56	6.59	6.94
Change		-35%	
Other Grade Configurations			
1990 (before ETI)	8	8.04	8.75
1991	9	6.38	8.31
Change		-21%	

Table 4.3 displays the same information appearing on Figure 4.3, but includes the standard deviation to provide information about how much variability is found in length of computer usage at each grade level. In all cases, the magnitude of the standard deviation exceeds the average use, indicating there is considerable variation from school to school in the amount of time students at each grade level spend using computers.

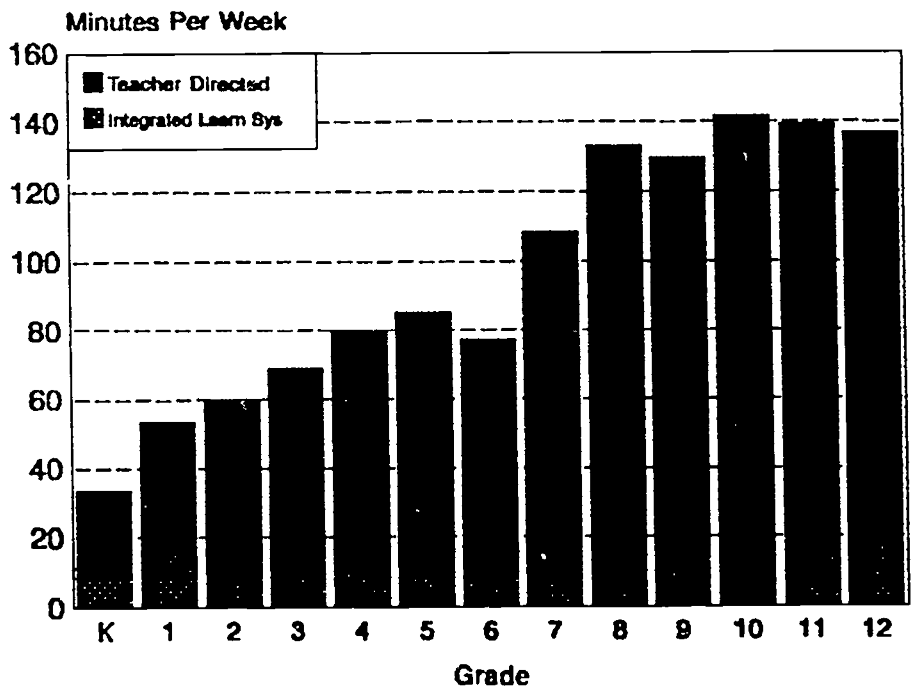
How Many Schools Use Computers in Instruction?

Tables 4.4 and 4.5 display the percent of schools at each grade level reporting that they use computers for instruction in reading, writing, mathematics and other subjects.[14] The tables demonstrate that the majority of schools rely on teachers rather than Integrated Learning Systems to involve students in computer instruction. Teachers use computers for reading instruction in about 50% of the elementary schools, and about 25% of the secondary schools. The use of computers to facilitate writing and editing increases as students move up the grades from kindergarten to 12th grade. Teachers in roughly 42% of the elementary schools in our sample use computers as part of their writing instruction. In contrast, teachers in roughly 71% of the secondary schools use computers in writing instruction.

The use of computers in mathematics instruction presents a pattern similar to that found for reading instruction. Sixty-one percent of the elementary principals in our sample reported that their teachers used computers in their mathematics instruction. Only 50% of the secondary principals told us that their mathematics teachers used computers in their instruction.

Taken together, these usage patterns for reading, writing, and mathematics may suggest that elementary teachers more frequently use computers for basic skill instruction, while secondary teachers more frequently use computers to facilitate the critical thinking and composing necessary for good writing. At the same time, these results may reflect the quality and focus of the software available to teachers. Secondary teachers, for example, may not be aware of quality software programs for secondary reading and mathematics skills.

Figure 4.3: Average Student Computer Use in 1991



$N_{Grades K-6}$ = 220-288, $N_{Grades 7-8}$ = 69-74, $N_{Grades 9-12}$ = 60-69

Data from Principal Reports

Table 4.3: Computer Use by the Average Student in K-12

Grade Level	# of Schools Reporting	Length of Computer Usage in Minutes per Week			
		Integrated Learning System		Teacher Directed	
		Average	SD	Average	SD
K	285	8.89	23.13	24.80	30.63
1	288	15.40	30.80	37.95	45.02
2	288	19.21	36.03	40.72	45.56
3	287	22.28	44.25	46.64	50.20
4	286	24.99	49.15	55.22	60.37
5	284	26.29	52.01	58.89	56.40
6	220	22.49	48.62	54.66	59.29
7	74	21.13	56.17	87.14	117.12
8	73	25.11	63.43	108.26	168.90
9	69	27.08	64.10	102.48	124.11
10	60	38.63	86.03	102.88	124.11
11	60	35.40	81.45	104.11	123.70
12	60	38.29	86.14	98.47	107.83

Table 4.4: Percent of Schools in which Students Use Computers to Learn to Read and Write in Grades K-12

Grade Level	# of Schools Reporting	Type of Computer Usage			
		Reading		Writing	
		Integrated Learning System	Teacher Directed	Integrated Learning System	Teacher Directed
K	288	15%	47%	3%	14%
1	291	24%	54%	8%	25%
2	291	24%	55%	11%	32%
3	291	24%	56%	13%	47%
4	289	24%	55%	18%	58%
5	287	23%	55%	18%	64%
6	222	19%	46%	19%	61%
7	76	11%	22%	18%	58%
8	74	14%	24%	22%	59%
9	71	8%	23%	21%	70%
10	62	8%	24%	23%	82%
11	62	6%	23%	21%	82%
12	62	5%	21%	21%	79%

Table 4.5: Percent of Schools in which Students Use Computers to Learn Mathematics and Other Subjects in Grades K-12

Grade Level	# of Schools Reporting	Type of Computer Usage			
		Mathematics		Other Subjects	
		Integrated Learning System	Teacher Directed	Integrated Learning System	Teacher Directed
K	288	15%	48%	7%	28%
1	291	24%	61%	8%	32%
2	291	27%	63%	10%	37%
3	291	28%	67%	13%	44%
4	289	29%	66%	15%	52%
5	287	31%	67%	16%	55%
6	222	27%	55%	14%	47%
7	76	18%	46%	11%	50%
8	74	20%	43%	15%	53%
9	71	18%	42%	20%	69%
10	62	21%	56%	19%	68%
11	62	18%	61%	18%	69%
12	62	18%	55%	19%	71%

Since these data do not allow us to know exactly how teachers use computers in their instruction, these thoughts must remain speculative. In the June 1992 evaluation report, we will report our analyses of teacher surveys, and attempt to explain these disparate patterns of computer use.

Summary

Based on the information we received from principals, it appears that the number of computers in elementary classrooms and computer labs doubled from 1990 to 1991 as a result of the Utah Educational Technology Initiative. Increases at other levels were less spectacular, but still multiplied by at least 44 percent. This allowed the average elementary school student/computer ratio to shrink from 22 to 1 in 1990 to 11 to 1 in 1991. In middle/junior high schools, the student/computer ratio declined from 18 to 1 to 11 to 1. In high schools the student/computer ratio shrank from 10 to 1 to 7 to 1. Utah elementary students spend an average of about 60 minutes a week using the computer; the bulk of that time is directed by teachers, although some of it takes place with Integrated Learning Systems. In middle/junior high school this number increases to approximately 110 minutes, and in high school, the average student spends about 135 minutes a week on the computer. Student access to computers within elementary, middle/junior high, and high schools increased dramatically from 1990 to 1991 as a result of the funds made available by the Utah Educational Technology Initiative.

CHAPTER 5
Salt Lake City Case Study

Salt Lake City Public School District is a large urban public school district with a student population of 24,736: 14,736 elementary, 3,479 intermediate, 5,934 high school and 617 students in self-contained special education classrooms. There are 27 elementary schools, 5 intermediate schools, 4 high schools and 7 special education schools. The district student population is becoming increasingly culturally diverse. In the 1990-91 school year 21.28% of the students were from these minority groups: 11.88% African American; 5.42% Asian; 2.32% Hispanic; 2.23% Native American; and .34% Pacific Islander. Schools on the east side of town are located mainly in affluent or middle class neighborhoods. Schools on the west side of town have larger concentrations of low income and minority students.

Salt Lake City public schools have had a technology program since 1982. The program was organized by a technology committee which was comprised of representative teachers, principals and district administrators. This committee decided how to allocate about $100,000 of district funds which were allotted annually for technology. In 1983, as the program expanded, a junior high school mathematics teacher with expertise in technology was appointed as full-time District Technology Coordinator to work with the committee. Before the implementation of the Utah Educational Technology Initiative (ETI) the district planned to place a computer on each teacher's desk at all school levels. In addition, the plan included providing access to computers for students. Each high school was to have a computerized writing laboratory, general curriculum laboratory and computer science laboratory. The intermediate schools were to have writing and general curriculum computer laboratories. The elementary schools were to have a general computer laboratory.

The district was gradually implementing this technology plan when ETI money became available. The ETI sped up the process and allowed the development of a much more elaborate technology program in the Salt Lake City public schools. According to the superintendent, "This really got us more on a fast track." The district's budget for technology increased from $100,000 to $1.1 million. The district increased it's own contribution from $100,000 to $500,000, substantially more than required by the legislation. If funding continues at the current rate the districts currently planned program will be fully implemented by the 1995-96 school year.

How was the Salt Lake City School District's ETI Plan Developed?

Salt Lake City School District began developing their ETI proposal in the fall of 1989 when the ETI was being discussed in legislative committee. They wanted to be ready with a plan if the legislation passed. The Salt Lake City District ETI proposal was built on their prior technology program. An ETI committee was established to develop the plan. The committee was chaired by the district's technology coordinator, and included the district's administrators for library/media services, data processing and vocational education, two Chapter One program teacher consultants, a high school, intermediate and elementary school principal, three high school teachers, one intermediate school teacher, two elementary school teachers and an elementary school librarian. The principals and teachers were chosen because of their expertise and/or interest in technology applications to education. The plan was developed by the ETI committee, reviewed and approved by the superintendent and his staff and then forwarded to the school board for final approval.

What happened during the planning process? The planning process began with a "Vision Conference" in December 1989. This conference was organized by the Salt Lake City School District Education Foundation, a private fund-raising organization. The conference lasted for a full day and was attended by the technology committee and district administrators. Representatives from leading national and local computer companies were invited to present "their vision of technology and how that might fit into the schools" (ETI Coordinator). The committee wanted to see future directions and cutting edge technology. Six companies made presentations: Apple, AT&T, IBM, Novell, Tandy and Wasatch Educational Systems. Each company made a 45 minute multi-media presentation which focused on the use of technology in classroom practice.

According to the ETI coordinator, the Vision Conference helped the committee members understand ways in which technology could enhance current instructional practice. For example:

> Many of our people had a mathematics background and they knew the problems of trying to help kids understand mathematics. But (in teaching

> slope) when you drew it laboriously on a chalk board and tried to make it come alive for the kids it just wasn't happening. But by using an LCD plate, an overhead and the computer you could watch the slope change. They (the committee members) lit up and understood that technology could be a major force....It just deepened their understanding and gave them a reality check on what was really possible instead of being in some science fiction movie.

Members of the technology committee were shown a variety of instructional applications including networking (both distributed networks and lab-based networks) LCD's and a variety of software and hardware systems.

The Vision Conference was followed by a series of meetings to develop a plan. Subgroups focused on elementary, intermediate and high schools. For each level of schooling goals were identified for mathematics and language arts. Based on these goals, recommendations were made about computer hardware and software systems. The aim was to develop a general structure which would allow faculty at individual school sites to identify their own needs and develop a plan--"a vision of technology and education in the district."

After the technology committee had drawn up a general plan the allocation of resources was negotiated with school principals. The technology committee decided to allocate the money to the elementary, intermediate and high school levels according to student enrollment. Fifty percent of students were enrolled in elementary schools so 50% of the ETI money was allocated to the elementary level, 15% to intermediate schools, 25% to high schools. The remaining 10% was allocated to automate the K through 12 library system. A plan to distribute the money was negotiated with the principals of the elementary, junior and high schools and a different system was developed for each level of schooling. The final proposal was written by the Technology Coordinator and approved by the committee, the superintendent and the school board.

The district administrators and ETI committee spent almost a year prior to the onset of the ETI project planning their program.

> We had a planning year where the technology committee really looked into the various options and as a group, which included a lot of teachers, administrators and people in the district, looked at the best way we would be able to implement the technology. When we came up with an overall plan (I think it was 100% unanimous), that was the way we should go and so everybody came out of it feeling good."

What were the influences on proposal development? Three factors influenced the development of Salt Lake City School District's ETI plan: (1) the district's commitment to shared governance and site-based management, (2) lack of current knowledge of 'what works' in technology, and (3) the ETI focus on instructional outcomes.

The Salt Lake City School District has a policy of shared governance and site-based management. This means that policy decisions are made collaboratively by teams of district and school administrators. District policies also encouraged school faculties to develop site-based plans. This orientation was applied to the ETI.

> We have site-based decision-making in schools. If we had arbitrarily taken the money and divided by the number of students as some districts have done...This is not in keeping with our philosophy. We wanted to allow school level involvement. (Assistant Superintendent).

The influence of the shared governance and site-based decision making policies on the district's plan can be seen in the different approaches taken at the elementary, intermediate and high school levels and by individual school teams.

The district administrators and ETI committee were also committed to finding the most effective use of educational technology. A review of the literature by the ETI coordinator, who is currently completing a Ph.D dissertation on educational technology, had revealed little systematic data on the effectiveness of different approaches. According to the superintendent:

> We didn't know what was the most promising way to go and felt like we needed to try some different approaches and try to ferret out the strengths and weaknesses of those approaches before trying to go district-wide with anything.

The district's plan, therefore, included an emphasis on research with a specific focus in the first year on evaluating the effectiveness of Integrated Learning Systems (ILS) at the elementary school level. The focus on evaluation was also reinforced by the requirements of the ETI. Committee members believed that the ETI proposal writing process pushed them to become more goal oriented in their application of technology to education. Before the ETI the district's plan had been fairly general, for example, "a computer on every teacher's desk." The ETI proposal writing process pushed them to link goals to demonstrated instructional outcomes--"how will this influence teaching and learning in math and reading?"

> The ETI forces us to say, 'Well, we need some hard data to support what we are doing.' It has forced us to be more goal oriented and more outcome oriented and that is probably good, because you can play at technology and please parents no end, please the kids and yet not know we're going to make a difference in teaching the reading process. (ETI coordinator).

What was in the ETI Plan? Salt Lake City School District's emphasis on shared governance and site-based management meant that the plan was individualized by level of schooling and by school site. The allocation of funding differed at each level of schooling. These different approaches were negotiated between the ETI committee and the school principals representing their faculty. The elementary school principals agreed to go through a competitive proposal review process in which only four or five schools were to be funded each year. In addition, one teacher in each elementary school was to be given an Apple IIe workstation and software. At the intermediate school level two schools opted to take equal shares of money while the other three schools decided to competitively bid on the remainder. At the high school level the money was equitably divided between the four high schools.

Each school, whether participating in the competitive funding or equal sharing program, was required to submit a site-based plan.

> We wanted it to be a piece of (the plan they were putting together for their whole school and so we made them tell us what they are doing as a school, what their schools goals are. It's got to be congruent to those. It has to just make sense. It can't be just a cute little add-on. (Assistant Superintendent).

These plans had to be approved by the District's ETI committee before money was allocated. This school planning process is viewed as a strong aspect of the district's ETI program.

> I'm the most pleased about the process--the proposal-based outcome direction, the focus, the fact that schools are taking responsibility for it--which it has to have if it's really going to work. There is real ownership by the schools. There has to be, in order to become a winning proposal, the enthusiasm of the teachers, even though we are demanding a lot of them and there is a lot of frustration, they are still enthused and wanting to do right by the whole process...It needs to be site-based for the ownership of the teachers and because I don't believe there's one right way of doing it. It needs to be the right way for that school. (ETI Coordinator).

The district's 27 elementary schools competed for $618,356 in funding in 1990-91 and $481,645 in 1991-1992. There were two main reasons the ETI committee and elementary school faculty elected to participate in a competitive bidding process. First, a process of equal division of funds would have given each school approximately $22,084 and $17,202 for the first and second years respectively. This would not have provided sufficient funds to put in place a fully functioning computer lab or a dispersed system. The majority of faculty wanted to install a complete system rather than install technology in a piecemeal process. Second, the ETI committee and principals reasoned that there was less information available on the integration of technology into the elementary school curriculum than at other levels of schooling. They wanted time to study "what worked." This focus on systematic evaluation of technology programs was influenced by the ETI's emphasis on instructional outcomes.

The ETI committee decided to install and evaluate the use of Integrated Learning Systems in the 1990-91 year. Proposals were only accepted from elementary schools willing to install an ILS and participate in a study of the outcomes. Although Salt Lake City School District had begun planning early for the ETI process, by the time the legislation passed, district guidelines were established and school proposals solicited, schools had only two weeks to write and submit their proposals. Six elementary schools--Bonneville, Hawthorne, Nibley Park, Uintah, Wasatch and Whittier--submitted proposals. The proposals were reviewed by an ETI subcommittee and rank ordered. The top three schools, Bonneville, Hawthorne, and Wasatch, were funded.

In the first round of funding, because of the short turn around time for proposals, schools who were already involved in working with technology had an advantage. According to the chair of the ETI committee schools who were funded in the first year:

> We're already studying technology and had a commitment to technology. They already had school-based technology committees in force. They were going out and raising money to do the kinds of things we were offering funding for. So they had done a lot of leg work, a lot of homework, a lot of thinking prior to [submitting the proposal]. Their faculties were well trained already. They had an installed base of technology because they had used every penny that they had been able to scrape together to do technological things already....They had strong community support that had been out helping them look at issues and the parents really wanted it. So when the proposals came in it wasn't even a difficult decision. When you read them (the school proposals) it was like night and day in terms of readiness, in terms of having really thought things through.

In the first year the committee decided it was best to go with schools who were already prepared to start up in order to give other schools time to develop their plans.

Another factor which influenced the proposal submission and selection process was the district's requirement that ETI schools commit 10% of their discretionary funds to the ETI project to cover incidental expenses such as wiring, minor remodelling etc. Chapter One schools and schools on the west side of town which have higher proportions of low income students tended not to apply because they could not afford to allocate these funds. Their discretionary funds tend to be allocated for teaching assistants to help deal with low achieving students and disciplinary problems.

In the first year, therefore, due to differences in preparedness and economics, the three schools given ETI grants were in the middle or east side of town in middle income neighborhoods. The school board was concerned that schools in low-income neighborhoods had not received grants. As a result, the ETI coordinator worked with westside schools to help them develop proposals for the 1991-92 round of funding.

Eleven elementary schools submitted proposals for the second round of funding: Backman, Bennion, Ensign, Franklin, Jackson, Lowell, Newman, Nibley Park, Parkview, Washington, and Whittier. The ETI committee used a new system of evaluation in second round of funding. Five independent readers (school district faculty and administrators) read the proposals and used an evaluation form to award school proposals points on the basis of six criteria:

- completeness and coherence of the plan;
- clearly articulated goals;
- systematic plan of evaluation;
- plan for teacher training;
- creativity; and
- support of parents, teachers and students.

Three schools received full funding--Ensign, Newman and Washington. Parkview received partial funding and will receive complete funding in the 1992-93 school year. Three of the four schools--Newman, Parkview and Washington--are on the west side of town and have large populations of low income and minority students.

What were the elementary school projects for 1990-1991? The three schools funded in the 1990-91 school year each installed Integrated Learning Systems. An ILS typically provided schools with a complete technology package that included a computer system, software, teacher manuals, student workbooks, a student evaluation system, and teacher training. With an ILS, students are working through computer activities in a sequential fashion with early activities laying the foundation for later activities. Instruction consisted of computer presenting problems (in a tutorial or drill and practice format) which students worked through, received feedback on their answers, and were presented with further problems based on their performance. This form of computer usage fits well with the traditional public school curriculum in which teachers and workbooks pose problems to students. Most Integrated Learning Systems had a record-keeping system which tracked student progress. This feature enabled teachers to monitor student progress and easily produced progress reports to send home to parents. Many ILS packages included a service agreement which provided maintenance of hardware for some specified period of time and inservice training for teachers. Essentially, the complete ILS package was relatively simple for teachers to set up and incorporate with their current instructional practice.

Interviews with teachers in the ILS schools indicated that these systems were, in fact, easily integrated into their instructional programs. Teachers most frequently used the system for presentations and for drill and practice. For example, a second grade teacher said, "I can do presentations on the T.V. screen with any software" and a fourth grade teacher, "Starting long division. I can do it with a computer program and show children because it is right on the screen". Many teachers believed that, "the computer is a tool for practice.....and they (the students) like to practice SRA (a math drill and practice program). SRA just pops up questions in a sequence from easy to hard. Not telling how (to do them), just drill." Teachers in ILS schools felt it was too early to see tangible results on student achievement. "We've just started. It is too early to tell," and "as far as long range impact, it's too early to tell."

Bonneville Elementary School had an active technology program before the implementation of the ETI. Beginning in 1983, the PTA, School Community Council and school staff worked together to raise money to purchase computers and software, and develop a computer-assisted curriculum. In 1985 the school opened a computer lab with 12 Apple IIe computers. With the help of parent volunteers students were divided into small groups to work in the computer lab. In addition, eight Apple computers were shared on a rotational basis between classrooms. The school had in place a computer committee and a technology specialist funded with career ladder money. All the faculty had gone through inservice training on computer operation and instructional applications.

The majority of students at Bonneville were achieving at or above grade level in reading and mathematics. With their ETI grant of $125,804 the school faculty wanted to purchase a system that would stretch their capabilities. They decided to install an ILS system developed by Wasatch Educational Systems because they had a wide range of software in reading, writing, math, science and social studies that extend beyond the elementary age level. This system was installed in a 36-station networked PC lab. The Wasatch Learning Network utilized a "Basic Skills Test" which pretested and placed students at the appropriate level in the reading, writing and math software. Once students had been individually placed in the courseware, they worked through sequential skills at their own rate. Outcomes of student performance were analyzed using assessment built into the program.

Hawthorne Elementary School wanted to install a computer system that would serve the 90% of students who perform within the average range of achievement and remaining 10% who have special learning needs. Before ETI the school had 13 Apple II computers--nine placed in individual classrooms including two resource classes and three self-contained classrooms--the other five computers were rotated. All the teachers in the school had been trained in computer operation. Twenty-two out of 26 teachers had taken classes in Appleworks, word processing and database. Eight teachers were using a computerized grading system. The school also had a computer/math specialist who did computer workstation training for the district.

The school used $197,907 in ETI funds to install a distributed network using the Wasatch Education Systems ILS program. Three PC computers and one printer were placed in each classroom. Self-contained special education classes were provided with one workstation and a printer. Like the Bonneville faculty the teachers liked the individualized tutorial aspect of the ILS system with built in pre-testing to place students at the appropriate level and utilized continuous assessment. Wasatch Education Systems provided inservice training for the ILS system.

Wasatch Elementary School used their $204,745 in ETI funds to install Jostens' Learning Corporation ILS system. They also believe that this is the most effective way to use computers to individualize instruction for a wide range of students. Before ETI the school had 15 Apple IIe and two Macintosh SE computers that were rotated through the classrooms and used for skills/drill game programs, in the library and for the District Computer Acquisition program. The ETI project focused on math and reading. The goal was to help low-achieving students perform at or above grade level and also challenged students who are already working at grade level to strive for higher levels of thinking and attainment.

The faculty believed that the ILS system, through individual tutorials, would help provide drill and practice for low-achieving students and enrichment activities for average and high-achieving students. The school installed distributed network with three PCs in every classroom. Before the implementation of the ETI 96% of the teachers had been trained in computer operation. As part of the ETI, Jostens trained teachers in the use of the ILS. In addition, the school dedicated two career ladder positions to provide specialist teachers to support implementation in grades K-3 and 4-6. The school faculty, collaborating with faculty from Utah State University, have developed an ongoing program of research and evaluation on the ETI project.

What were the Elementary School Projects in 1991-1992?

The three elementary schools funded in the 1991-92 school year all installed tool-based computer systems. These systems allowed teachers and students to develop representation of problems. The computers were used, essentially, as open-ended flexible tools. In using a tool-based system teachers and students controlled rather than responded to the machine. In mathematics, for example, using a program such as ToolBook, students program the computer to solve problems. Using Hypercard, a student preparing a social studies report on Thailand included photographs, maps, spoken language, music, etc., in the text. The teacher, instead of reading a report, experienced a presentation on the computer.

These programs were not quite as simple to integrate into regular instruction because they were more complicated to operate and often required a shift in instructional practice from close-ended to open-ended solutions. Students learning through these programs often took longer on a single concept than in regular instruction. For example, students learning fractions using ToolBook first figured out the problem, represented the problem graphically and then programmed the computer to solve similar types of problems. One fifth grade teacher talking about her students using a Hypercard stack to do a writing project said, "They do far more, they keep wanting to go on and on, it's difficult to get them to stop." Many teachers commented, however, that tool-based systems have increased student motivation to learn. One sixth grade teacher said his students "now felt smart at math...they felt like they were learning."

Ensign Elementary School's ETI project focused on the reading/writing process and incorporated a program of portfolio-based student assessment. The school received $122,000 and installed a 35-station Macintosh Classic Lab with a Laser printer and six Imagewriter II printers. Each teacher received a Macintosh LC and Imagewriter printers networked to the computer lab. The school also purchased an LCD plate and overhead, an Apple scanner, an interactive video player, and a 9600 baud modem.

During implementation teachers, using the Reader/Writer workshop approach, focus on improving students' writing skills. Students go through a writing process including brainstorming, drafting, editing and refining their text. Teachers conference with students and add developmental end notes indicating growth and progress to the students personal computer diskette. A computer-based portfolio of student writing, teacher feedback, student self-evaluation, reflective thinking, and reading and writing goals will record student progress throughout the elementary grades. This portfolio will be used by students and teachers for ongoing assessment of progress and at the end of grade 6 for evaluation of language arts performance for middle school placement.

Newman Elementary School received $72,000 to install a tool-based system utilizing the LEGO-LOGO robotics, LogoWriter and Write More Learn More Plus software systems. The school distributed 24 Tandy workstations in the classrooms. The school's ETI project has a strong focus on improving students' problem-solving and higher order thinking skills. The faculty wants to integrate hands-on learning activities with computer-based instruction. The software programs they installed focused on problem-solving and the writing process. Lego Logo Robotics was used to teach a wide variety of math and science concepts.

Washington Elementary School received an ETI grant of $204,000 to implement a computer education program in partnership with faculty from the Department of Educational Studies at the University of Utah and IBM. The project focused on integrating computer-assisted instruction in mathematics and reading in conjunction with hands on learning activities. A particular concern was improving the teaching and learning of mathematics. Students' math scores had declined over the previous four years and as a consequence the Chapter One program had been placed on probationary status. The school installed five IBM PC workstations in each classroom and 18 in a computer lab. 104 workstations were purchased through the ETI grant and 15 were donated through the IBM grant awarded to the Graduate School of Education at the University of Utah. IBM donated the software.

IBM TLC software was used in the reading, writing and math programs. This program integrated the use of computers with a program of conceptual learning which emphasizes the use of manipulative materials, active student involvement in problem-solving situations and cooperative learning. IBM provided five days of staff development in the use of the TLC program. In addition two university of Utah mathematics educators and a graduate student engaged in a program of classroom-based staff development with the 4th, 5th and 6th grade teachers. The university and school faculty have been working together to implement Toolbook--a tool-based software system--in the math classes. A third faculty member from the University of Utah has been collecting data on student achievement and teachers' instructional practice.

What were the intermediate school projects? At the intermediate school level two schools opted to take equal shares of the ETI money and the other three to competitively bid on the remainder. Bryant and Northwest, equal-share schools, were both awarded $30,000. Bryant school did not develop an ETI plan for the 1990-91 school year so their funds that year were reallocated to the elementary program and Bryant was awarded $60,000 in the 1990-91 school year and is currently developing a program. Clayton, Glendale and Hillside intermediate schools competed for $90,000. In 1990-91 Glendale's proposal was funded and in 1991-92 Clayton was funded.

Northwest Intermediate School built on their existing program in reading and language arts and expanded this to include a math program. Prior to ETI, the school had in place a language arts lab with 15 Sperry Computers which used the Wasatch ILS reading program and eight Apple IIes in a math lab. With ETI funding the school added another 15 station language arts lab and a 15 station math lab. These labs both used Tandy computers and Wasatch Reading and Math ILS software. Eleven computer stations have been installed in individual teachers classrooms. All computers in the school are networked. Teachers receive ongoing staff development from Wasatch Computer Systems.

In the future, the school plans to install computers in all teacher classrooms. They plan to expand their existing program to include tool-based software such as Hypercard.

Glendale Intermediate School's ETI project focused on improving the reading skills of basic skills students (those students who read two or more years below grade level). Their primary goal was that all students would be reading at or above grade level. In the 1989-90 school year an eight station WICAT ILS reading computer lab had been successfully used to improve test scores for the 7th grade basic skills students. Teachers scheduled this lab for the full time that school was in session. The faculty wished to extend this program to 8th grade students so the school installed a second WICAT reading lab with eight computer stations. Glendale also had a 15 station computer lab in place for use with the state's TLC vocational education program which was only used for two to three periods a day. They have also placed 15 IBM PC workstations in the library. These are used with expanded this lab to a 30 computer facility and added Jostens' language arts software. This lab has been completed and is now fully scheduled for use with TLC, literacy and word processing programs.

Clayton Intermediate School is in the process of installing a 36-station networked PC computer lab to be used primarily to improve students' writing skills. The school will also install a distributed system to be used for a math exploration program. In addition, the faculty wanted to build a program that bridged the programs in the feeder elementary schools equipped with ILS computer systems and the high schools which had writing labs. The lab utilizes word processing and writing software packages: Microsoft Works, Grammar Checker, Writers Helper, Style Checker, Desktop Publishing and WordMap. The school already had in place a lab with 27 Apple IIes which is fully scheduled for the Business/Marketing core classes.

What were the high school projects in 1990-1992? The three regular high schools and one alternative high school in the Salt Lake City School District already had a significant amount of technology in place. Each high school had a business-oriented computer lab which was used to teach word processing and business systems. The district math/science advisor had put several IBM Pcs in the math and science departments which students used to analyze statistical data. Highland High School had a writing lab which had been provided through private fund-raising.

On the basis of student enrollment the ETI Committee allocated 25% of the funds ($262,639 in 1990-91 and 226,298 in 1991-92) to the high schools. A sub-committee of four teachers, chaired by the principal of the alternative high school, negotiated the division of money among the four high schools. The alternative high school, Salt Lake Community High, requested and was awarded $75,000 over two years to purchase an Integrated Learning System. The rest of the money was equally divided between East, West and Highland High Schools--approximately $75,000 per school in 1990-91 and $64,000 per school in 1991-92. Unlike the elementary schools the high schools did not compete for funding. In order to receive the money allocated each school was required to write a proposal and receive approval from the ETI committee. The high school plans built on their previous technology base and individual needs.

Salt Lake Community High School, the alternative high school, had a student population with very diverse learning needs. The school's goals were to raise the math and reading scores for at-risk students. The school purchased an Integrated Learning System which could be used to individualize instruction across the curriculum, bring students up to grade level in a variety of subject areas, and help them complete high school graduation requirements. The school purchased Computer Curriculum Corporation's instructional system which includes 26 courses grouped in five curriculum packages which provide kindergarten through adult instruction in math, reading, language skills, computer education and science. This system had a sophisticated program to track student progress and provide individual and group reports. The school installed a computer lab with 20 networked Tandy workstations and a file server. This system built on the Novell system already installed in the school which had been used to teach computer application programs. The school's remote sites at Oasis and Garfield have access to the network via modem. School faculty were provided with five days of in-service by Computer Curriculum Corporation in 1990-91.

East High School's technology plan focused on improving students' skills in mathematics, reading, science, writing and technology. Each mathematics teacher was provided with a PC computer workstation, a LCD plate and overhead for class presentations and math software including IBM Toolkit and Math CAD. In addition, a writing lab with 15 networked PC computer stations was established. Future plans included adding modems and phone lines so students could call in, retrieve files and continue working on their projects at home. The use of computers in science to conduct and analyze experiments has been growing.

East high school now has four operational computer labs (science, writing, business and computer science), computer workstations in each special education classroom, and two computers in the graphics department. In 1992 the number of computers in the science lab will increase to 15 PCs and two computers will be available for science faculty to use in their classrooms, and the school plans to create a new cross-departmental computer curriculum lab containing 15 to 20 PCs. This lab will also have modems and phone lines for use by students who want to work at home during the night or who are unable to attend school due to illness. An Internet hookup will be established and students will be able to use computers to link with bulletin board services such as Compuserve, Dow Jones, the Source and East High's own computer bulletin board.

East's faculty experience with computers ranges from none to very competent. About half the English teachers are trained to use computers to teach writing. In the math department, most teachers have some computer training and use their computers for instruction. Most training is provided in-house.

In the summer of 1991, one teacher attended a Computer Equity Expert Project Seminar and is training other teachers to involve more girls in computers, math and science. The faculty see a need for ongoing staff development in technology. The impact of ETI at East High is to make the use of computers a regular part of the instruction in math, science and writing. It has also introduced students to some of the benefits of advanced technology such as using the computer network to work at home and do research using national databases.

Highland High School had three computer labs prior to the ETI: business, computer science and writing. The Mac writing lab had been funded by the community. The school had also encouraged teachers to gain expertise in computer technology by attending university classes and district in-service courses. These teachers were given access to computers in school. The school's goal was to make all teachers and students computer literate. The school wanted to provide each teacher with a computer workstation in his/her classroom to use for instructional presentations, record keeping and planning while students used computers across the curriculum. With ETI funding Highland installed a 15 IBM PC workstation in the math, science and social studies areas to be used in all areas of the curriculum and has purchased site licenses for Word Perfect, Draw Perfect and Plan Perfect. They also upgraded the writing lab and placed a computer workstation in each English teacher's classroom. Twenty teachers were trained in-house in basic computer operation, word processing, spread sheet and data base. With ETI funding Highland High School has increased access to computers for both students and teachers.

West High School focused on integrating advanced technology into instruction across the curriculum and increasing access to students. The school has a shared governance committee where teachers from each department work on the development of the ETI program. Before the implementation of the ETI the school had two Epson 20 computer labs that were used for business classes and 20 Epsons in a writing lab. With ETI funds the schools has installed a curriculum lab, upgraded the writing lab and provided computer workstations to all math and science faculty members. The school has installed 25 networked PC workstations in a curriculum lab which can be used by teachers from all subject areas, though presently used by the English teachers. The lab has been equipped with a wide variety of word processing, spread sheet, data base, math coprocessing and graphics capabilities. It has a modem and dedicated phone line so students can access national databases.

Beginning February 1, 1992, students will have open access to the curriculum lab before and after school. It will be staffed by a supervisor and will be open from 7:30 am to 6 pm.

The writing lab has been upgraded by the installation of 15 PCs networked with the Epsons to provide a 35-station facility. This has been opened for student use during lunch times and for two hours after school. Each math teacher has been provided with a Tandy workstation with math co-processor, an LCD plate with overhead projector and a wide variety of math ILS and tool-based software. Similar equipment has been made available to the science teachers. Six stand alone machines donated by Hewlett Packard have been upgraded with 40 megabyte hard drives and are being use by the science faculty with five LCD plates and overhead projectors.

The school has begun using advanced technology in multi-media instructional presentations. Five video laser players have been purchased, giving teachers the capabilities to give video disc presentations. In addition, a pilot project has been started in biology and chemistry to develop multi-media curriculum materials, where teachers can transfer material from video disc to videotape and incorporate their own voice over. This project has been led by a science teacher but also involved teachers in English, foreign language and math. About 40% of the teachers in the school have been trained in-house in basic computer operation and software programs.

How did ETI contribute to the library program? In 1988-89 a library subcommittee of the district's technology committee began an analysis of the technology needs of the library system. This committee recommended the computerization of the catalogue for student use. Members of the committee pointed out that the catalogue systems in the state's universities and libraries were already fully computerized. It served little purpose to teach grade school students to use the outdated card catalogue system. The committee also wanted to make technology accessible to all students. "Many other school districts have put in computer systems for circulation but that doesn't give access to students. We just felt kids need it." (Librarian)

The committee recommended the installation of an integrated computerized catalogue and circulation system. They also recommended that all school be provided with CD ROM technology, a fax machine, a copy machine and computer access to the Salt Lake City Public Library. ETI allowed the district to implement this plan.

Ten percent, about $110,000 per year, of Salt Lake's ETI money has been allocated to the library system. The district installed the DYNIX program using Hewlett Packard computers to computerize the card catalogue in each school. It also installed the Union Catalogue in the media building to catalogue all the books owned by the district, enabling schools to access the central system via modem and obtain books through inter-library loan. The district obtained a state productivity grant which they used to hire Retrolink Associates to input the information about books for 14 schools. DYNIX Corporation then loaded the program onto the computers. Each participating school received a Hewlett Packard 386 PC. The elementary and intermediate schools received four networked student access terminals, the high schools five, and the alternative high school three. All schools received a modem to access the central Union catalogue.

Schools who wished to apply to become part of the program were required to satisfy two criteria. First, they had to 'weed' their collection and get rid of out-of-date books, those containing inaccurate information and worn out books. Second, they were required to list shelf cards for each book the Library of Congress and International Book numbers which could be used to generate machine readable records. Schools that met these criteria submitted an application which was reviewed by the ETI library subcommittee. Schools were selected based on faculty expertise in technology, willingness to engage in-service training, and support from the principal. In 1990-91, six elementary, one intermediate and two high schools were selected. In 1991-92, seven elementary, intermediate and two high schools entered the program. The district plans to involve three intermediate and six elementary schools in 1992-93 and the remaining eight elementary schools in 1993-94 to complete the program.

DYNIX provided two days of staff development for librarians in the participating schools, plus on-site support and trouble shooting throughout the year. The district library staff provided in-house staff development on a bi-weekly basis throughout the 'ear. In the second year of the program school librarians, who had been trained in year one, acted as mentors to school librarians who were entering the project. The library staff also developed a CD on the project, which was disseminated to the other 39 school districts in the state.

Did ETI contribute to special education programs? No independent provision was made for the special education program. Previously Chapter One schools had been provided with computer labs and the alternative high school with an ILS system.

What Constraints did Salt Lake City School District Experience?

Five constraints emerged in the implementation of the ETI plan:

- teachers lack of expertise in technology;
- limited funding for in-service training;
- space limitations in schools;
- technological support; and
- increased paperwork.

A primary issue was teachers' ability to effectively utilize the new technology. The majority of teachers in the district had not been trained in how to integrate technology into their classroom instruction. The pre-ETI technology program had provided limited in-service training in word processing, and specific instructional programs such as the IBM math and reading programs. Elementary school teachers who had received workstations participated in a two day workshop in computer operation. At the secondary level a series of classes had introduced teachers to computer operation and subject-specific software. Teachers' expertise, however, was typically limited to the use of a specific program. Few teachers had the knowledge and skill to integrate technology into their daily mathematics and language arts instruction.

During the first year of implementation there was confusion as to whether funds could be used for in-service training. In the second year there were many restrictions. "It is just not worth figuring out a way to use ETI money for inservices." The district used $8,000 of their State supplementary funds to provide inservice training.

> It's almost one-on-one kind of training that's needed--a mentor and then another one. That's what it takes to be really effective. I'm teaching inservice because my salary covers that. I'm doing everything I can to try and stretch the dollar, to try and get inservice to the level it needs to be. That's just something that's not thought about--how much inservice is going to be, because there's hardware inservice (provided by computer companies). They (the teachers) have to have the time to really look at software. It's just like when you get a new series of math texts. The teacher really has to digest the texts themselves. The same thing. It requires sitting down in front of the machine and spending hours looking at software so you know how to integrate it into the curriculum. Then they need to know the strategies of using it effectively with children. Then you want to teach them the kinds of things that will empower them as a teacher to do some of their administrative tasks, and on and on and on....That's the part I don't think the legislators realize--just how labor intensive it is for the teachers to become competent. (ETI Coordinator).

The district staff was concerned that unless school faculty received sufficient training and support they would become overwhelmed by the complexity of integrating the technology into their instruction. Space was also a concern. After recent years of declining enrollment in which several schools were closed, Salt Lake City district's student population is now growing. Most elementary schools were at capacity, many were using portable classrooms. It was often difficult to find space to put in a computer laboratory. The assistant superintendent cited the case of an intermediate school teacher who wrote a successful grant proposal to integrate technology into instruction for limited English speaking students.

> We really have encouraged teachers and schools to be innovative to seek grant money. Well, one of our intermediate school teachers wrote a grant for ESL funding and she got half a million dollars over a five year period and it requires a (computer) lab. We went over the school with a fine

> tooth comb and we can't find a place to put it....So now we're trying to pick up the pieces and see how to do it. But we might spend as much money to remodel the building as you got for the initial grant. It's a huge issue. (Assistant Superintendent.)

Issues of space were compounded by security concerns.

> You can't put it (a computer lab) in on a first floor where there has already been break-ins without making some major modifications security wise, and all that adds up to dollars and cents.

The installation of a large number of new computers also put additional demands on the district's resources for technical support services. Much of this additional work has been undertaken by the district's ETI coordinator who has considerable technical expertise.

The ETI coordinator's load was also increased by new paper work.

> Just the bookkeeping stuff I have to do for the ETI is incredible. I mean $1.1 million worth of expenditures and I have to fill out a form for each individual purchase--you have to put the retail price, the normal education price, and the ETI price. I mean that increased my workload twofold.

In addition every requisition over $2500 must be approved by the school board.

How are the Salt Lake City School District ETI Projects Being Evaluated?

Two main approaches are being used to evaluate the ETI in Salt Lake City public schools: (1) district-wide studies of Integrated Learning Systems in the elementary schools and language arts at all levels, and (2) individualized site-based school evaluations.

In the first year of the ETI project the district focused on evaluating the effectiveness of an ILS to teach reading and mathematics in elementary schools. The three ETI schools-- Bonneville, Hawthorne and Wasatch--were matched on the basis of student achievement and demographics with three non-ETI control schools. The research and evaluation department compared student achievement gains in the ETI and non-ETI control schools for the 1990-91 school year. One ETI school, Bonneville, showed significant student achievement gains in both reading and mathematics when contrasted with the non-ETI schools. The other two ETI schools also scored better than the non-ETI schools, although the gains were not statistically significant.

The district is continuing to do research to identify the key teaching and learning factors that support the effective use of technology. In the 1991-92 school year all ETI schools will cooperate with the district's newly established Evaluation and Program Audit Department to evaluate student performance gains in reading and writing. In the spirit of site-based management each ETI school will establish individual criteria. Measurement tools will include: (1) norm referenced achievement tests, (2) criterion referenced tests, (3) teacher evaluation of student performance, (4) increased number of word-processed written documents submitted by students for teacher evaluation, and (5) improvement in writing samples randomly selected and holistically scored.

Also, the district required schools to develop an evaluation plan in their ETI proposal. Several elementary schools have joined with faculty from local universities in collaborative research and development projects. Faculty at Washington Elementary School are working with faculty from the Department of Educational Studies at the University of Utah to implement and evaluate the use of the conceptual tool-based computer program Toolkit in the teaching and learning of mathematics. Wasatch Elementary School has joined with instructional technology faculty from Utah State University to evaluate the use of an Integrated Learning System to teach mathematics and reading. Newman Elementary School faculty members are working with the faculty from the WEMATH program based in the Mathematics Department at Weber State University to develop an evaluation of their LEGO-LOGO program. Ensign Elementary School is using a portfolio assessment to evaluate its computer-based writing program.

The District staff believes it is very important to involve outside experts from local universities in evaluating the ETI program:

> I think it's critical. Number one, we don't have that kind of expertise necessarily in the district. Number two, I just think it's part of the puzzle that we want to make sure the universities and the public schools are communicating in a technological sense. (ETI coordinator.)

The district's decision to focus on the installation of ILS systems in 1990-91 and tool-based systems in 1991-92 will allow them to systematically study the instructional and student achievement outcomes of these two approaches.

Evaluation at intermediate and high school levels will begin in the 1991-92 school years because their new programs are just getting under way. These schools will be involved in the district-wide assessment which will track students reading scores on the district's criterion referenced tests.

CHAPTER 6:
From the Perspective of the Evaluators

The Utah Educational Technology Initiative appears to have energized and excited teachers and administrators. It has given them an extraordinary opportunity to establish or expand computer labs, install distributed classroom computers, purchase desired software, and acquire advanced, multi-media hardware. ETI has made it possible for schools to reduce the student/computer ratio, and make educational technology more available to students. These are significant accomplishments, and students' resulting familiarity with computers will help equip them to succeed in an increasingly technological world. As a high school English teacher put it as she proudly showed off the newly expanded writing lab, humming with activity as students worked on English essays and history term papers:

> "We're turning out writers! Everyone who leaves here knows how to use a computer for word processing. Some students become more accomplished, and master graphics programs that allows them be both author *and* illustrator."

Although ETI has accomplished a great deal by making the opportunity to use technology more available to students and teachers, it faces a significant challenge if it is to fully impact Utah education. This challenge is training teachers to use the newly available technology effectively. In our visits to schools, we encountered teachers exhibiting disparate levels of computer expertise. Some were quite competent; others were fearful and hesitant to touch a machine. For many adults, the computer is a frightening apparatus. Intensive training and time to experiment and discover what a computer is good for is necessary to overcome initial fears.

- If computer technology is to really make a difference in the instructional life of most teachers, then attention to teacher training and support is needed.

Beyond operational competence, there is the challenge of integration. Most teachers, even if they know how to use a computer, don't know how to integrate students' use of computers into their instructional programs. This takes time, experimentation and support. Teachers often learn best about innovations such as computers by observing more experienced teachers who have already made progress in melding appropriate curriculum and instruction with computer technology. Professional meetings, where teachers can talk with one another and see demonstrations of new curriculum and instructional techniques, are important sources of information and support. A practitioner support organization can enable teachers to learn from and share with other teachers. We advocate attention to the development of an educational technology support organization that can aid and eventually supplant school districts' efforts to train their teachers to use educational technology effectively.

A final challenge is to confront and change current school structures so the technology now available can be utilized to the maximum extent possible. In some schools we visited computer labs sat idle because of scheduling conflicts or staffing constraints. In other schools, the lab was busy from before school began to several hours after it closed. District and state funding formulas which have nothing to do with technology can significantly affect whether a school can afford to hire a full-time computer specialist. Class schedules determine how many minutes a student can spend on a computer. Pre-existing space allocations can prevent the efficient distribution and allocation of computers. Student and teacher access to computers is determined by much more than the number of machines available for use. Institutional constraints like scheduling, staffing formulas, and space allocations will determine whether computers actually will get used.

- If computer technology is to be used efficiently to the fullest extent possible, then state and district policies that affect computer use should be examined and modified as appropriate to facilitate computer use.

In summary, the overall challenge facing the Utah Educational Technology Initiative is a reorientation from a program primarily designed to enable districts to purchase hardware and software to a program that places equal emphasis on the more difficult task of helping teachers use the purchased hardware in an educationally effective manner.

Methodological Notes

Chapter 2

1. District ETI Coordinators were asked to verify the goals on Table 3.2. We did not receive responses from the following districts: Daggett, Iron, Morgan, Piute.

2. These data were reported by District ETI Coordinators.

3. These data were supplied by the Utah Educational Technology Initiative office and sent to school districts for verification.

Chapter 3

4. The following Schools are included in the ETI treatment group:

Alpine School District

- Cascade Elementary
- Cherry Hill Elementary
- Meadow Elementary
- Pleasant Grove High
- American Fork High

Box Elder School District

- Bunderson Elementary
- Lincoln Elementary
- Mountain View Elementary
- Willard School Elementary
- Bear River Middle
- Box Elder High

Cache School District

- Lincoln Elementary
- Millville School Elementary
- North Park Elementary
- Providence School Elementary
- North Cache Middle
- Mountain Crest High
- Sky View High

Carbon School District

- Mount Harmon Jr. High

Davis School District

- Burton Elementary
- Clinton Elementary
- Columbia Elementary
- Meadowbrook Elementary
- Farmington Elementary
- Millcreek Jr. High
- Davis High

Garfield School District

- Bryce Valley Elementary
- Escalante Elementary

Granite School District

- Holladay School Elementary
- Pleasant Green Elementary
- Redwood Elementary

Logan City School District

- Wilson Elementary
- Hillcrest Elementary

Morgan School District

- Morgan Middle

Nebo School District

Brockbank Elementary
Mapleton Elementary
Santaquin Elementary
Taylor Elementary

North Sanpete School District

Spring City Elementary
North Sanpete High

Ogden School District

Grandview Elementary
Horace Mann Elementary
Carl Taylor Elementary
Wasatch School Elementary
Mound Fort Middle
Mt. Ogden Middle
Ben Lomond Middle
Ogden High

Provo School District

Joaquin Elementary
Canyon Crest Elementary
Timpanogos Elementary
Dixon Middle

Provo School District (continued)

Provo High

Salt Lake School District

Bonneville Elementary
Hawthorne Elementary
Wasatch Elementary
Northwest Intermediate

South Summit School District

South Summit Elementary
South Summit Middle

Weber School District

Bates School Elementary
Green Acres Elementary
Plain City Elementary
Roosevelt Elementary

5. To examine whether there was a statistically significant shift, between 1990 and 1991, in the percentage of ETI and control group elementary schools above the predicted median, we used McNemar's chi square test for significance of change. For this analysis, a 2 x 2 contingency table was generated, with rows representing the number of schools below and above the predicted median in 1990, and columns representing the number of schools below and above the predicted median in 1991 (see below). If the null hypothesis is true, and there is no change between 1990 and 1991, then the upper-right cell (below the median in 1990 but above the median in 1991) and lower-left cell (above the median in 1990 but below the median in 1991) will contain approximately the same number of entries because those entries are attributable to random variation. The chi square statistic, derived by squaring the difference between the values in the those two cells and dividing by their sum, will therefore be low. A significant chi square suggests a shift, between 1990 and 1991, in the percentage of ETI schools above the predicted score.

For the first table below, McNemar's chi square (1*df*) = 3.267, p = .07, suggesting such a shift. Examination of the table reveals that the shift is accounted for by schools moving from below the predicted median in 1990 to above the predicted median in 1991. A smaller percentage of control schools shifted in this direction and these were balanced by a shift of schools moving from above the median in 1990 to below the median in 1991. The second table below displays the same data for as the control elementary schools. Here, McNemar's chi square for significance of change (1*df*) = 0.131, p = 0.72.

The third table below is based on the 1990 and 1991 Stanford Achievement Test reading achievement data for schools in the ETI treatment group. McNemar's chi square for significance of change (1*df*) = 2.273, p = 0.13. The final table displays the same data for the control elementary schools. McNemar's chi square for significance of change (1*df*) = 0.392, p = 0.53.

(See S. Siegel, *Nonparametric Statistics*. New York: McGraw-Hill Book Company, 1956, pp. 63 - 67.)

Mathematics Scores of Elementary Schools in ETI Treatment Group

	SAT Math Scores	1991 Below Predicted Score	1991 Above Predicted Score
1990	Below Predicted Score	8 (18.6%)	11 (25.6%)
1990	Above Predicted Score	4 (9.3%)	20 (46.5%)

Mathematics Scores of Elementary Schools in the Control Group

	SAT Math Scores	1991 Below Predicted Score	1991 Above Predicted Score
1990	Below Predicted Score	127 (31.1%)	63 (15.4%)
1990	Above Predicted Score	59 (14.4)	160 (39.1%)

M.4

Reading Scores of Elementary Schools in ETI Treatment Group

	SAT Reading Scores	1991 Below Predicted Score	1991 Above Predicted Score
1990	Below Predicted Score	11 (25.6%)	8 (18.6%)
1990	Above Predicted Score	3 (7.0%)	21 (48.8%)

Reading Scores of Elementary Schools in the Control Group

	SAT Reading Scores	1991 Below Predicted Score	1991 Above Predicted Score
1990	Below Predicted Score	136 (33.3%)	66 (16.1%)
1990	Above Predicted Score	59 (14.4)	148 (36.9%)

6. The Spearman Rank-Order Correlation of agreement between statements about improved student performance and the report of substantiating evidence = +0.54.

7. The response rate for the principal survey was approximately 73% for elementary schools, 59% for junior high/middle schools, and 63% for high schools. This is calculated by including only schools receiving ETI funding during the 1990-1991 school year.

Chapter 4

8. Our response rate for this part of the report is estimated to be: elementary schools = 75%; junior high/middle schools = 60%; high schools = 63%. This rate is an estimate because there was some confusion regarding which schools were scheduled to participate in the first year of ETI. Although we mailed surveys to all schools reported as participating, responses indicated that some of these schools did not yet have ETI funding, and some schools we did not survey informed us they were already receiving ETI funds.

   Another problem with estimating the number of computers purchased with ETI funds is that we did ask principals to distinguish the funding source (i.e., district vs. ETI) when reporting the number of computers at their schools. This was intentional. We believed the important question was: How many computers are now available for student and teacher use.

9. Such configurations include kindergarten only, kindergarten - third grade, kindergarten - twelfth grade, sixth - twelfth grade, etc.

10. This figure was calculated by dividing number of instructional computers available in elementary schools by the average daily membership of elementary students.

11. The accuracy of these numbers is affected by response rates, but are probably fairly accurate since they make sense when compared to the 1989 USOE figures. Moreover, non respondents were distributed rather evenly across districts, and thus there is no particular reason to expect the responses are not representative of the school population as a whole. For the record, the response rates for these analyses are: elementary = 74%, junior high/middle school = 59%, high school = 61%.

12. Response rates vary by grade, and range from 76% to 79% of schools surveyed.

13. Integrated Learning Systems are networked computers, controlled by proprietary software that controls students' interactions with the computer. The software determines the pacing of instruction, administers tests, and records students' performance, all without teacher intervention.

14. The response rates for these tables are approximately: Grades K - 6 = 76%, Grades 7 - 9 = 62%, High School = 64%.

Appendix A:

Student Performance Goals

Table A.1: Student Performance Expectations for Reading

District	Elementary	Secondary	Measurement Instrument to be Used
Alpine			Stanford Achievement Test
Beaver	Increase 2 percentile per year to 56% by 1994	Beginning 1991-1992, increase 2.5 percentile per year to 54%	Stanford Achievement Test
Box Elder	75% of students to reach CORE criterion		CORE Tests
Cache			CORE Tests/Portfolio
Carbon	5% increase in CORE - decrease # scoring below 25 percentile by 20%, both over 4 years	10% increase in CORE - increase American College test scores to state average	CORE, Stanford Achievement, American College Tests
Daggett	100% of students to reach CORE criterion	100% of students to reach CORE criterion	CORE, Stanford Achievement Test
Davis	26% average gain sought	3% average gain sought (High School)	CORE Tests
Duchesne			Stanford Achievement Test
Emery	Increase 10% on CORE Tests	Increase 10% on CORE Tests	CORE, Stanford Achievement and American College Tests
Garfield	Increase 3% per year one/10% by year four	Increase 3% per year one/10% by year four	CORE, Stanford Achievement Tests
Grand	Increase 5 percentile by fall of 1994	Increase 5 percentile by fall of 1994	CORE, Stanford Achievement Tests and Comprehensive Test of Basic Skills
Granite	23% of students to increase test scores	26% of students to increase test scores	CORE, Stanford Achievement Tests
Iron	Increase # correct by 10%	Increase # correct by 10%	CORE Tests
Jordan	Increase # of students scoring above sixth stanine 15% by 1995 - decrease # of students scoring below 4th stanine 15% by 1995	Increase average % passing by 20% by 1995	American College, Stanford Achievement Tests
Juab	Increase 5% percentile by 1993	Increase 5% percentile 1993/80% on CORE by 1995	COP.., Stanford Achievement Tests
Kane	Increase 2% per year from 1991-1992 until score reaches 62%	Increase 2% per year from 1991-1992 until score reaches 62%	Stanford Achievement Tests
Logan			As included in 3rd party evaluation
Millard	Increase 2%	Increase 2%	CORE (ODDM), Stanford Achievement Tests
Morgan	Increase 10%	Increase 10%	CORE, Stanford Achievement, and American College Tests
Murray			CORE, Stanford Achievement Tests

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Table A.1: Student Performance Expectations for Reading (continued)

District	Elementary	Secondary	Measurement Instrument to be Used
Nebo			CORE Tests
N. Sanpete	Increase 5% by end of year two/10% by year four	Increase 5% by end of year two/10% by year four	CORE, Stanford Achievement Tests
N. Summit	Compare Stanford Achievement test scores annually	Compare Stanford Achievement test scores annually	CORE, Stanford Achievement Tests
Ogden			
Park City	Achieve mastery	Achieve mastery	CORE, Stanford Achievement Tests
Piute	Achieve mastery	Achieve mastery	CORE, Stanford Achievement Tests
Provo	Increase 3% per year/students achieve CORE standards		CORE, Stanford Achievement, WICAT Tests
Rich	Increase 5% over 5 years	Increase 5% over 5 years	CORE, American College Tests
Salt Lake City	Reach grade level	Reach grade level	CORE, Stanford Achievement Tests, Teacher evaluation
San Juan	Increase to be determined by each specific school within district	Increase to be determined by each specific school within district	CORE, Stanford Achievement, and Comprehensive Test of Basic Skills
Sevier	Increase 10%	Increase 10%	
S. Summit			CORE, American College Tests
S. Sanpete	Increase until 90% reach 90% mastery	Increase until 90% reach 90% mastery	
Tintic	Increase 3%	Increase 3%	Stanford Achievement, American College Tests
Tooele	Achieve CORE standards	Achieve CORE standards	CORE Tests
Uintah	Increase to 80%	Increase 5% per year	CORE, Stanford Achievement Tests
Wasatch	80% reach 80%; 60 percentile Stanford Achievement Tests by 1992	80% reach 80%; 60 percentile Stanford Achievement Tests by 1992	CORE, Stanford Achievement Tests
Washington	Increase 2 percentile per year	Increase 2 percentile per year	CORE, Stanford Achievement
Wayne	Increase Stanford Achievement Tests 5 percentile by 1993; 70% on CORE by 1993; 85% by 1995		CORE, Stanford Achievement, American College Tests
Weber	Increase to be determined by each specific school within district	Increase to be determined by each specific school within district	CORE, Stanford Achievement Tests

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Table A.2: Student Performance Expectations for Writing

District	Elementary	Secondary	Measurement Instrument to be Used
Alpine			
Beaver	Increase 2 percentile per year to 56% by 1994	Begin 1991-1992, increase 2.5 percentile per year to 54%	Stanford Acievement Tests
Box Elder			
Cache			
Carbon			
Daggett			
Davis	2 7% average gain sought	3% average gain sought	CORE Tests
Duchesne			
Emery			
Garfield			
Grand			
Granite			
Iron			
Jordan			
Juab			
Kane			
Logan			As included in 3rd party evaluation
Millard			
Morgan			
Murray			
Nebo			A writing assessment project being piloted during 1991-1992
N. Sanpete			

Table A.2: Student Performance Expectations for Writing as Stated in Project Proposals (continued)

District	Elementary	Secondary	Measurement Instrument to be Used
N. Summit	Compare pre/post test norms	Compare pre/post test norms	
Ogden			
Park City			
Piute			
Provo			
Rich	Increase 5% over 5 years	Increase 5% over 5 years	CORE, American College Tests
Salt Lake City			
San Juan			
Sevier			
S. Sanpete			
S. Summit			
Tintic			
Tooele	Writing goals included with language arts	Writing goals included with language arts	
Uintah			
Wasatch			
Washington			
Wayne		Reach scale #3 on statewide writing assessment (12th graders)	
Weber	Increase to be determined by each specific school within district	Increase to be determined by each specific school within district	

Table A.3: Student Performance Expectations for Language Arts

District	Elementary	Secondary	Measurement Instrument to be Used
Alpine			
Beaver			
Box Elder			
Cache			
Carbon			
Daggett			
Davis	2.7% average gain sought	3% average gain sought (Sr.H.S.)	CORE Tests
Duchesne			
Emery			
Garfield			
Grand	Increase 8 percentile by fall of 1994	Increase 8 percentile by fall of 1994	CORE, Standard Achievement Tests, Comprehensive Test of Basic Skills
Granite	26% of students to increase test scores	35% of students to increase test scores	CORE, Standard Achievement Tests
Iron	Achieve 80% mastery by 1995	Achieve 80% mastery by 1995	CORE Tests
Jordan	Increase 15 percentile points by 1995 - Increase # of students scoring above sixth stanine 15% by 1995 - decrease # of students scoring below fourth stanine 15% by 1995	Increase 15 percentile points by 1995	Standard Achievement Tests
Juab			
Kane		Demonstrate a 5% increase	CORE, Standard Achievement Tests
Logan			As included in 3rd party evaluation
Millard			
Morgan	Increase 10%	Increase 10%	Standard Achievement, CORE, American College Tests

Table A.3: Student Performance Expectations for Language Arts (continued)

District	Elementary	Secondary	Measurement Instrument to be Used
Murray			A writing assessment project is being plotted this year, 1991-1992
Nebo			
N. Sanpete			
N. Summit			
Ogden			
Park City			
Piute			
Provo			
Rich			
Salt Lake City			
San Juan			
Sevier	Increase 10%	Increase 10%	
S. Summit			
S. Sanpete			
Tintic			
Tooele			
Uintah			
Wasatch			
Washington	Increase 2 percentile per year	Increase 2 percentile per year	CORE, Stanford Achievement Tests
Wayne			
Weber	Increase to be determined by each specific school within district	Increase to be determined by each specific school within district	CORE, Stanford Achievement Tests

Table A.4: Student Performance Expectations for Math

District	Elementary	Secondary	Measurement Instrument to be Used
Alpine			Standard Achievement Tests
Beaver	Increase 1 percentile per year to 68%	Increase 1.5 percentile per year to 63%	Standard Achievement Tests
Box Elder	75% of students to reach CORE criterion	60-70% to reach CORE criterion	CORE Tests
Cache			CORE, American College, Student Portfolio
Carbon	5% increase in CORE over four years	10% increase in CORE over four years	
Daggett	100% of students to reach CORE criterion	100% of students to reach CORE criterion	CORE, Standard Achievement Tests
Davis	2.5% average gain sought	2.5% average gain sought (Jr. H.S.) 1.5% average gain sought (Sr. H.S.)	CORE Tests
Duchesne			Standard Achievement Tests
Emery	Increase 10% on CORE test	Increase 10% on CORE test	CORE, Standard Achievement, American College Tests
Garfield	Increase 3% year one/10% by year four	Increase 3% year one/10% by year four	CORE, Standard Achievement Tests
Grand	Increase 6 percentile by fall of 1994	Increase 6 percentile by fall of 1994	CORE, Standard Achievement Tests
Granite	69% of students to increase test scores	44% of students to increase test scores	CORE, Standard Achievement Tests
Iron	Increase # correct by 10%; 80% CORE mastery	Increase # correct by 10%; 80% CORE mastery	CORE, Standard Achievement Tests
Jordan	Increase # of students scoring above sixth stanine 15% by 1995 - Decrease # of students scoring below fourth stanine 15% by 1995	Increase average % passing 20% by 1995	CORE, Standard Achievement, American College Tests
Juab	Increase 5 percentile by 1993; 80% CORE Mastery	Increase 10 percentile by 1993; 80% CORE Mastery	CORE, Standard Achievement Tests
Kane	Increase 3%, 1% per year	Increase 3%, 1% per year	CORE, Standard Achievement Tests
Logan			As included in 3rd party evaluation
Millard	Increase 2%	Increase 2%	CORE(ODDM), Standard Achievement Tests
Morgan	Increase 10%	Increase 10%	CORE, Stanford Ahievement, American College Tests
Murray			CORE, Standard Achievement Tests

Table A.4: Student Performance Expectations for Math (continued)

District	Elementary	Secondary	Measurement Instrument to be Used
Nebo			CORE Tests
N. Sanpete	Increase 5% by end of year two; 10% by year four	Increase 5% by end of year two; 10% by year four	CORE, Standard Achievement Tests
N. Summit	Compare Standard Achievement Test scores annually	Compare Standard Achievement Test scores annually	CORE, Standard Achievement Tests
Ogden			CORE, Standard Achievement, WICAT Tests
Park City	Achieve mastery	Achieve mastery	CORE, Standard Achievement Tests
Piute	Achieve mastery	Achieve mastery	CORE, Standard Achievement Tests
Provo	Increase 4% per year/students achieve core standards		CORE, Standard Achievement WICAT Tests
Rich	Increase 5% per year until mastery	Increase 5% per year until mastery	CORE, American College Tests
Salt Lake City	Reach grade level	Reach grade level	CORE, Stanford Achievement Tests
San Juan	Increase varies among school plans	Increase varies among school plans	CORE, Comprehensive Test of Basic Skills, Standard Achievement Tests
Sevier	Increase 10% on Benchmark Test	Increase 10% on Standard Achievement Tests	Benchmark, Standard Achievement Tests
S. Summit			CORE Tests
S. Sanpete	90% reach 90% of mastery	90% reach 70% of mastery	American College Test
Tintic	Increase 3%	Increase 3%	American College, Standard Achievement Tests
Tooele	Achieve CORE standards	Achieve CORE standards	CORE Tests
Uintah	Increase to 80% on CORE	Increase 5% per year on CORE to mastery	CORE, Standard Achievement Tests
Wasatch	80% reach 80%; 60 percentile Standard Achievement Tests by 1992	Increase 5% per year until 80% achieved to 80% on CORE	CORE, Standard Achievement Tests
Washington			CORE, Standard Achievement Tests
Wayne	Increase 5 percentile by 1993; 10 percentile by 1995; reach 70 percentile by 1993; reach 85% CORE by 1995	Increase 5 percentile by 1993; 10 percentile by 1995	CORE, Standard Achievement Tests
Weber	Increase to be determined by each specific school within district	Increase to be determined by each specific school within district	CORE, Standard Achievement Tests

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Table A.5: Student Performance Expectations for Science*

District	Elementary	Secondary	Measurement Instrument to be Used
Davis		3% average gain sought (Jr. H.S.)	CORE Tests
Granite	5% of students to increase test scores	18% of students to increase test scores	CORE, Stanford Achievement Tests
Kane	Increase 3% (1% per year for 3 years)	Increase 3% (1% per year for 3 years)	CORE, Standard Achievement Tests
Rich	Increase 5% per year until mastery	Increase 5% per year until mastery	CORE, American College Tests
Tooele	Achieve CORE mastery	Achieve CORE mastery	CORE Tests

* Thirty seven districts did not include science goals in their ETI proposals

Appendix B:

Examples of Student Writing Using Computers For Word Processing and Editing

Tenth Grade Writing Assignment:

Describe a place important to you

First Draft

GRANDMA'S HOUSE

My grandma's house is a special place to me because I would often go there when I was younger. When you first pull into the dirt and rocky driveway you pass an old mailbox that splinters off into many directions. The tin and wood garage is a grayish-blue color which is like the sky just before a spring shower is about to take place. The minute you enter the old door with peeling paint you become hit with the deep smell of various things my grandma has just baked. To the left a bookcase which is full of antique lanterns hovers over you. The front room is crowed by a round oak coffee table which has two large jars full of different types of candy. The atmosphere continues to draw you in and relax you. The television continually projects many soap operas and obnoxious game shows. As you leave the front room you walk down a tiny hall which contains large cupboards filled with torn color books and damaged crayons. This hall also connects to my grandma's bedroom. Her room sickens you with many loud and tacky paintings. Down the hall a little more and off to the right a bathroom which always seemed cold and dreary laid untouched. Off to your left is another bedroom filled with boxes of memories. This is the end of the hallway and house.

Weeping willows calmly shade the backyard. Long grass reminds one of fresh ripe peas. The back yard cools and refreshes after being inside the warm and cramped house.

B.1

Tenth Grade Writing Assignment: Describe a place important to you

Final Draft after response groups and revision on computer

GRANDMA'S HOUSE

As you pulled into the dirt and gravel driveway, you bumped past the old, dented mailbox. It perched precariously on a cedar pole with the wood worn smooth and tan-gray. You parked in front of the garage, the unpainted wood softened to a grayish-blue color like the sky just before a spring shower.

The minute the old door with the peeling paint swings open, deep smells of freshly baked bread and peanut butter cookies fill your nostrils. To the left in the living room, a bookcase is full of antique lanterns hovers collected from yard sales and swap meets over many years. The front room is crowded by a round oak coffee table, too big for the room but made by long-dead Uncle Robert. It holds two candy dishes full of candy corn and lemon drops. The relaxing atmosphere invites you in.

Leaving the front room, visitors walk down a narrow hall which contains large cupboards filled with dolls and toy cars, story books and puzzles, and worn coloring books for the grandchildren and the neighbcr children. This hall leads to my grandma's bedroom. Her room is different than the rest of the house. The walls are filled with paintings of horses, flowers, and parrots. A closer look shows they are "paint by number" pictures, painted by relatives and carefully framed by Grandmother.

Down the hall a little more and off to the right is the bathroom. It's claw-footed tub and speckled mirrow always seemed cold and dreary. There was no heat in the room, so people did not waste time there.

Off to the left was another bedroom filled with boxes of memories. Photo albums, old yearbooks, and stacks of letters tied with faded ribbons nestled in one box. In another wooden box were old clothes, army uniforms, hats, shawls, baby clothes, and wonderful ..nkly shoes from another period of time. The room was not for playing; it was for remembering.

Grandma's house was a special pllace for me; it was summer vacations and Thanksgiving dinners, a place to get to know my cousins and to have all my problems solved. It was a place filled with comfort and love.

Twelfth Grade Writing Assignment: Write a New Ending to a Short Story By Ray Bradbury

First Draft

ZERO HOUR

"peekaboo," said Mink.

Mr. and Mrs. Morris stood there in the dark clutching each other in sheer terror, unable to think, speak, or even move. Mink could see the horror in her parents eyes, but in hers--nothing. It was like she wasn't their daughter anymore, like she was being taken over by some evil force.

Mrs. Morris started to speak in a trembling voice. "Mink, it's your mommy. Don't you remember? Please you've got to remember!" She was becoming hysterical now and her clentching fingers were starting to dig into Henry's skin. "What are we going to do?" She cried.

Henry grabbed a board and hit Mink over the head with it. "Quick! The roof!" He screamed. They ran to the open window and crawled onto the roof. They knew the children would be after them, but they had nowhere else to go. They could hear the heavy footsteps again, and Mrs. Morris' heart started pounding furiously. They were getting closer and closer.

"There is no escape!" Mrs. Morris screamed. "We are going to die!" Henry grabbed his wife's hand and started for the edge of the roof. They climed down onto the road and started running. They didn't know where to, but all they could do now was run--run for their lives.

Twelfth Grade Writing Assignment: Write a New Ending to a Short Story By Ray Bradbury

Second Draft - additions to First Draft in italics

ZERO HOUR

"Peekaboo," said Mink.

Mr. and Mrs. Morris stood there in the dark clutching each other in sheer terror, unable to think, speak, or even move. Mink could see the horror in her parents eyes, but in hers--nothing. It was like she wasn't their daughter anymore, like she was being taken over by some evil force.

Mrs. Morris started to speak in a trembling voice. "Mink, it's your mommy. Don't you remember? Please you've got to remember!" She was becoming hysterical now and her clentching fingers were starting to dig into Henry's skin. "What are we going to do?" She cried.

Mink, listen to me. Snap out of it! This isn't a funny game anymore. We are your parents!" Henry screamed. "It's no use. It's like she's in some sort of a trance."

Mink just laughed. "It's time for you and mommy to go. I am in charge now. You know, us kids are going to rule the world and I might even be queen. We can't have you in the way telling us what to do. We can do whatever we want. We won't have to take baths or go to bed early anymore. This plan of Drill's is perfect!"

Mink started slowly moving toward Henry but he grabbed a lamp, hit her over the head, and kicked the door shut. "Quick, the roof!" They ran to the open window and crawled onto the roof.

They're going to come after us," Mrs. Morris cried, "there's no escaping them!" They could hear the heavy footsteps again and their hearts started pounding furiously. *"What now? Can't you see it's hopeless? No matter where we go, they will find us...and kill us!"*

"Come on," Henry said grabbing his wife's hand. "It's not hopeless. We'll find a way to stop them somehow. We've got to at least try!" They ran to the edge of the roof and

climed down the trailless onto the road. They didn't know where they would go, but they had to start running. The children would be close behind.

"What's that buzzing?" Asked Mrs. Morris. "It is driving me crazy!"

"That's it!" Exclaimed Henry. "That must be what's putting the children under a trance. If we can get to that and somehow shut it off, we can stop the children. It's got to be coming from the tower. Quick, let's go.

"They ran to the tower, with Mink and the children not too far behind.

"Don't worry, we're almost there!"

"They climbed up the steps of the tower with Mink right behind. At the top Henry found the control box and just as Mink was about to hit him over the head with a hoe, he shut off all the power. At that very instant all the children stopped dead in their tracks and Mink dropped the hoe.

Mrs. Morris ran to Henry. "We did it! We did it Henry!" They both turned and looked at Mink.

"Peekaboo," she said.

Twelfth Grade Writing Assignment:
Write a New Ending to a Short Story By Ray Bradbury

(Student's Explanations of changes from first to second draft)

On my first draft I ended it like the story did, just kind of left you hanging, but on my final draft I changed it. I still had it so Mink and the children were after the parents, but Mink's parents save everyone. I used some of the things from the original like the loud buzzing noise, and how Mink said she would be queen.

Appendix C:

Examples of Writing Assignments Facilitated by Word Processing and Style Checking Software

Persuasive Unit Directions

In your paper use **six** persuasive/oratorical devices, **three** in **each** of the following groups, and using the symbols below, mark in the left margin the ones used.

Group 1		Group 2	
RQ	rhetorical question	S	simile or M metaphor
RS	restatement	CS	card stacking
RP	repetition	CT	common touch
P	parallelism	BW	bandwagon
CC	comparison/contrast	T	testimony

1st day: After finishing the test, go to the Writing Lab.
Oct. 10 Type your Resume in; print it, and turn it in to me at the end of the period. Begin typing your rough draft onto your disk.

Homework: Finish your rough draft if you haven't done so. Go over your paper to be sure that you have followed the directions on page 4 of your persuasive essay unit.

2nd day: Finish typing your rough draft. Make all corrections from previous day.
Oct. 18 Continue working on your paper. Be sure you have your full paper on the disk by the end of the second day because Wordmap will be run giving you possible corrections to make on your paper. **Be sure that the name you give your paper on your disk is "persuade."** If you have time begin working on Writer's Helper II.

3rd day: Correct errors shown by Wordmap in your paper.
Oct. 22 Get Writer's Helper II and the instructions for it. Choose Revising Tools and then load your own paper. Do the following. **(YOU MAY PRINT ANYTHING FOR YOUR OWN USE, BUT DON'T HAND IN ANYTHING EXCEPT THE SUMMARIES AND LIST BY SENTENCES).**

C.1

1. Structure
   a. Paragraph Development--Be sure you have at least three to five sentences in each paragraph.
   b. List by Sentence--Put **two** lines between each sentence. Print. After printing, be sure that each sentence is really a sentence, not a fragment.
   c. Word Frequency--Exclude a, an, the. Be sure that you don't have an overuse of any word.
   d. Print Summary to be handed in.
2. Audience
   a. Diction Level--Update your words to six or higher.
   b. Transitions--Your ratio should be **under** ten.
   c. References--Your ratio should be **over** ten.
   d. "To Be Verbs"--Your ratio should be **more** than fifty.
   e. Print **summary** to be handed in.
3. Checks: Use Alt C to go to next word.
   a. Usage--Check and correct all usage.
   b. Homonyms--Check and correct all homonyms.
   c. Usage2--Check and correct all usage.

Get three copies for peer review the next class period.

4th day: Oct. 26 — Make all corrections including the changes you wish to make as a result of your peer review and run the speller disk. **Remember: You will get an "F" if you have a misspelled work found by the Speller Disk, and you will also lose two points for every misspelled word**. Go through Writer's Helper II again and hand in both copies of Writer's Helper labeled "before" and "after."

Hand in the following: Oct. 30

Final Paper

1. grade sheet
2. final paper
3. bibliography (?)

Statistics

1. grade sheet
2. before summary stats.
3. after summary stats.
4. peer reviews

C.2

Criteria for Grading of Persuasive Essay		
Audience stated under name Persuasive/oratorical devices marked	5	
Introduction: A brief history of the issue Issue clearly stated Opinion clearly stated	5 5	
Validity of author Audience directed	5	
Main Body: Three clearly stated reasons supporting the opinion Additional supports for those reasons	15 15	
Conclusion: Draft ends interestingly & thoughtfully	5	
Devices--group 1	9	

Devices--group 2	9	
Punctuation	15	
Grammar Usage	12	
TOTAL	100	

Statistics for Persuasion Paper

Corrected Wordmap printout	10	
Three peer response copies	30	
Before & After Writer's Helpers summaries	20	
Total	60	

C.4

Writing Lab Instructions
Typing and Revising Your Short Story

Directions: This assignment has two parts: one is your resume, the other centers around the "map" stories that we have been writing in class. However, this time you will finish one rather than leaving it in a rough format. The major revision and editing will take place in class before we enter the writing lab. This means that if you are absent on the days we have our read-arounds and in-class polishing time, you will need to see me to make this up. THIS MUST BE DONE BEFORE WE ENTER THE WRITING LAB.

You must also have your resume to a point where you can type it into the computer and turn it in on the first day.

A word of caution: Our time in the writing lab is limited. Each day you will have specific tasks that you will need to accomplish and have me check off. If there is any wasted time or unnecessary disturbances, you will not receive your points.

All written work will be judged both by content and mechanics. The content aspect we have discussed in class - remember to "Magnify the Moment" and use all the aspects of an interesting short story. For mechanics and usage, your tools will be the programs in the writing Lab. All the disks, such as the Speller and Writer's Helper will help you to improve your writing. If there are any spelling errors, you will receive an "F" until you can correct them -- if this makes them late, 10 points will be deducted for each late day (including weekends).

Day 1 — Begin with your WordPerfect disk and type in your resume. Pay close attention to the format. When you have completed it, use the Speller disk and check for errors. You must have all addresses and phone numbers (your references) ready and <u>on a separate sheet of paper</u>. When you are finished, turn in **two** final copies.

Begin typing in the short story you have selected as your final project. This short story should have already been through a preliminary revision process in class.

Day 2 This day will be spent typing in the rough draft of your short story. Be sure to check your spelling when you finish, then print one copy and turn it in at the end of the period. Your story must be completed by the beginning of Day 3. If you are not done by the end of this day, you must come in before or after school to finish it. No credit will be given unless your story is in the computer!

Day 3 Once your story is completely entered, exit WordPerfect and get a Writer's Helper disk. We will do the next few steps together in class to refresh your memory. Go to Revising Tools under Next and then to Load and load your document. Move to Structure.

Structure: Go to sentence length. If any sentences are more than 30 words, print this screen (Alt-P). Now go to Work Frequencies, press return, then print. On your printout circle all the words used more than 5 times so you can change them in your paper.

Audience: Go to Readability and type 11 for your grade. Pay close attention to the comments and then print it out. Next, to References. You should have a ratio of 1 to 25. If it is under this number, print it out so you can change the marked words. Now go to "to be" verbs. You should have a 1 to 50 ratio. Print, then circle all of them to change later. Lastly, go to Sweet and or Stuffy, where you make the decision where you want your paper to be. Now move to the right to Checks.

Checks: Go to Usage and Usage 2 and press ALT-C to check it. Now, is any words are misused mark them with ALT-M and print when completed. Homonyms is your last one. When you get there, press ALT-C again, and mark (ALT-M) all the words used incorrectly. Then print.

Now you are ready to exit Writer's Helper and return to WordPerfect. Using your p rint-outs begin to make the revisions that will help you get an A. This may seem to take some time, but it is worth the effort. You will notice a definite improvement in the quality of your paper.

*** BE SURE TO TURN IN YOUR PRINT-OUTS AT THE END OF THE DAY ***

Day 4 This is the last day to work on this story. Today you need to make it as perfect as possible. Continue using your Writer's Helper print-outs to help ycu revise. You may also want to re-check your spelling using the Speller, and do anything else that will make your story wonderful!

At the end of the day make a title page for your story by following the format on the poster in the Writing Lab. Now print out a copy of your paper and turn it in at the end of the period.

*** DID YOU SAVE YOUR DOCUMENT? ***

Points Possible

1.	Resume	50
2.	Rough draft.	25
3.	Writer's Helper	25
4.	Title page	10
5.	Final story	75
	TOTAL	185