DOCUMENT RESUME

ED 381 129 IR 017 044

AUTHOR Losak, John; MacFarland, Thomas
TITLE An Evaluation of Florida's Model Technology Schools Program: 1988 to 1993: (You Can't Go Home Again). Report 94-02.
INSTITUTION Nova Univ., Fort Lauderdale, Fla.
SPONS AGENCY Florida State Dept. of Education, Tallahassee.
PUB DATE Jan 94
NOTE 107p.
PUB TYPE Guides - Non-Classroom Use (055)

EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS Access to Information; Assistive Devices (for Disabled); Career Planning; Classroom Techniques; Computer Networks; *Computer Uses in Education; Educational Innovation; *Educational Technology; Electronic Mail; Elementary Secondary Education; Microcomputers; Models; *Public Schools; Student Motivation; Surveys; *Teaching Methods; Use Studies
IDENTIFIERS *Florida; Model Technology Schools; Special Needs Individuals

ABSTRACT

The broad objectives of the Model Technology Schools project were to study the impact of technology on schools and student learning; to develop models for using educational technology as a tool for school management and classroom teaching; and to disseminate these models for use in public schools throughout the state. Research involved site visits and two surveys to participating schools. Project procedures, a review of previous evaluations, and observations from site visits and survey results are reported. Findings highlights include: (1) technology serves as a student motivator; (2) technology improves access to information; (3) knowledge of technology is viewed as critical to career and preparation for high school graduates; (4) adaptive devices for students with special needs are insufficient though where available provide excellent tools for individualized instruction; (5) 91% of students spend between 1-10 hours per week on microcomputer usage; (6) teachers report availability and student usage of computers at a much higher level than overall usage in the United States; (7) generally, conditions known to support learning (enthusiasm, improved time on task, and collaborative behavior) were reported by teachers to be much more in evidence with computer usage; (8) classroom management improved and teacher involvement in the communication network has improved thanks to electronic mail; and (9) careful use of limited, and sometimes older, computers demonstrates that state-of-the-art, expensive computers are not essential. Based on research findings, eight project recommendations are made. Twenty tables illustrate findings. (Contains 20 references.) (MAS)

AN EVALUATION OF FLORIDA'S MODEL TECHNOLOGY SCHOOLS PROGRAM: 1988 TO 1993:

(You Can't Go Home Again)

John Losak, Ph.D.

Thomas MacFarland, Ed.D.

Nova Southeastern University

3301 College Avenue

Fort Lauderdale, Florida 33314

January 1994

This project was conducted under contract with the State of Florida, Department of Education

Table of Contents

Preface

In the spring of 1993 the senior author was invited to attend a meeting of the Advisory Committee to participate in discussion regarding a prospective evaluation of the Model Technology Schools Program. During this meeting, the Advisory Committee made a commitment to proceed with an evaluation and recommendations were initiated to effect this decision. Dr. Thomas MacFarland agreed to participate in this effort commencing in August 1993 and when final approval for this undertaking was received from the Department of Education in September, substantial groundwork had already been laid for the project. The Advisory Committee was most helpful in providing insight and guidance to the authors regarding the nature and history of the program. During on-site visitations to the five Model Technology Schools, coordinators were not only helpful but essential in the conduct of this evaluation.

The purpose of the Model Technology Schools Program is to positively influence student learning, to enhance teaching, to improve management of learning, and to disseminate information learned from the project to other schools. In all of the interactions with students, faculty, administrators, staff and others, the positive goodwill generated by the program was evident at every level. Students were most cooperative, interrupting their schedules and providing interviews for the project. For those of you who have an opportunity to view the videotapes of the interviews, it is evident that at each of the schools the students and teachers interviewed were quite enthusiastic.

I would also like to take this opportunity to thank the editor, Ms. Dian Moorhouse, for her work and to thank Ms. Kelly Ferguson for her attention to a multitude of administrative and word processing tasks necessary to generate this report. Special thanks are due to Mr. Steve Luschelle, Studio Production Specialist, who edited many hours of taping into coherent productions of a six- and a twelve-minute video.

John Losak, Ph.D.
Project Director

Executive Summary

Project Overview

The Florida Department of Education (DOE) provided funding for five schools in 1988 under the Model Technology Schools (MTS) Program. Over the five-year period, schools participating in the project were:

Chamberlain High School, Tampa

John I. Leonard Community High School, Lake Worth

L.D. McArthur Elementary School, Pensacola

Mainland Senior High School, Daytona Beach

Webster Elementary School, St. Augustine

The broad objectives established were to study the impact of technology on schools and student learning; to develop models for using educational technology as a tool for school management and classroom teaching; and to disseminate these models for use throughout the state in public schools. In September of 1993, consultants from Nova Southeastern University were hired to evaluate the extent to which these broad goals had been achieved based on a previous evaluation undertaken in 1991, recent judgments by participants, as well as current comparative data.

Procedures

Materials prepared by the five Model Technology Schools, as well as the formal evaluation prepared in 1991 by Dr. Robert Stakenas, were reviewed by the evaluators. In order to gain perspective on the history and intended direction for the program, two meetings were held with the Model Technology Schools Program Advisory Committee for the Florida Department of Education and several discussions were held with Mr. Michael Eason, Program Director, of the Department of Education.

Site visits were scheduled at each of the five schools, during which evaluators met with students, teachers, parents, staff, MTS Program Coordinators and one school superintendent. During the visits, interviews were videotaped and subsequently edited to produce two summary profiles of student and teacher reactions to the activities funded at their technology-related school.

A survey was developed by the authors and administered by the MTS Program Coordinators at each of the five schools to a mechanical random sample of one-third of all teachers. The numbers distributed and returned from each school are as follows: Chamberlain, 35 out of 43; Leonard, 33 out of 44; Mainland, 19 out of 50; McArthur, 34 out of 50; and Webster, 20 out of 22, for a total of 209 distributed and 141 returned, generating a total response rate of 67%.

In addition, a survey developed by Legislative Aides was distributed and completed by each of the MTS Program Coordinators. It should be noted that this survey requested some information which would have required the generation of new data for which there was not sufficient time. The coordinators supplied information that was either already available or which could be obtained fairly easily from other sources.

The report used to develop the comparative figures for the United States was generated by the International Education Association, published in 1992, and gives information not only for the United States, but for several other countries as well. For the most part, only data from the United States were used for comparative purposes.

Responses from the surveys were treated differently for each of the two surveys. For the survey developed by the authors, the data from all five schools were collapsed to give a broad picture for the entire program. For the responses to the survey generated by the Legislative Aides, the data are reported by school. The format and nature of the questions and responses do not lend themselves to collapsing the data for an overall report.

Highlights of Findings

- Technology serves as a student motivator.
- Technology improves access to information.
- Knowledge of technology is viewed by teachers as critical to career and preparation for high school graduates.
- Adaptive devices for students with special needs are insufficient though where available provide excellent tools for individualized instruction.
- Ninety-one percent of students spend between 1-10 hours per week on microcomputer usage.
- Teachers in Model Technology Schools report availability and student usage of computers at a much higher level than overall usage in the United States.
- Generally, conditions known to support learning (enthusiasm, improved time on task, and collaborative behavior) were reported by teachers to be much more in evidence with computer usage.
- Classroom management has improved and teacher involvement in the communication network has improved thanks to Electronic Mail.
- Careful use of limited, and sometimes older, computers demonstrates that state-of-the-art, expensive computers are not essential.

Results from the essentially qualitative evaluation as they relate to the initial goals clearly demonstrate that the Model Technology Schools served as centers of information and learning for hundreds of colleagues who visited the schools over the five-year period. The MTS Program Coordinators have been able to guide others away from pitfalls and on to decisions regarding use of technology that saved time, energy, and money for others. Most teachers have come to view the use of technology as a superior mechanism for classroom and administrative management. Enthusiasm among teachers abounds in this area and was also expressed by numerous students, for whom the Electronic Grade Report, in particular, is viewed very positively.

Improvement in student learning related specifically to use of technology is quite another matter and is best viewed from two perspectives. From a qualitative perspective, anecdotes from teachers, students, and other participants expressing satisfaction and enthusiasm, reflect that the impact of the program has been positive. From a quantitative perspective, which demands comparative data over time, there is little or no evidence made available to the authors to support the proposition that student learning has improved from the initiation of this project. This point was also made in the previous evaluation report. However, in contrast to the previous report, it is the view of the evaluators that the primary reason for this is that the conceptualization of the project was flawed from the beginning. The essential flaw was to assume that the project could be simultaneously a model and a research study. The project has served well as a model. It was, however, neither funded nor designed to be a research study which could produce hard evidence related to the question of improvement of student learning. No research designs were established, no demands made to gather comparative data, no appropriate findings offered, and no research personnel hired in the initial stages, all of which would have been necessary to adequately address the student learning question. Given all of the work related to the process of establishing the five schools as models, including personnel training and physical installations, these schools are now at a point when a formal research project can be usefully initiated.

Recommendations

- *Continue funding for the five schools currently participating in the MTS Program:* The five Model Technology Schools should continue with the project and receive special funding for an additional five-year period. There has been a great deal of progress in creative uses of technology at the Model Technology Schools and this progress should be continued.
- *Broaden the scope and diversity of the MTS Program:* The number and diversity of Model Technology Schools should be expanded. Significant effort should be devoted to ensuring that schools selected for project participation reflect the widest possible representation of schools based

on a number of factors, including: size, funding base, geographic location, community setting, socioeconomic status of the student body, experience with the use of computers, academic performance measures, and extent of exceptional student education and other specialized programs. Based on the current composition of the Model Technology Schools, and the need to expand diversity, consideration should be given to adding the following types of schools:

- At least one middle school. Children in this age group are very adept in the use of technology, and their curiosity and enthusiasm should be captured by participation in a Model Technology School.
- At least one school in a predominantly rural area. Florida has many rural areas and it is imperative that the state make attempts to assure equity in opportunity for rural residents and their children. Technology has the promise to meet this challenge.
- At least one school in a heavily urban area, where there is broad diversity in race and language. As reported by teachers, individual students who were in English for Speakers of Other Languages (ESOL) programs appeared to show positive improvement when instruction was offered through the use of technology. It is important to determine if this positive effect can be duplicated on a larger scale.
- At least one vocational training center, ideally a center that serves adult students as well as secondary students. Training and retraining of the workforce are essential to Florida's economic future.

■ *Expand the project to incorporate a formal research phase:* The Department of Education should request a proposal to conduct research on the complex issues of the impact of technology on student learning.

- Established Model Technology Schools are now ready for implementation of a formal research project.

- This research phase of the Model Technology Schools project should be of sufficient length (3-5 years) and sophistication to yield hard data at the end of the project.
- The research design should incorporate both qualitative and quantitative measures.
- The RFP for the research phase should include a series of questions to be addressed in conducting evaluation/research.
- The research design should incorporate methodologies to distinguish the approach applied to schools in-process, i.e., those with a five-year history in the project, from those being examined from the point of implementation.
- The research design should examine the impact of technology use on student learning relative to other means of impacting learning outcomes and not solely relative to the absence of technology. For example, could comparable outcomes be achieved through similar investment in other initiatives, such as a significant reduction in the student/teacher ratio?

■ *Develop assessment tools that reflect how technology is used in the curriculum:* Among the outcomes of the MTS Program, it was noted that technology improves classroom management tasks and communication among faculty. It was also observed that students in MTS Program were highly motivated when technology was incorporated in the curriculum. However, students tended to exhibit parity in standardized test scores when compared to their peers at other district schools. There is reason to question the validity of paper-and-pencil standardized testing for students who have been trained in innovative problem solving experiences based on methodology that demands group interaction and implicit interaction with computing machinery and other forms of technology.

■ *Expand parent and community involvement in the MTS Program:* Although there is effort in this direction and awareness of the need, more intense focus should be directed at disseminating information to parents and the community at large and to promoting and facilitating their increased involvement in the program.

- *Develop a training model for use by non-Model Technology Schools in incorporating technology into the curriculum:* The five Model Technology Schools have achieved an impressive record of project dissemination, one of the three program goals. Even so, five Coordinators are simply not sufficient to offer guidance in the use of technology in education to every teacher in the state of Florida. The DOE, MTS Program Coordinators, and other participants should develop a standardized training model for how other schools can best incorporate leading edge technology into the curriculum. Based on the large numbers of potential participants, a series of videotapes, curriculum guides, or similar media may be viewed as appropriate means of dissemination for this task.
- *Develop mechanisms to ensure flexibility in the application of project components:* A driving principle of continued project implementation should be that not all aspects of the MTS Program are universally applicable at other schools. Replication should not be conducted on a rote basis, but should incorporate latitude for accommodation to the unique needs and capacities of individual schools.
- *Ensure a primary focus on learning outcomes:* Immersion in technology use as an end in itself is not the intent of the program. The focus should not be on technology per se, but on technology as it affects student learning and teacher management efficiencies.

Previous evaluation by outside consultants, annual reports from the coordinators, judgments by teachers, students, and the evaluators' own observations support the conclusion that the Model Technology Schools have carried out their tasks in a manner that has permitted improvement in classroom management, disseminated information to their colleagues, and enhanced student motivation in the classroom.

Procedures

Materials prepared by the Model Technology Schools (MTS) Program, as well as the formal evaluation prepared by Dr. Robert Stakenas, were reviewed by the evaluators. To gain perspective on the history and intended direction for the Program, the evaluators attended two meetings with the Advisory Committee for the Florida Department of Education in addition to participating in several discussions with Mr. Michael Eason of the Department of Education.

Visits were scheduled at each of the five schools, where the two evaluators met with students, teachers, parents, staff and one school superintendent. During the visits interviews were videotaped by Mr. Steve Luschelle, video producer with the Media and Technology office of Nova Southeastern University. Each was eventually reviewed and edited producing a six- and a twelve-minute video.

Surveys were developed by the authors and administered by the MTS Program Coordinators to a mechanical random sample of one third of all teachers. The numbers distributed and returned from each school are as follows: Chamberlain, 35 out of 43; Leonard, 33 out of 44; Mainland, 19 out of 50; McArthur, 34 out of 50; and Webster, 20 out of 22, for a total of 209 distributed and 141 returned, generating a total response rate of 67% .

In addition, a survey developed by Legislative Aides was distributed and completed by each of the MTS Program Coordinators. It should be noted that this survey requested some information necessitating the generation of new data for which there was not sufficient time. The Coordinators supplied information that was either already available or which could be obtained fairly easily from other sources.

The report used to develop the comparative figures for the United States was generated by the International Education Association, Computers in Education Study, cited in Anterson (1993), and gives information not only on the United States, but on several other countries as well. For the most part, only data from the United States were used for comparative purposes.

Responses from the surveys were treated differently for each of the two surveys. For the surveys developed by the authors, the data from all five schools were collapsed to give a broad picture for the entire program. For the responses to the survey generated by the Legislative Aides, the data are reported by school. The format and nature of the questions and responses do not lend themselves to collapsing the data for an overall report.

Review of Previous Evaluations

Background

Motivation for the MTS Program

The Florida MTS Program evolved from activities initially established by the Florida Model School Consortia Act of 1985, 228.0855, Florida Statutes. The Program is structured as a partnership among the many constituencies concerned about the use of technology in the education of our youth:

- The Florida Department of Education
- Selected Model Technology Schools
- State and private Universities
- Commerce and businesses
- Parents and family members
- Concerned community members
- External constituencies

After careful deliberation, the MTS Consortia Planning Committee established the following objectives for the MTS Program:

> *Objective 1:* Study the impact of technology on schools and student learning.
>
> *Objective 2:* Develop models for using educational technology as tools for school management and classroom teaching.
>
> *Objective 3:* Disseminate these models for use throughout the state in public schools

A request for proposals cognate to the MTS Program was issued and the following schools were selected:

- Chamberlain Senior High School, Tampa
- John I. Leonard Community High School, Lake Worth
- Mainland Senior High School, Daytona Beach
- L.D. McArthur Elementary School, Pensacola
- Webster Elementary School, St. Augustine

Purpose of the Report

The purpose of this report is to provide a review and validation of the formative evaluation processes used in the MTS Program, to produce two video tapes, summarize findings, and to present recommendations related to the future of the Program. Commissioned reports, materials provided to the general community, end-of-year self-study evaluations from the five participating Model Technology Schools, and responses from teachers and coordinators to surveys developed for this project served as the basis for findings and recommendations.

Synopsis of the Formative Evaluation Prepared in October 1991 by Robert Stakenas, et al.

Introduction

Personnel from Florida State University's Center for Policy Studies in Education (Robert G. Stakenas, Ph.D.; Research Assistants Dennis P. Tishken, Cleaver C. Ota, and Marc M. Resnick) presented a "mid-course assessment of the accomplishments, problems, and constraints involved in the implementation of the Florida Model Technology Schools (MTS) Program" (Stakenas et al., 1991, p. 1). That assessment gave specific consideration to the following activities:

- Establishment of MTS goals, objectives, and expectations
- Oversight and administration of the MTS Program at the state level
- Oversight and administration of the MTS Program at the local level
- MTS Program task components in relation to state mandates

Findings

Goals, Objectives, and Expectations

The original 1988 Request for Proposal (RFP) was reviewed for purpose, goals, and objectives of the Program. Relative to Program purpose, Stakenas et al. noted:

> The RFP stated that the overall purpose of a model school was to explore and study the impact of technology on schools and student learning and to develop highly productive uses for instructional technology as management and learning tools. (1991, p. 7)

Particular attention was given to the support offered to MTS Program Coordinators and participating schools.

- The 1988 RFP was worded so that local school districts were to offer long-term support for selected Model Technology Schools.
- MTS Program funds were to supplement, not supplant, funding for technology.

- Model schools have been successful in developing collaborative relationships with business. Assistance has been in the form of:
  - Donations of equipment to Model Technology Schools.
  - Donations of software to Model Technology Schools.
  - Donations by business personnel of services and time for inservice training and systems support.
- Model schools have been less successful in developing collaborative relationships with local colleges and universities.

Staff Development

Although each participating school in the MTS Program has implemented a unique vision on how technology can be used in the curriculum, staff training and retraining on the use of technology should be seen as a common activity for all schools. To this effect, several major issues were identified related to staff development in the model schools, as follows:

- Inservice training on the use of technology in the curriculum needs to be a systematic process, based on needs identification and comprehensive planning.
- Inservice training and consequent applications of technology need to include a broad spectrum of available technology: CD-ROM, telecommunications, etc. Computers are only one tool in a vast matrix of technology appropriate to the curriculum.

Infrastructure

As expected, participating schools in the MTS Program have given considerable attention to the acquisition of hardware, software, and systems. Emphasis has been placed on "acquiring microcomputers for use in classrooms, laboratories, teacher work preparation areas, media centers and administrative offices" (p. 43). Other types of technology that have been obtained, due to the MTS Program, include:

- School-wide networked computing systems
- Closed circuit television in each classroom
- Videotape production studios
- Satellite transmission for distance education
- Laser videodisc players

- Stand-alone and networked CD-ROM reference disks in library/media centers
- Speech viewers for exceptional students
- Sensing probes in science laboratories
- Computer aided design (CAD)
- Barcode scanning
- Integrated learning systems

Documentation and Research

Participating schools in the MTS Program are expected to conduct research on how technology can be used in the curriculum. Although many activities have been devoted to research and evaluation at participating schools, Stakenas, et al. claim that "most of the model schools have shown a lack of progress in fulfilling the research mandate of the MTS Program" (p. 87). They further observed that:

> . . . each model school project was required to have an evaluation design, [but] it did not specify any details regarding such matters as who should conduct the evaluation or what components should be included in such an evaluation. . . . we have concluded that most of the model schools have made little, demonstrable progress in the area of evaluation. (p. 89)

Dissemination of Models and Findings

Model Technology Schools are also expected to be proactive in disseminating information and outcomes attributable to the MTS Program. Model Technology Schools have attempted dissemination about their participation in the MTS Program through tours for visitors, technology newsletters, videotapes, conference presentations, district-wide inservice training, and district demonstrations.

Conclusions

- The MTS Program should receive continued support.
  - The infrastructure has been developed at each school and continuance is needed to fully integrate technology as a pervasive part of the curriculum.
  - There is every expectation that technology will assume an increasingly important role in society. Florida MTS Program participants are in a position to offer dynamic leadership in this area.

- MTS Program participants are in the best position to prototype emerging technologies, due to their extensive experience with existing technology.

- Schools participating in the MTS Program have done an excellent job of disseminating information about the use of technology in education.

- The research and evaluation component of the MTS Program needs more attention. Participants in the MTS Program need to develop collaborative relationships with local colleges and universities, in relation to research and evaluation.

- MTS Program Coordinators need additional support if they are to offer quality services to all faculty and administrative staff.

- Additional MTS Program participants are needed at the Middle School level. At present, Model Technology Schools do not include this grade level.

Synopsis of Self-Studies Prepared by MTS Program Coordinators

Chamberlain Senior High School Tampa, Florida

Background Information

Chamberlain, which has an enrollment of approximately 2,500 students, was built in the 1950s. It's activity in the Florida MTS Program is especially challenging due to the difficulty of retrofitting a 30 year old school for cutting edge technology.

MTS Program Goals at Chamberlain

After initial activities in planning and developing a technology infrastructure and culture, the following goals established:

- Add additional instructional labs in science, writing and mathematics.
- Incorporate all areas into technology activities.
- Develop new instructional strategies to use existing technology.
- Continue to enhance the curriculum through new technology advances.
- Explore classroom presentation options.
- Conduct research with the University of South Florida.
- Continue dissemination and inservice activities.

Selected Outcomes Related to the Attainment Status of Goals

As identified in Chamberlain's MTS Program Self-Study Report:

> The third year of implementation of the Chamberlain Senior High School Model Technology School (MTS) has seen an increase in the amount of technological hardware and software, a greater use of the network system, an increase in the methods of incorporating technology into the curriculum and a continuing increase in the dependence of administrators, teachers and students on the now almost transparent technologies used at the school. (Blanchard, 1992, p. 3)

Indicators cited in the report of near transparent use of technology include the following activities:

- The school's daily bulletin is distributed to teachers via Electronic Mail.
- Word processing and gradebook programs are now standard practice, so that teachers often forget to include these utilities when describing technology usage.
- Juniors reported nearly a 26% increase in computer use.
- A radio telescope was built by students in science classes.
- A new media production was built, to serve as a resource for student projects.
- The school conducts technology tours for state-wide and international educators concerned about technology in education.

Formative Results

Results on technology usage are detailed in the complete Self-Study Report. Throughout this document, it was observed that Chamberlain has used technology to make many advances in teaching, learning, and administration, as evidenced in the following examples cited in the report:

- Electronic Mail saves time and paper-work.
- Faculty now have greater access to student information, such as absences, tardies, and referrals.
- Teachers use a gradebook program to easily compute student grades, during term and at end-of-term.
- Students using computers produced more course-work than students using paper and pencil, since computer usage facilitates the revision process.
- The three areas with greatest interest for training by teachers are word processing, gradebook, and Electronic Mail. Each of these three utilities is presently used more for classroom management and administration than for instruction.
- Teachers are very interested in the introduction of research tools on the local network. Particularly, these tools (software products such as *Carmen Sandiego*) are used as rewards for students as well as serving as a valuable reference source.
- Teachers are very interested in continuing with the use of technology as a valuable tool.

John I. Leonard Community High School
Lake Worth, Florida

Background Information

There are approximately 2,300 students in this comprehensive high school. Many special services are offered at Leonard as it serves as the district center for handicapped and exceptional students.

Leonard's inclusion in the MTS Program is unique in that technology was well-established at this school before the MTS Program was implemented. As such, the challenge was to "expand the level of technology and [ ] make it available to all students and teachers" (Brewer, 1992, p. 45).

MTS Program Goals

Goals for the MTS Program were based on prior experiences in the potential use of technology throughout the entire learning process at a comprehensive high school. The faculty and staff established the following goals for the MTS Program at the school:

- Implement activities to develop skill and comfort in the use of technology:
  - Provide inservice training for all teahcers.
  - Provide training for all students.
- Enhance the curriculum through the integration of technology into the instructional activities of the school.
- Evaluate the impact of the technology on curriculum and instruction.
- Disseminate information on exemplary programs and practices to other schools and projects.
- Become a site for district/state training after identifying programs, practices, and technologies that are effective in a "real school" environment.

Selected Outcomes Related to the Attainment Status of MTS Goals

As summarized in Technology in Education: Florida's Model Technology Schools Project Report, 1992 (Brewer, 1992), technology has become a vital support vehicle for student learning and school-based management at Leonard:

- Computer-Aided Design (CAD) has become an integral part of the Industrial Arts curriculum, closely paralleling activities in the industry.

- In cooperation with Palm Beach County's Teacher Education Center, MTS Program participants conducted intensive inservice training for colleagues at other schools during a summer institute.

- Technology usage is now the norm, with 100 percent of all faculty/staff involved in the MTS Program.

- Students use the complex hardware and software associated with Desktop Publishing to produce professional quality internal publications at Leonard.

- The Electronic Gradebook is central to teacher grading and record-keeping. Schilit et al. (1990, p. 4) reported that 87.9 percent of all faculty reported the Electronic Gradebook program as "useful in providing information and/or motivation for students."

- Distance education via satellite was used to support instruction in Japanese and Russian.

- Electronic Mail has greatly improved communication between administration and faculty, providing information in an efficient and cost-effective manner.

- Since the beginning of the MTS Program, the number of students on the honor role has increased by 67 percent.

Formative Results

- Internal communication across a large campus is a time-consuming activity. The faculty and administrative staff use tools such as Electronic Mail to save time associated with communication and to increase accountability.

- Faculty are positive about electronic grading, with respect to its use in transforming a time-consuming and tedious task into a relatively simple activity.

- Students are equally adept at computing across the curriculum. Technology has become a standard part of the instructional delivery system.

- Faculty and staff serve as technology catalysts at inservice training activities in Palm Beach County.

- Professional development in the use of technology in education is further enhanced when professional staff serve as adjunct professors in undergraduate and graduate courses in instructional technology for local colleges and universities.

Mainland Senior High School
Daytona Beach, Florida

Background Information

Mainland Senior High School is a comprehensive 9 to 12 high school, with an enrollment of 2,000 students served by a faculty of 140 teachers. Mainland has received many awards for academic excellence, as evidenced by its selection as one of only eight Star Schools in Florida. In addition, Redbook magazine designated Mainland as "one of the 52 best overall high schools in the nation, the best overall in Florida" (Brewer, 1992, p. 57).

MTS Program Goals at Mainland

Goals for the MTS Program at Mainland were developed by a steering committee, where emphasis was to be placed on:

> restructuring the traditional delivery of instruction by combining the use of state-of-the-art technology applications and instructional restructuring to enhance the educational experiences of students. (Bozeman et al., 1992, p. 10)

- Develop a climate of excellence which promotes high interest, motivation, and achievement of teachers.
- Develop a staff of highly qualified, effective teachers, who later can assist with the dissemination of components of the prototype schools in the district and around the state.
- Facilitate student learning through the use of state-of-the-art technology and innovative organizational approaches.
- Eliminate student failure by developing attitudes of independence, self-confidence, and responsibility.
- Create more teaching time by using technology to assist with classroom management.
- Provide access to new technologies for all exceptional and learning disabled students.

Selected Outcomes Related to the Attainment Status of MTS Goals

- The MTS Program has enhanced student attendance.
- Technology has resulted in a positive influence on student discipline.

- Technology has had a positive influence on academic performance:
  - The use of technology increased the comfort level of participation in class activities.
  - Technology has been used to increase student motivation.
- The computer-based testing system and related applications of technology has greatly enhanced the testing process and time associated with record-keeping:
  - The creation of test items in an electronic format saves teachers hours of time.
  - Accuracy of grading is increased when testing is computer-based.
  - Teachers are more willing to assign weights when complex calculations are calculated by a computer.

Formative Results

The use of technology has greatly enhanced the school climate at Mainland. Quite simply, technology has helped this school to involve students and faculty in projects that more closely parallel the needs and activities of a society that is increasingly based on the use of computing machinery and other forms of technology to process information. The following activities are examples of the positive effects of the MTS Program at Mainland:

- Science laboratories now use adaptive devices to collect data in real-time. This activity parallels to how science is now conducted.
- Language arts and journalism students now produce printed matter with computing hardware and software that is the norm in private industry. These students will be prepared for similar activities after graduation.
- Computers are used for after-school tutoring, increasing motivation and subsequently participation.

Mainland is now firmly committed to the use of technology as a support for instruction and management. Future plans on the use of technology at the school include:

- The faculty plan to increase their participation in in-service training on the use of technology for instruction and management.
- The school will be placed on a fully networked Local Area Network (LAN).
- Outcomes-Based Education will be expanded into additional curricular areas. Technology will play a vital role in how this program will be implemented.

L.D. McArthur Elementary School
Pensacola, Florida

Background Information

L. D. McArthur Elementary School is one of two elementary schools participating in Florida's MTS Program. Enrollment changed dramatically during this school's participation in the MTS Program when another Escambia County elementary school opened, decreasing enrollment from nearly 1200 students to 650 students. This change in enrollment and teacher staffing brought about major changes in equipment allocation and the availability of technology for individual students.

MTS Program Goals

- To increase each student's command of critical thinking skills in the learning curriculum, together with the utilization of group problem solving.
- To increase each student's learning productivity through revising the organization and practices of the school to reduce the time dependence upon the teacher's traditional classroom performance.
- To use technology to reduce all non-instructional tasks to a minimum both for teachers and educational leaders through such means as networked information management systems, automated data collection systems, and access to databases.

Selected Outcomes Related to the Attainment Status of MTS Goals

McArthur's goals are specifically focused on its role as an elementary school, with attention given to student motivation and individual learning styles. Goals were presented from two perspectives: instruction and administration.

- Instruction
  - Reduce time dependence on the teacher's traditional classroom performance.
  - Increase critical-thinking and decision-making skills.
  - Individualize the curriculum and utilize group problem solving.
  - Improve communication skills.
  - Transform the teacher from a font of information to a model of wisdom.

- Provide for teacher utilization of knowledge.
- Develop and implement evaluation methods.

- Administration
  - Serve as a role model in how administration is implemented.
  - Use technology to reduce all non-instructional tasks to a minimum.

Formative Results

The use of technology at McArthur is summarized in an end-of-year report (L. D. McArthur Elementary School, 1992). Careful review of this document provided ample evidence that technology is used extensively, resulting in many favorable educational outcomes. Specific uses of technology include the following:

- "Real-time, real-life" videotapes have been used to support acquaintance with the research process.
- Electronic Mail has been used to network with students in other states. Instruction during this activity focuses on language arts, social studies, and telecommunication skills.
- An online card catalog that is accessible from every classroom has been installed. This activity greatly enhances the availability of reference material.
- After enrollment was reduced, an impressive array of equipment was made available for each class and each grade level.
- Compact-Disk Read Only Memory (CD-ROM) has become a common reference source in the library. This medium has great potential in schools that have developed a technology infrastructure.
- Teachers are constantly exposed to inservice training in the use of technology:
  - Teachers are writing articles on the use of technology
  - Teachers offer inservice training on the use of technology to their peers at other schools
  - Teachers have met with counterparts from other states as well as their MTS Program counterparts

Webster Elementary School
St. Augustine, Florida

Background Information

Webster is a K to 5 elementary school that serves students with many different abilities: basic education, full-time gifted, specific learning disabilities, and students with varying exceptionalities. The enrollment at the school is approximately 732.

MTS Program Goals

Goals for the MTS Program focused on teacher training, since inservice training is essential to the effective use of technology. The goals clearly demonstrate how this school has developed a cadre of "Teacher Experts" for technology in education:

- To implement and demonstrate a cost-effective plan for the use of technology in the schools for all of Florida's students.
- To plan and conduct research that analyzes and documents the impact of technology on learning and on teaching.
- To field test new technologies and develop strategies and use them to support Florida's curriculum and instructional objectives.
- To develop and implement effective training models for teachers and administrators that can be used throughout Florida's school system.
- To establish facility standards necessary for effective use of technology in existing schools, as well as new schools.
- To inform educators, business, legislators, and the community about the best strategies for using technology to meet Florida's educational goals.

Selected Outcomes Related to the Attainment Status of MTS Goals

A formative evaluation of the MTS Program at the school (Eggen, 1992) details effects on instruction and school-based management at Webster. The following activities serve as evidence of effectiveness:

- Webster is serviced by a school-wide Macintosh network. The implementation of this form of technology makes it possible for faculty and staff to send and receive Electronic Mail throughout the school.

- All teachers now use an Electronic Gradebook, which saves time when grades are processed.
- Technology is now being introduced into appropriate curricular areas.
- Parents are also included in the effective use of technology. A telephone access system lets parents hear prerecorded messages on school-wide issues as well as messages about their own children.
- A school-wide closed circuit video systemis in place. This tool will serve as a support to the video production studio.

Formative Results

Technology has been well-received by the faculty and staff. Coffee et al. (1992) summarized the manner in which technology has contributed to the educational climate and educational outcomes:

- Record keeping and paper work are reduced when technology is used to support these activities.
- Internal communication is improved when participants use Electronic Mail.
- Forms and letters that are word processed are easy to generate and additionally look more professional than typed copy.
- Teachers use a computer for instruction two hours per day, on average.
- Technology has also changed how instruction is organized and delivered. At Webster, computing machinery and other forms of technology are used in many innovative ways:
  - Word processing software is used to emphasize writing skills.
  - Hypertext utilities are used to present information in varied ways, as opposed to sequential presentations.
  - Computers and other forms of technology increase the opportunity to offer individualized instruction.
  - Data bases are used to organize materials related to curricular content.
  - Videodiscs allow the presentation of visual materials in life-like imagery.

Observations from Site Visits and Survey Results

Overview

Site Visits

During November and December 1993 the evaluators conducted on site visitations at the five schools participating in the MTS Program. These visitations were designed to observe the effects of the MTS Program at each school after five years of activity in this state-sponsored program. At each site, relevant publications were reviewed, detailed notes were taken regarding interviews with faculty, staff, and students, and observations were recorded. In addition, video recordings of several interviews were made, generating a six- and a twelve-minute video. Background information, program goals, and observations of the evaluators relative to each school are contained in this section.

Teachers Views on the Impact of Technology in the Model Technology Schools

This survey was designed by the evaluators to capture the views of teachers regarding the impact of technology. A total of 209 surveys was distributed at the five Model Technology Schools and 141 surveys were returned, generating a 67% response rate, as summarized on page 9.

Responses to the survey are reflected in Tables 1-11, which comprise the section entitled, Teachers Views on the Impact of Technology in the Model Technology Schools. The tables reflect aggregate data for the schools. Separate tables summarizing responses by school were prepared by the evaluators and are available upon request.

Table 1 provides the responses of teachers to 24 statements regarding the impact of technology in the Model Technology Schools. Teachers responded to these statements using a ranking scale from one to five, with one representing a response of "little effect" and five representing a response of "significant effect." The 11 statements receiving a mean response of 4.00 or higher are listed below in the order of highest rating. As reflected, no statements received a consistent 5.00 rating.

- Technology improves access to information 4.79
- Technology improves communication 4.65
- Knowledge of technology is critical to career and promotions 4.61
- Technology improves the quality of presentations in class or to the community 4.54
- Technology requires students to be active learners 4.51
- Technology improves student learning 4.38
- Technology requires teachers to be learning mentors 4.36
- Technology serves as a student motivator 4.33
- Technology improves collaboration among professional staff 4.23
- Technology improves the quality of classroom management activities 4.12
- Technology demands the creation of new evaluation and assessment tools 4.10

Only one statement received a mean rating below 3.00:

- Technology reduces loss or theft of media and/or materials 2.97

Six other statements received a mean rating of less than 3.50 but greater than 3.00, reflecting the perception of neglible to minimal effect. These are listed below in order of lowest ranking:

- Technology improves parent participation in school-related activities 3.02
- Technology improves student attendance 3.09
- Technology encourages community participation in school-related activities 3.20
- Technology decreases student behavior problems 3.27
- Technology results in overall cost saving 3.34
- Technology encourages student participation in before and/or after school activities 3.41

Overall, some degree of positive impact was perceived by respondents in 23 of the 24 response categories, with mean ratings of 3.50 or higher in 17 of the categories.

Table 2 summarizes the equipment and services available to faculty, students, and staff and reflects wide availability of all but the most costly equipment. Responses to some categories of equipment and services show significant disparities in availability to faculty, staff, and students. For example, Electronic Mail is available to over 90% of faculty and 82% of staff, but only 8.5% of students. Such a disparity is consistent with the differing levels of need for usage among these groups.

Table 3 provides a summary of applications. As could be expected, word processing applications are highest for all three groups. Class management applications, while available to 95% of teachers and staff, are not intended for students. Accordingly, only 6.3% of students have access to such applications.

Data presented in Table 4, which address the types of microcomputers used, reveal no surprising results, i.e., IBM, Apple MacIntosh, and Apple II Series microcomputers are the most commonly used. Although there is significantly less usage for Tandy/Radio Shack microcomputers (62%), this usage level exceeds that for all remaining microcomputers by a wide margin.

Table 5 addresses the frequency of microcomputer usage by students. The majority of respondents (63%) reported a student usage rate of "1-5 hours per week;" however, approximately 28% of respondents reported a student usage rate of "6-10 hours per week."

Table 6 summarizes the locations of microcomputers, in Model Technology Schools indicating reflects that the schools typically have microcomputers located in administrative offices, teacher planning areas, classrooms (grade-level and subject-matter teachers), and central computer laboratories.

The ways in which central computer laboratories are used are summarized in Table 7. Approximately 98% of respondents indicated that teachers take their students to the laboratory, with instruction provided by the regular classroom teacher.

In Table 8, respondents were asked to address their perception of why computers and other forms of high technology are not used on a more regular basis. The two highest contributing factors were perceived as "an insufficient number of computers" (52% of respondents) and "an inadequate amount of time to use computers in regular classroom activities" (44% of respondents).

Table 9 addresses the professional position of survey respondents. Nearly 89% of the respondents, as intended, were teachers.

The three schools with the largest shares of respondents were Chamberlain, McArthur, and Leonard (24.8, 24.1, and 23.2 respectively) as shown in Table 10. The combined number of respondents from the remaining two schools, Webster and Mainland, 14.2 and 13.4 respectively, approximate the number of respondents from each of the other three schools individually. Approximately 58% of the professional staff have a microcomputer at home (Table 11).

MTS Program Coordinators' Responses to a Survey Prepared by Legislative Aides

This survey was initiated by legislative aides to address summative effects of Florida's MTS Program. The survey was provided to MTS Program Coordinators in mid-November, 1993 with no advance notice. Given the extremely short turn-around time required, Coordinators were not able to generate new data, but had to use already existing information or that which could be obtained over the telephone. Coordinators expressed several concerns with the survey, especially those related to the need for more lead-time to obtain and then compile data, and the difficulty in obtaining data comparing MTS Program statistics with those for other schools.

It should be noted that responses which were left unanswered by the respondents were coded as NR (Not Reported). Some MTS Program Coordinators offered narrative responses to questions; these responses were also coded as NR.

The responses to this survey are presented in the section entitled, MTS Program Coordinators' Responses to Survey Prepared by Legislative Aides, were essentially based on estimates and are to be viewed only as approximations for many of the responses. Most Coordinators tracked the visitors to campus so that the numbers reported in item 59 are relatively accurate.

Overall, responses to the Legislative Aides Survey provide little guidance for analysis for reasons already noted. Moreover, many of the questions lacked sufficient definition. For example, item 59 does not indicate to the respondent what the time period should be. Responses initially captured for this question reflected the application of disparate time periods to the tabulation of visitors, requiring post-survey contact with the respondents to clarify responses and achieve consistency regarding the time period covered (yearly). Questions regarding socioeconomic status are extremely difficult to derive in most instances as are comparative cost questions. If these and related issues are deemed important, it is recommended that they be incorporated in a Department of Education RFP at the initiation of any future projects, to be addressed in a consistent manner by all respondents using pre-determined definitions for the various categories.

National Comparative Data

This section addresses computer access and usage issues as they relate to the overall U.S. population. Relevant data are presented in Tables 12-20. The source of information reported in Tables 12-17 is Computers in American Schools 1992: An Overview (Anderson, 1993). The data were originally reported in a document entitled, I.E.A. Computers in Education Study, which was produced by the International Association for the Evaluation of Educational Achievement in 1992. The source of information reported in Tables 18-20 was the Statistical Abstract of the United States: 1992 (U.S. Bureau of the Census, 1992).

Table 12 addresses the types of computers used for instruction in elementary schools for 1989 and 1992, by elementary, lower secondary, and upper secondary levels. Not surprisingly, the mean percentage was highest across all levels during 1989 for Apple II usage. Reflecting the trend toward increased IBM PC and IBM-compatible computer usage in the nation's schools, the mean percentage usage for IBMs doubled, or nearly doubled, at all three levels over the four year period from 1989 to 1992. During this same period, the mean percent of Apple II and Apple MacIntosh usage combined increased only moderately at the elementary and lower secondary levels, decreasing from 56% to 49% at the upper secondary level. The high usage rate for IBM computers in the Model Technology Schools is consistent with this national data.

Table 13 addresses computer usage rate during 1992 in a typical week by students in English classes at the 5th, 8th, and 11th grade levels. Over half of the students at the 8th and 11th grade levels did not use computers at all during a typical week. Approximately one-fourth of students at the 11th grade level used computers less than once a week, with declining percentages for increased frequency of use. At the 8th grade level, comparable percentages (18% and 20%, respectively) were reported for a frequency of "less than once a week" and "1-3 times per week." The highest usage frequency was reported at the 5th grade level; 42% of these students used computers "1-3 times per week."

Software usage by students at the 5th, 8th, and 11th grade levels, as reported by English teachers, is summarized in Table 14. Keyboarding skills practice and word processing software represented the highest usage rates at all the 5th and 8th grade levels. At the 11th grade level, spelling checker software represented the highest usage rate, with keyboarding skills practice and word processing software rated the highest and second highest, respectively. These findings are consistent with students in Model Technology Schools, for whom the highest usage rates were reported for "drill and practice tutoring" and "word processing."

Table 16 addresses the percentage of students at the 5th, 8th, and 11th grade levels who have "ever been taught" various types of computer education. A consistent 65% of students at all three grade levels had been taught "to run programs." A similar percentage of students at the 8th and 11th grade level, but only half of students at the 5th grade level, had been taught "to use a word processor or to write an essay." Nearly one half of students at the 8th and 11th grade levels had been taught "to use a database program," with comparable percentages reported for students taught "to run programs and use word processing and use either databases or spreadsheets."

The percentages of students who reported having "any computer access outside school" and of those who reported having a "computer in the home" are shown in Table 17, along with the average number of hours per week students spent using a non-school computer. This information is presented for students at the 5th, 8th, and 11th grade levels and within those levels at a low, medium, or high socioeconomic status. Approximately 80% of students across all grade levels had access to a computer outside school, with a slightly higher percentage reported for males than for females. Computer availability in the home was reported at around 40% for 5th graders, with an increasing percentage at the succeeding grade level intervals. The highest reported level of home computer availability was that for males in grade 11 (57%). There appears to be a direct relationship between access to and usage of non-school computers and socioeconomic status, with the highest levels of access and usage reported among students at the highest socioeconomic levels. Usage rates were higher among males at all three grade levels.

Table 18 addresses the availability of microcomputers for student instruction in public schools at the elementary, junior, and senior level for each year from 1981 to 1990. The percentage of microcomputers available per school increased significantly at all levels over the 10 year period, with the most dramatic increase occurring between 1981 and 1983. During this period, the percentage availability doubled at the senior level, more than tripled at the junior level, and increased more than six times at the elementary level. The percentage availability was reported at 90.0% or higher for all three levels as of 1985, reaching a percentage of 97.3% by 1990 at the elementary level and sustaining a 98.5% or higher rating at the junior and senior levels since 1990. Negligible decreases of 0.1% and 0.3%, respectively, are shown for the junior and senior levels between 1989 and 1990. The number of microcomputers per student decreased continuously throughout the 10 year period, reaching a level of 20.9% by 1990. Comparatively, as addressed in question 7 of the Legislative Aids Survey, the number of students per computer at the Model Technology Schools ranged from three to nine.

Table 19 provides a picture of microcomputer availability in private elementary and secondary schools during the 1981-1990 period, reporting an aggregate percentage as opposed to a per level analysis. The percentage availability per school increased consistently during the ten year period, although at a lower rate than for public schools. Interestingly, as shown in Table 20, the number of students per microcomputer was lower in the private schools than the public schools for all time periods for which data were reported, but not nearly so low as that for the Model Technology Schools.

Observations from Site Visits

Chamberlain Senior High School
Tampa, Florida

Background Information

Dr. John Losak and Dr. Thomas MacFarland visited Chamberlain Senior High School on November 1, 1993. The visit was hosted by Ms. Lois Plaag, the local staff member temporarily charged with responsibility for the MTS Program. Mr. Larry Nanns, the original MTS Program Coordinator, had recently moved to Hillsborough County Schools Central Administrative Services. Approximately 2,030 students are enrolled.

MTS Program Goals

During this visit, the program evaluators toured every part of the school with the singular exception of the area devoted to Vocational Agriculture. Observation and dialogue were conducted with administrators, teachers, media specialists, and clerical and support staff, as well as students in advanced placement classes, regular classes, vocational and business education classes, and special education classes.

During meetings with administrators and faculty, they pointed out that MTS Program goals reflect their desire to:

- Add additional instructional labs in science, writing, and mathematics.
- Incorporate all areas into technology activities.
- Develop new instructional strategies to use existing technology.
- Continue to enhance the curriculum through new technology advances.
- Explore classroom presentation options.
- Conduct research with the University of South Florida.
- Continue dissemination and inservice activities.

Observations

The most constant observation of technology at Chamberlain is that technology, in its many forms and levels of sophistication, has become a pervasive support for nearly every teaching and administrative activity. The faculty, administration, clerical staff, and students use technology as vehicles to improve efficiency of virtually all school operations.

- By design, technology was first put into place in the administrative area.
  - *Strong administrative support:* It was perceived that faculty would only accept infusion into the technology culture if they knew that administrative staff were equally involved in the challenge of learning how to integrate the new paradigm of computer-assisted management into education.
  - *Enhanced computer literacy among faculty:* Technology is so important at Chamberlain that potential faculty members are queried during the interview process regarding their background with computer literacy and technology usage.
- Technology is an integral part of the curriculum:
  - *User-friendly system:* The Novell-based network is quite impressive. Menus are easy to read and follow, software is up-to-date, and the entire system is user-friendly even at the novice level.
  - *Operation at capacity:* The computer assigned as the network server reached capacity one year in advance of projections. Obviously, technology and the pervasive computer culture is the norm at this Model Technology School.
  - *Creative use of technology:* Technology is used in creative and often non-intended ways. For example, the Electronic Gradebook program is used as an efficient interface for database purposes by teachers, apart from the original intent of grades and grading.
  - *Extensive student use of computers:* Students are active users of the computing system. All students who graduate exit with a resume of professional quality, generated by a specialized software program.
  - *Enhanced record keeping:* The cosmetology program maintains all customer records on a local database. In turn, clients can be served with consistency when students graduate from the program and new students take their place.
  - *Enhanced assessment of student progress:* Teachers are now beginning to use the test generator module of the Electronic Gradebook. By use of this program, teachers save time scoring tests. Perhaps equally important, this program will also conduct statistical analysis of all tests, if desired by teachers.
  - *Reduced publication costs:* The school newspaper is produced by students using desktop publishing technology. Because of this technology, production costs are so minimal that the newspaper is distributed to all students at no charge.

- Many teachers are using technology at the highest level of sophistication. As an example, one English teacher had students prepare their senior research report using Linkway Live, a very complex computer-based presentation program. By using this software product, students were able to incorporate a vast array of impresive media-based activities into this assignment:

  - Hypertext buttons that allow multiple branching
  - Word processed and desktop publishing quality text
  - Audiographics
  - Slow motion videographics

- The sign-in process for tardy students is a computer-based real-time activity. What is possibly quite unique is that the activity is operated by students, with only minimal guidance by clerical staff. As such, clerical staff reported during interviews saving at least 30 minutes per day previously spent on this task which can now be devoted to other activities.

- The daily bulletin, with important information such as daily attendance records, is now generated using barcoding technology. The benefits of this action include the following:

  - *Reduced absenteeism:* Teachers receive accurate and timely information on student attendance. As a result, students are less likely to miss the first four periods of class, a common activity at many schools.
  - *Enhanced reporting:* Administrators receive precise information that is suitable for reporting purposes, such as mandated reports related to average daily attendance.

- The Registrar's office is fully computerized and networked, resulting in:

  - *Enhanced decision-making:* Student grades (present and past) are easily retrieved, thus allowing better decision-making during interviews between students and professional staff.
  - *Enhanced college-search potential:* Students are able to search databases for colleges and universities that best meet their needs.
  - *Enhanced financial aid resources:* Students are able to access databases on scholarships and other financial aid. As a result of this utility, students and their parents are able to find potential financial resources for post-secondary education that would otherwise go unnoticed.
  - *Enhanced communication:* Communication between guidance personnel and teachers is greatly facilitated by Electronic Mail. "Phone tag," is totally eliminated when professional staff use Electronic Mail for communication that does not require telephone or face-to-face contact.

- The library media center is totally computerized. All reference materials in the media center are available online, via computer searching, which results in:

  - *Increased access:* Students and professional staff are able to quickly access information of high quality.

  - *Greater utility:* Reference materials (bibliographic and often full-text) can be downloaded to disk, allowing greater utility as opposed to paper-copy reproductions.

- Many students have access to personal computers at home, thus continuing the technology culture established. One science teacher estimated that over 50 percent of all Advanced Placement Physics students have a personal computer which is used to support activities initiated in class.

- Computers are often used to support teaching in an innovative manner, e.g.:

  - *Positive use of spell check:* The spell check modules of word processing programs are used in Alternative Education classes to teach spelling in a less threatening and less obtrusive manner.

  - *Real-time data collection:* Physical science teachers use probes to collect real-time data during experiments. In turn, students receive immediate reinforcement when computers are used to produce graphs of experimental outcomes as the experiment progresses.

  - *Opportunities for Special Education students:* Special Education students have many opportunities to make use of technology. Hyper Studio, a hypertext software program, is used to empower a quadraplegic student who displayed proficiency in an English class activity. According to his teacher, his original Individual Education Plan (IEP) was limited only to personal care.

- Staff demonstrated that old equipment, with some degree of initiative, can be put to effective uses, e.g.:

  - *Alternative use for obsolete equipment:* Old 286-microprocesser MS-DOS compatible computers do not have the computing power needed to operate today's sophisticated application software packages. However, these machines are used as printing spoolers, a use quite suitable for printing documents in a shared computer network environment.

  - *Increased student access to computers:* Apple Macintosh computers have greatly advanced in the use of color, graphics, and multimedia. However, the science laboratory was equipped with older Macintosh computers that only supported monochrome display. The head of the science department described how many abstract concepts taught in the physics curriculum did not yet require color or graphics. As such, Advanced Placement Physics students are able to use computers on a one-to-one basis, coupled with the use of a laser videodisc player. There is no internal pressure to share these machines with other departments, where it is common to have two students at a single workstation.

- Technology became common before its infrastructure was fully supported. Originally, the physical plant and furniture were not suitable for technology:
  - *High cost:* Extensive costs were associated with wiring the physical plant for the computer system. Today, wiring costs are typically estimated at $1.00 per foot of cable. Over $100,000 was spent at the beginning of the MTS program for developing the wiring infrastructure. The project took over 1.5 years and it was so complex that an outside contractor was needed.
  - *Incompatibility between furnishings and computers:* School furniture is now specifically available for computer use, where the human-computer interface is a critical element in design. Furniture that takes into account the human-computer interface was observed in only a few laboratories.
  - *Inadequate air conditioning:* Air conditioning remains a concern in schools that have computer systems. The inclusion of technology into central-office air conditioning plans has yet to be fully implemented.
- Chamberlain is heavily dependent on technology. However, many of those interviewed expressed concern that there is insufficient support:
  - *Insufficient allocation of training time:* Extra training time is needed if individuals are to be more adequately empowered through technology. Teachers receive some release time for technology training, but the amount of time offered is simply insufficient to keep up with evolving needs.
  - *Inadequate level of support staff:* Additional support staff members are needed in a school heavily dependent of technology. Staff are particularly needed for training and systems maintenance.
  - *Costly maintenance:* On-site maintenance of the computing network by the local certified software engineer costs $100 per hour. As such, most troubleshooting is done by resident personnel. Yet, this cost-saving activity takes time away from other activites, such as training and guidance on the use of computing in education.

Summary of Observations

It became readily apparent during this school visitation that the faculty and staff have become active innovators in the use of technology in education. A comparative advantage for the faculty and staff is that they have developed expertise in the processes needed to retrofit an older school for modern technology. Throughout the learning process, technology is an activity that affects all sectors of the entire school culture including administration and management, teaching, and learning. The administration, faculty, staff, and students use technology as an essential tool for day-to-day activities. Other comprehensive high schools should do well to parallel activities that are now standard practice.

John I. Leonard Community High School
Lake Worth, Florida

Background Information

Dr. John Losak and Dr. Thomas MacFarland visited John I. Leonard Community High School on November 9, 1993. Mr. Jim Sheehan, Assistant Principal and MTS Program Coordinator set up the schedule. A videotape production specialist from Nova Southeastern University was on-site.

MTS Program Goals

The evaluation began with a one hour meeting with the MTS Program Coordinator and the Principal, Mr. Hugh Brady. This was followed by meetings with administrators, clerical staff, faculty, maintenance workers, media specialists, and students. Meetings, videotaped interviews, observations, and classroom visitations offered an excellent sense of how technology affects the learning environment.

Observations

The technology infrastructure is quite impressive. There are approximately 500 personal computers with approximately 150 faculty and 2,400 students. This one-to-five computer-to-student ratio is approximately four to five times the national average. The demand for technology in education at the school is bottom-up, not top-down, as evidenced by the following:

- Students were nearly unanimous in their desire to have more computing machinery in use:
  - *Extensive computer use:* There are approximately 75 laptop computers available for student checkout at nights and over weekends and holidays. Typically, all computers are checked out each night and more computers would be taken home by students and staff if they were available. Students and faculty see these machines as valuable tools for their activities.
  - *Desire for increased computer use:* Students expressed a desire to have computers serve a greater role in art classes, reflecting current trends in this profession.

- *Standard use of the Electronic Gradebook:* The immediate feedback associated with the Electronic Gradebook is now an assumed part of grading.

- Teachers throughout the visitation continually expressed the notion that technology is the cornerstone of how they organize their daily activities, including instruction and classroom management.

- Administrative staff is so dependent on the immediacy and accountability of Electronic Mail that paper copy messages are posted only when an official signature is needed.

- Clerical staff continually stated that they could not do their job without technology. It was observed that highly technical activities such as word processing and spreadsheet analysis have become so common that they were often neglected when clerical staff were asked about how they use technology to enhance the efficiency of their jobs.

- Maintenance staff is also involved in the use of technology. All work orders are relayed to the head custodian via Electronic Mail. This activity results in greater accountability and efficiency on how the school functions.

As the on-site evaluation progressed, comments and observations indicated a specific pattern of continual technology usage and the derived benefits:

- As impressive as sophisticated networks may be, people and their dedication to education are the reason why technology works. Faculty, staff, and students serve as technology change agents throughout Palm Beach County.

  - *Outreach training:* The faculty is regularly involved in planned and ad hoc training for their counterparts at other schools.

  - *Improved student academic performance:* Administrative staff are commonly asked to demonstrate how technology has improved educational outcomes. Although Leonard has recently experienced a reduction in the socioeconomic status of its student body, SAT scores improved after the MTS Program was set up.

  - *Superior student job placement rate:* Students in Distributive Education and Cooperative Education programs prepare a professional-quality resume with word processing software. Perhaps because of this activity, they have a competitive edge over their peers in other schools who are also looking for their first "real job." There is reported to be a 100 percent placement rate for all qualified students participating in these programs.

- It was observed that technology makes it possible for teachers to personalize instruction. That is to say, because of technology, the student is the class:

  - *Immediate feedback to students on academic performance:* Scanning devices make it possible for teachers to enter grades in the Electronic Gradebook with speed and accuracy. Students obtain nearly immediate feedback from homework assignments, quizzes, and tests. The positive effects that immediate feedback has on learning are well known.

- *Tying academic performance to learning objectives:* Teachers are beginning to investigate the use of computer-based item analysis of test questions. When this activity is put into full effect, teachers will receive diagnostics on their tests and individual student performance. This action will allow faculty to prescribe specific learning objectives for individual students instead of broad goals that are inherent in large-group instruction.

- *Sophisticated information resources for students:* Topics for assignments such as senior term papers and junior themes are now supported by access to Compact Disk-Read Only Memory (CD-ROM) reference materials that are easy to use and of the highest professional quality. In the few cases where the library/media center does not meet needs, students and faculty have toll-free online access to the Florida Information Resource Network (FIRN), based in Tallahassee. This service provides excellent reference materials, including access to: Educational Resources Information Center (ERIC), the state-wide university library system (LUIS), and selected references on the Internet.

- In reference to specific programs that benefit from technology, the ESOL program was very impressive:

  - *Enhanced instruction for ESOL students:* ESOL teachers report that children who have recently immigrated to Palm Beach County from areas such as Central America, South America, and the Caribbean basin benefit from immediate success when technology and computer-based instruction are used to full effect.

    In computer-based ESOL classes, instruction does not have to be age-specific; visual learners can recognize objects and themes, regardless of native language, and social stigmatization is maximized for behind grade level students when instruction is offered on a one-on-one basis.

- Students in Advanced Placement and Honors courses also expressed a keen desire to increase the use of technology:

  - *Enhanced student research capability:* A senior Honors English student who plans to major in law, pointed out that access to CD-ROM reference materials (as opposed to paper-based card catalogs) saves time in searching. Further, research papers are now of a much higher quality and, when composed with word processing software, research papers are now easier to prepare.

  - *Reduced on-task time:* A senior Honors student noted that computers are used as a support for research and word processing in all classes. In particular, this student noted that the computer-based college search program gave her the ability to determine that Georgia Tech was the university that would best meet her specific career goals. This student was able to save considerable time-on-task associated with the college application process, time that was better invested in leadership development and student council.

- Students with special needs are also prime candidates for success because of technology usage:

  - *Enhanced adaptive potential for speech impaired students:* A speech pathologist was pleased with how computing technology empowered one of her students. An adaptive device connected to a computer makes it possible for this student to personally control the feedback mechanism integrated into his speech pathology Individual Education Plan (IEP). The student receives feedback that far exceeds the information provided to students in programs that are not technology-based.

  - *Enhanced coordinated student participation:* A Special Education teacher for students with Specific Learning Disabilities noted that her students are often off-task during traditional instruction. However, she enjoys virtually total student participation in class activities when instruction is computer-based.

- Even students in the lower grades, although they are new to the use of technology in a school-based setting, expressed the value of technology and its effect on grades:

  - *Assistance with preparation for standardized testing:* A sophomore noted that she uses PSAT software at school to prepare for this important test, and takes it home so that she can continue practice on her family's own computer.

- Computers and the pervasive technology culture go beyond preparing for tests and course assignments. A Junior who is also an active participant in student council, offered the following comments:

  - *Assistance to students in extracurricular activities:* The student council would be lost without the availability of computers. Computer applications such as database management, word processing, and even Electronic Mail are now central to the structure of the student council.

- Technology also has a favorable role for students as they prepare for standardized tests:

  - *Enhanced access to laptops:* A senior who plans to enroll at Florida State University regularly takes advantage of the laptop personal computer checkout option available to all students. Along with standard activities such as word processing, this student also uses the computer to prepare for the SAT. Specifically, this student uses a custom-designed program that prepares students for SAT questions in terms of content and testing process. He was confident that his score on the SAT improved because of his ability to practice and study with the loaned computer while at home.

- The effects of the Program have also been well received by Palm Beach County administrators. Ms. Linda Nelson, Palm Beach County's Coordinator for Data Management Systems, expressed a more global view of the value of the MTS Program at Leonard:

  - *Enhanced preparation for real-world demands:* Local businesses need entrants in the workforce with the technology skills associated with graduates from Leonard. Students use technology and related tools that are often identical to those used in the local business community.

- *Applicability of program output:* Even when activities were not totally successful, Palm Beach County has learned much from the MTS Program and these experiences can be applied to other schools in the county. Without the MTS Program, each school would have to learn on its own on how to best fit technology into the learning environment.

- *Positive image for Palm Beach County:* Palm Beach County projects a positive image throughout the profession because of the many state wide, national, and international visitors to the MTS Program.

- *Enhanced satisfaction level among parents:* Parents are very pleased with the MTS Program.

■ The effect of the MTS Program was especially evident at the library/media center:

- *High level of student responsibility for learning:* Students come into the library/media center and quietly access computer-based information.

- *Independent access to learning resources:* Students asked for very little assistance on how to use computers and reference materials. It was noticed that the software was user-friendly, allowing students to organize their research needs in a very effective manner.

- *Student access to instruction:* In an area immediately adjacent to the media center, a separate class was participating in a telephone-based audiobridge class in Japanese. Specialized classes such as Japanese and Russian are always difficult to staff. However, technology such as the telephone-based audiobridge makes it possible for students to participate in low enrollment classes that would otherwise have to be canceled.

■ The visit ended with a seventh period meeting with available department chairs. Curricular areas represented in this meeting included: Business, Foreign Languages, Language Arts, Mathematics, Physical Education, Science, and Social Studies. A brief sampling of comments expressed during this meeting follows:

- *Enhancement of cooperative learning:* In science laboratory experiments, computers make it possible for students to proceed at their own pace, often with the assistance of a peer student. Thus, cooperative learning is enhanced through the use of computers in the science laboratory.

- *Reduced disciplinary problems:* It was agreed by all department chairs that student discipline problems in computer laboratories are rare.

- *Enhanced breadth of physical education instruction:* In association with a health and wellness program, students use computer-based technology in physical education programs. Technology permits students to pinpoint the long-term as well as short-term effects of selected diets and exercise programs.

- *Increased level of personalized services within large groups:* Language arts teachers have large classes, with more than 35 students per class the norm. By using computers and related applications, language arts teachers are confident that they are able to offer personalized services to their students at a greater level than they could offer without computer assisted instruction. Time saved by use of the Electronic Gradebook makes it possible for Language Arts to maintain use of student essays, a time-consuming task which would otherwise be eliminated in such large classes.

- Standardized test scores have increased in the last five years, in contrast to a national trend of declining test scores.

Summary of Observations

It was obvious that the MTS Program has been set up at the highest level of competence at John I. Leonard Community High School. Teachers, administrators, media specialists, support staff, and students use technology in creative ways that have resulted in valuable educational outcomes. Students and the general community are clearly benefitting from the MTS Program.

L. D. McArthur Elementary School
Pensacola, Florida

Background Information

Dr. John Losak and Dr. Thomas MacFarland visited L. D. McArthur Elementary School in Pensacola, Florida, on November 18, 1993. The visit was jointly hosted by Dr. Martha Lyle (Principal) and Ms. Barbara Holifield (MTS Facilitator). Superintendent of Schools, Mr. Bill Maloy, participated in an extensive interview on his vision of the Program and the use of technology in education. Approximately 650 students are enrolled.

MTS Program Goals

The evaluation began with a meeting between Mr. Maloy, Dr. Lyle, and Ms. Holifield, who recapitulated their vision of technology at a comprehensive elementary school. Because of the unique

needs of young children, MTS Program goals are specifically focused on the appropriate use of technology in an elementary school, with attention given to student motivation and individual learning styles. Goals were presented from two perspectives: instruction and administration, as follows:

- Instruction
  - Reduce time dependence on the teacher's traditional classroom performance.
  - Increase critical-thinking and decision-making skills.
  - Individualize the curriculum and utilize group problem solving.
  - Improve communication skills.
  - Transform the teacher from a font of information to a model of wisdom.
  - Provide for teacher utilization of knowledge.
  - Develop and implement evaluation methods.
- Administration
  - Serve as a role model for carrying out administrative responsibilities.
  - Use technology to reduce all non-instructional tasks to a minimum.

Observations

Throughout the meeting at the Superintendent's office, as well as the site visit, it became readily apparent that faculty and administrative staff have gone beyond the desire to use technology in innovative ways with young children. It was quite evident that the adoption of technology as a supporting mechanism for individualized instruction has become part of the pervasive culture. The following observations provide supporting evidence for technology use:

Interview with the Superintendent of Schools

- The Superintendent of Schools for Escambia County is totally committed to the use of technology in education and this commitment is demonstrated in the following activities, objectives and policies:
  - *Use of technology as a key requirement for administrative advancement:* To bring about educational reform in Escambia County, the Superintendent noted that the use of technology has been included as a criterion for administrative placement and promotion.

- *School exchange programs:* Exchange programs between sister schools are needed to enhance the comfort level with use of technology by teachers and administrators who are not experienced with the many tools regularly used in Model Technology Schools.

- *Student involvement in promoting use of technology:* Students and their eagerness to use technology should also be used to enhance the use of technology in schools. Students regularly assist their peers in problem solving through the use of computing machinery and other forms of technology.

- *The school as a total learning environment:* Technology also needs to move out from the schools into the general community served by schools. Technology may be the key to using schools as an impetus for the creation of a total learning environment, with an emphasis on individualized learning.

On-Site Visitation

- Originally designed as an open-space school, McArthur was built in the mid-1970s. It was noted that the school design did not support the placement of cables when the computer network was put into place. Outside support was needed to place cables and conduit throughout the school's brick structure. Several observations follow:

  - *Enhanced communication and information access:* After the school was networked, it became possible for teachers and administrators to communicate and find information without leaving their classrooms and offices.

  - *Extensive use of Electronic Mail:* Electronic Mail is a vital tool in the use of technology. Teachers and administrators indicated that they would not be able to function as efficiently without it.

  - *Network access to the card catalog:* The card catalog in the media center has also been placed on the network. Teachers and students regularly research the availability of reference materials in the media center without the disruption of leaving class or calling on the media specialist.

- The "stand-alone" computing machinery is also quite impressive:

  - The student-to-computer ratio is 3:1.

  - Each classroom is equipped with either three or four student workstations:

    - One workstation is dedicated to mathematics.

    - One workstation is dedicated to language arts.

    - One workstation is dedicated to word processing.

    - At the lower grade levels, one workstation is also dedicated as a talking computer, where children can follow along with stories by auditory reinforcement as well as visual reinforcement. This activity frees the classroom teacher from offering time-intensive one-on-one assistance when such assistance is not required.

- Computers and other forms of technology seemed to be in constant use by the students:
  - *Independent use of computers:* While visiting a kindergarten class of 30 students during nap time, it was noticed that the few students who were not tired were actively using computers for regular class activities. Further, they were using the computers with minimal assistance from the teacher.
  - *Multiple uses of technology:* Along with computers, other forms of technology seemed to be in constant use:
    - Many students were using audiotapes of reading stories to supplement instruction initiated by their teacher. Again, this type of self-directed activity with technology made it possible for the teacher to offer one-on-one assistance to students with greater needs at that moment.
    - Spelling machines were also commonly noticed. This form of technology reinforces a task that is time consuming and would otherwise limit the availability of the teacher to other students.
    - Students were also observed using film loops of topics related to class which they initiated and their teacher did not have to offer assistance.
- Willingness of students to do reports and projects that traditionally have been difficult to encourage:
  - *Age appropriate instruction:* The media center has an impressive array of computers along its perimeter. Students are able to sit at these workstations and access age appropriate information that is of the highest quality.
  - *Facilitated report writing:* Report writing in the media center is also facilitated by its easy-to-use word processing software facilities. Even students in the lower grades are able to generate documents that are quite impressive considering their age-equivalent peers in other schools.
- An observation at other Model Technology Schools was reinforced at McArthur Elementary School — discipline problems appeared to be minimal. Whether for reasons of technology usage or school-based leadership, students were attentive to teacher activities and willingly worked on their own whenever possible, thus allowing maximum one-on-one interaction between teachers and their students.
- The visitation included an extensive series of one-on-one and group interviews with faculty. Salient concepts identified by faculty during the interviews revealed:
  - *Increased motivation:* Student motivation has increased since technology was introduced. Learning is now often perceived to be a "fun" activity that often rivals the computer games that students in these age groups greatly enjoy.
  - *Increased discipline problems:* Student discipline problems have decreased since the broad-based introduction of technology.

- *Increased use of home computers:* About 20 percent of all students have access to a computer at home. Many students use a computer at home to continue with activities initiated at school and many parents are now calling on faculty for guidance on the purchase and use of home-based computers.

- *Integrated curriculum management:* In a project that has high potential for learning and management, the faculty and staff have decided to place the entire curriculum into a relational database designed as an Integrated Curriculum Management tool.

- *Long-range time savings through use of technology:* Initially, technology takes more time to learn than the time it saves on classroom management tasks. Indeed, the time devoted to learning how to use technology may be a formidable task for teachers who are not encouraged to adapt their behaviors to this new requirement. However, once the learning has occurred, technology saves considerable time on classroom management which allows more time for a teacher to offer individual and group instruction.

Summary of Observations

The use of technology as a means to solve real world problems in education has emerged as part of the pervasive culture at McArthur. Administrative staff, faculty, students, and the general community have become increasingly dependent on technology as a means of addressing day-to-day activities. The many associated constituencies have enjoyed educational success and it is suggested that this success is largely associated with the creative use of technology.

Webster Elementary School
St. Augustine, Florida

Background Information

Dr. John Losak and Dr. Thomas MacFarland visited Webster Elementary School in St. Augustine, Florida on December 2, 1993. The visit at Webster Elementary School was hosted by Ms. Cathy Hutchins, the MTS Program Coordinator. A two-person videotape production team was on-site from Nova Southeastern University. Approximately 730 students are enrolled.

MTS Program Goals at Webster

The importance of the MTS Program was evident by looking at the bulletin board in the front entrance. Prominantly displayed on the bulletin board was a series of images related to technology and the theme "Technology is Basic" in bold letters.

Although teacher inservice training in the use of technology is found at all five of the Model Technology Schools, the administration and faculty at Webster decided to place special emphasis on this activity. Goals for the MTS Program have specifically focused on teacher training. The concept of "Teacher Experts" received direct attention in the goals, which are outlined below:

- To implement and demonstrate a cost-effective plan for the use of technology in the schools for all of Florida's students.
- To plan and conduct research that analyzes and documents the impact of technology on learning and on teaching.
- To field test new technologies and develop strategies for using them to support Florida's curriculum and instructional objectives.
- To develop and implement effective training models for teachers and administrators that can be used throughout Florida's school system.
- To establish facility standards necessary for effective use of technology in existing schools, as well as new schools.
- To inform educators, business, legislators, and the community about the best strategies for using technology to meet Florida's educational goals.

After an initial meeting in the media center with Ms. Hutchins, Dr. Losak and Dr. MacFarland met with faculty and students during individual and small group videotaped interviews. The visiting team also had the opportunity to conduct classroom observations on the use of technology in education at the school, which has an average daily attendance of 700 students.

Observations

Even during the introductions and general discussion, which took place in the school's media center, it was apparent that technology has become a vital support to education:

- The media specialist's aid easily went about checking out books to children by merely using a scanning device to read in barcodes.

- Overdue book lists and similar status reports were generated in a simple manner, replacing an activity that would have otherwise been more time consuming.

- Children in this elementary school used Compact Disk-Read Only Memory (CD-ROM) tools such as Compton's Multimedia Encyclopedia and National Geographic Nature Series without assistance. The children seemed to be extremely attentive to this medium and they did not ask for assistance from the adults in the media center.

- In an area adjacent to the media center, children from grades 2 to 5 (including children with special learning needs) conducted daily morning announcements and the pledge to the flag in a state-of-the-art TV production studio. It appeared as if the children had been adequately trained, with children primarily in charge of production efforts.

- Instead of the obtrusion of an intercom message throughout the entire school, the MTS Program Coordinator sent out an Electronic Mail message to teachers, listing the agenda for the visitation.

- Progression in technology and its use in education resulted in de-centralization for educational purposes, even though the original plan was to centralize in the media center.

The many hours devoted to inservice training in the use of technology in education has resulted in the development of a cadre of "Teacher Experts" in technology at the school. Observations that support the creative ways the faculty and administration use technology include the following:

- All teachers who assign grades use the Electronic Gradebook. This tool is now vital to classroom management and the reporting of grades.

- Electronic Mail is now the official means of formal communication.

  - *Reduced hard copy needs:* Hard copy documents are placed in teacher mail slots only when an official signature on paper is required.

  - *Facilitated attendance recording:* Attendance records are easily sent by classroom teachers to the main office, using Electronic Mail.

  - *Facilitated communication regarding attendance:* Summative attendance records are easily transferred via telecommunications to central office personnel.

  - *Improved overall communication:* Electronic Mail is used to distribute the daily bulletin as well as ad hoc messages.

  - *Anticipated nearly exclusive use of Electronic Mail:* After Webster's retrofit in 1994, it is anticipated that written communications in this school will be nearly paperless, including communication to portable classrooms removed from the main physical plant.

- Veteran teachers claim that they perceive a noticeable change in how students approach learning when learning is supported by appropriate levels of technology:
  - *Improved written compositions:* Children find it easier to write compositions when they have the opportunity to key their text into a word processor, as opposed to writing on paper.
  - *Enhanced collaborative learning:* There seems to be more peer interaction and collaborative learning when instruction is offered in a format which requires groups of students to interact together at a workstation.
- Perhaps one of the more interesting visits was to a first grade classroom of 21 students. At first, it was perceived that this regular classroom was a computer laboratory. Instead, the dominance of computing machinery as an instructional tool throughout the entire day became evident:
  - Apple IIe computers were still being used in this class to support instruction at a level appropriate to these young students.
  - Students at the Apple IIe computers were using MECC software and they were interacting with the computer without placing demands on the teacher for assistance.
  - Other students were working one-on-one with MS-DOS compatible computers that were set up to support earphones or auditory instructions, based on the inability of children at this early grade to read complicated instructions on screen. These first grade children were using computers to practice letters, colors, and numbers:
    - Children were attentive to screen images and on-task requirements.
    - Discipline problems and acting out were foreign concepts to these students during their time with the computer.
    - The computer program was structured so that guidance was offered when students keyed in an incorrect response. Instruction was far more than electronic drill-and-practice.
  - A third group of students was working on basic mathematics on MS-DOS compatible computers. These students were involved in a game, where time and accuracy resulted in extra points. For these students, it was fun to practice basic skills such as number recognition and the addition of single-digit whole numbers.
- During this time, the teacher was able to individually work in a small group setting with a fourth group of students. Even without a teaching aid, this teacher was able to use computers to structure the classroom environment so that students received maximum personal attention.
- An additional observation was the ease by which children moved from one type of computer to another. The concept of difference in operating systems and computer architecture was apparently irrelevant to these young children.

Summary of Observations

Although all schools participating in the MTS Program have invested time and other resources into inservice training, training and the development of resident experts in technology has been particularly emphasized at Webster. As a result of this activity, it was evident that there is a total commitment to technology in education by the faculty, staff, and students at the school.

In an end-of-visitation meeting, Webster's Principal, Mr. Coffee, stated that training, access, and time are the keys to success in the effective use of technology in education. Mr. Coffee, responding to a question on student assessment, agreed that current assessment does not parallel technology-based teaching. Students use technology as a vehicle to support collaborative learning, peer tutoring, and problem solving, yet standardized achievement tests are still paper and pencil, where students work individually under timed conditions as they attempt to answer multiple-choice questions.

If technology in schools such as Webster is to gain increased attention and acceptance, then it will be necessary to also examine the assessment processes used in these schools. Otherwise, the gains that children enjoy in schools that use technology may not be readily evident, diminishing public acceptance of technology as an appropriate tool in education.

Mainland Senior High School
Daytona Beach, Florida

Background Information

Dr. John Losak and Dr. Thomas MacFarland visited Mainland Senior High School on December 3, 1993. The visit was hosted by Ms. Cindy Fisher, Mainland's MTS Program Coordinator. Throughout the all-day visitation, the evaluation team was also accompanied by the school principal, Mr. Tim Huth. Approximately 1,800 students are enrolled.

MTS Program Goals

MTS Program organization was to direct resources into the curriculum and the classroom instead of developing a networked infrastructure. As a result of this decision, the following goals were developed.

- Develop a climate of excellence which promotes high interest, motivation, and achievement for students and teachers.
- Develop a staff of highly qualified, effective teachers, who later can assist with the dissemination of components of the prototype schools in the district and around the state.
- Facilitate student learning through the use of state-of-the-art technology and innovative organizational approaches.
- Eliminate student failure by developing attitudes of independence, self-confidence, and responsibility.
- Create more teaching time by using technology to assist with classroom management.
- Provide access to new technologies for all exceptional and learning disabled students.

After this initial meeting with administrators, meetings were held with students, parents, and faculty. A two-person videotape production team was on-site from Nova Southeastern University.

Observations

Throughout, it was observed that the faculty and staff have developed many useful strategies to enhance classroom management and student learning through the use of technology. Activities that support this statement include the following observations:

Management

- The Electronic Gradebook has been accepted by over 80 percent of all faculty.
  - *Widely supported:* This tool is well received by administrators, teachers, students, and parents since it allows timely information on grades previously quite difficult to generate.
  - *Vital management tool:* The administration views the Electronic Gradebook as a vital management tool and even refers to its use in the School Improvement Plan 1993-1994 (Huth, 1993, p. 10), as follows:

> "Teachers will provide a minimum of two electronic progress reports per nine weeks. All nine week lesson plans will reflect the use of electronic gradebook".

- *Easy access to information by management:* Data from the Electronic Gradebook are easily used to prepare ad hoc reports that serve as further management tools to better meet student needs.

- *High level of student support:* Students interviewed as a group (22) were unanimously enthusiastic and supportive of the Electronic Gradebook.

- Class scheduling for the 2,000 students is now totally generated in electronic format. An activity that once consumed an extreme number of administrative staff hours is now easily met on an as-needed basis. As a result of this activity, administrators have more time to work directly with students and teachers.

- School-wide grading patterns are more easily determined when grades and other records are subject to electronic manipulation.

  - *Improved analysis of grading patterns:* After queries were made to grades in electronic format, it was observed that nearly one-third of all ninth grade students had a Grade Point Average of 1.5 or less.

  - *Improved response by administration:* Strategies to improve upon this condition have been implemented throughout the school, as reflected in the School Improvement Plan 1993-1994 (Huth, 1993). These intervention strategies would have been very difficult to identify and implement without the supporting documentation offered by electronic grading.

- Production costs for the yearbook have decreased through the use of technology.

  - *Reduced pre-production on-task time:* Traditionally, a yearbook is quite difficult to prepare and many hours are consumed in typing, retyping, and "cut-and-paste" of photographs and text.

  - *Easy accomodation of changes:* The yearbook is totally prepared with electronic tools. Changes are easily accommodated without limiting presentation and quality.

  - *Reduced production time:* Going further in the use of technology than most other yearbook production teams, students have placed all pictures for the yearbook into digital format. This action makes it possible for yearbook staff to send and receive digital images from the publisher via modem, thus reducing production time and costs.

- Teachers now prepare lesson plans with word processing software. Many teachers have created a general template for their lesson plans and then only make the necessary changes for specific instructional activities.

  - *Improved lesson planning:* Lesson plans are now easier to generate, which has a secondary effect of improving the quality of these documents through subsequent revisions.

  - *Facilitated integration of goals and objectives:* Goals and objectives are now easily reviewed by colleagues, with the intent of integrating pervasive goals and objectives into the overall curriculum. When achieved, this action will improve quality while reducing time and effort related to this component.

- Teachers have received Teacher Education Center (TEC) inservice training points for MTS Program training activities.

  - *Increased need for in-service training:* To be fully effective, the introduction of technology into a school requires teachers to participate in more hours of instruction and inservice training than administrators are able to offer during the regular school day through release time.

  - *Limitations on in-service training time:* There are reasonable limits on how many extra hours teachers will devote to inservice training on technology.

  - *Coordination of TEC guidelines and recertification requirements:* The coupling of inservice training in technology offered under TEC guidelines to State requirements for recertification provides the opportunity to serve as a motivator for more teachers to participate in technology training sessions.

Instruction

- All calculus students use TI-81 graphing calculators. It was suggested that as a result of this use of technology students are better able to understand the complex interactions when visual presentations are in real-time, as opposed to the traditional use of hand-graphics in delayed-time. Students continue to receive an exceptionally high (92 percent) pass rate on the AP calculus test, and will be in a very favorable position, compared to their peers, in 1994 when the AP calculus test is changed to allow students to use graphing calculators during the test.

- Electronic reference materials in the media center are so well received that students queue at terminals rather than attempt to use reference materials in printed form.

- As opposed to traditional instruction, where hand-drawn sketches are made on the chalkboard, teachers are able to use sophisticated equipment to present images of the highest quality:

  - *Enhanced level of mathematical analysis:* Physics experiments are further enhanced by placing data into digital format. These data are then entered into a spreadsheet, allowing what-if mathematical analyses that would otherwise be extremely difficult for most high school students.

  - *Enhanced visualization:* An LCD computer screen projection device is used in geometry classes so that students may clearly visualize the complex interaction of arrays and planes in three-dimensional space.

  - *Simplification of complex subjects:* Laser disc images are projected on a large screen for students in human anatomy classes. A complex subject like genetic recombination was presented with a clarity and visual simplicity that would be impossible to achieve with less sophisticated media.

  - *Enhanced potential for group instruction:* In the Honors Biology class, a microprojector microscope was linked to a 19 inch monitor. Microscope slides presented in enhanced format to the entire class, as opposed to asking each student to examine slides individually, with no assurance of quality for presentations that tend to degrade over time.

- The sciences are by no means the only areas enhanced by the use of technology.
  - *Improved quality of expression:* Advanced Placement (AP) English students use a Macintosh Local Area Network (LAN) to develop and then share information with their peers. It was suggested that this action improves the quality of expression, with students serving as peer tutors and graders.
  - *Enhanced monitoring and personalization of achievement:* The Dropout Prevention Program uses networked computers to personalize and monitor achievement in areas related to basic skills. Games are embedded into the software, motivating students who are often bored with school.
  - *Ease and reduced cost of concept presentation:* Art students use Amiga computers to prepare computer-generated imagery that easily parallels concepts that are quite difficult and expensive to present in a traditional curriculum.
  - *Improved resume quality:* As a motivator, many students enhance their resume with a personal photograph in digital format.
  - *Enhanced physical education instruction:* Physical Education students use special equipment to monitor their heart rate in real-time. As a result of this activity, students are able to see the immediate and long-term benefits of planned exercise and its impact on their health.
  - *Enhanced quality of compositions/reduced time for production:* Students in regular English classes were quite supportive of how the benefits of word processing, as opposed to the traditional preparation of compositions on paper. Word processing gives students the ability to produce text in correct format with minimal concern about the time-consuming revision process.
  - *Enhanced engagement of multiple senses in learning:* Students emphasized the value of computing machinery and other forms of technology in presenting information and concepts in visual and auditory format. For many students, multi-sensory instruction is quite beneficial, and technology easily supports instruction that engages multiple senses.
- The faculty and staff have also been extremely attentive to students with special needs using technology to offer these students an improved educational experience:
  - *Enhanced communication potential for learning impaired students:* Deaf students use telecommunications and the Florida Information Resource Network (FIRN) to communicate in text format with other deaf persons through project DEEP (Deaf Electronic Excursion Project). Students in the DEEP program have an individual user account with FIRN. They use a computer, modem, and communication software to share experiences with their peers throughout Florida. Without telecommunications, it would be very difficult for these deaf students to communicate with their peers. Eventually, these many messages will serve as a database that may be used to help preserve their culture.
  - *Enhanced instruction potential for special education students:* Technology has also been used for special education students in the drafting program. A student with special needs was using adaptive pointing devices in the Computer Assisted Drafting (CAD) program. If drafting were

restricted to traditional paper-and-pencil format, this student would have been unable to participate in a drafting class.

- The MTS Program visiting team was very fortunate to meet with a few parents. As a group, parents were quite supportive of the MTS Program and its positive impact on their children:

  - *Increased enjoyment of learning:* It was clear to parents that their children viewed instruction based on the use of technology as an exciting activity.

  - *Increased constructive use of time:* It was also mentioned by one parent who had a child in AP classes that technology gave her child something constructive to do when free time was offered.

  - *Improved quantity/quality of written materials:* Parents noted that word processing (as opposed to traditional composition on paper) improved the quality and quantity of written materials by their children.

  - *Applicability throughout curriculum:* One parent viewed technology as a basic tool for instruction that needs to be implemented throughout the total curriculum.

  - *Reduced limitations on learning:* It was also mentioned that computing machinery and other forms of technology have empowered children to the point that they can go beyond the constraints of a predetermined curriculum.

  - *Lack of computer literacy among parents:* The meeting with parents of children at Mainland ended with the revealing observation that these individuals, although they are very motivated, feel frustrated in their inability to help their children with technology-related questions. If parents in the early 1960s were unable to help their children with the "New Math" of that era, then many parents in the mid 1990s are equally frustrated in their inability to assist their children with technology currently employed in the curriculum.

Summary of Observations

Mainland will be a networked campus after the retrofit in 1994. The school has incorporated technology throughout the School Improvement Plan 1993-1994 (Huth, 1993) and it is expected that after the retrofit and the introduction of tools such as Electronic Mail, this school will enjoy the benefits of technology usage in management and communications as well as in development and presentation of the curriculum.

Teachers' Views on the Impact of Technology in the Model Technology Schools

Table 1

Response to Statements by Participants in Florida's Model Technology Schools Program

Statement	1 = Little Effect to 5 = Significant Effect N	Mean	SD	Median	Mode
Technology results in overall cost saving	131	3.34	1.34	3	3
Technology reduces paperwork	142	3.97	1.26	4	5
Technology improves communication	142	4.65	0.76	5	5
Technology improves collaboration among professional staff	142	4.23	0.91	5	5
Technology reduces loss or theft of media and/or materials	129	2.97	1.25	3	3
Technology encourages student participation in before school and/or after school activities	135	3.41	1.27	3	3
Technology encourages community participation in school-related activities	137	3.20	1.20	3	3
Technology improves student attendance	138	3.09	1.16	3	3
Technology decreases student behavior problems	136	3.27	1.28	3	3
Technology serves as a student motivator	142	4.33	0.91	5	5

Table 1 (Continued)

Statement	1 = Little Effect to 5 = Significant Effect N	Mean	SD	Median	Mode
Technology improves parent participation in school-related activities	133	3.02	1.18	3	3
Technology improves student learning	140	4.38	0.72	5	5
Technology improves access to information	140	4.79	0.46	5	5
Technology improves the quality of presentations in class or to the community	140	4.54	0.68	5	5
Technology improves the quality of classroom management activities	140	4.12	0.92	4	5
Technology decreases the time-on-task needed for classroom management activities	138	3.73	1.19	4	4
Technology increases the time available for individual instruction	136	3.74	1.14	4	4
Knowledge of technology is critical to career and promotions	140	4.61	0.62	5	5
Technology requires students to be active learners	140	4.51	0.67	5	5
Technology requires teachers to be learning mentors	140	4.36	0.74	5	5
Technology demands a new paradigm for on-site-based governance and decision-making	132	3.64	1.17	4	4

Table 1 (Continued)

Statement	1 = Little Effect to 5 = Significant Effect N	Mean	SD	Median	Mode
Technology demands a new paradigm on flexible scheduling	135	3.83	1.07	4	5
Technology demands the creation of new evaluation and assessment tools	134	4.10	0.84	4	4
Technology requires an inter-disciplinary approach toward teaching and instruction	135	3.96	0.98	4	5

Table 2

Frequency of Equipment and Services Available to Faculty, Staff, and Students in Florida's Model Technology Schools Program

Survey participants were asked to respond to the following statement:

> To the best of your knowledge, what types of equipment or services do you have in your school available for faculty, staff, and students?

	Faculty		Staff		Students	
Equipment or Service	N	% of Total	N	% of Total	N	% of Total
Adaptive Devices for Students with Special Needs	24	16.9	24	16.9	102	71.8
Barcode Readers	117	82.4	97	68.3	45	31.7
CD-ROM Drives	133	93.7	105	73.9	118	83.1
Commercial Telecommunication Service	64	45.1	51	35.9	79	55.6
Computer Screen Image Panels	107	75.4	70	49.3	28	19.7
Computer Screen Image Projectors	99	69.7	68	47.9	24	16.9
Data Storage Backup Tape Units	64	45.1	57	40.1	6	4.2
Digital Photography	60	42.3	39	27.5	34	23.9
Dot Matrix Printers	122	85.9	113	79.6	107	75.4
Electronic Mail	128	90.1	117	82.4	12	8.5
Florida Information Resource Network (FIRN)	120	84.5	93	65.5	21	14.8

Table 2 (Continued)

Equipment or Service	Faculty N	Faculty % of Total	Staff N	Staff % of Total	Students N	Students % of Total
Inkjet Printers	37	26.1	31	21.8	19	13.4
Interactive Video Workstations	95	66.9	73	51.4	82	57.7
Laser Printers (B&W)	136	95.8	113	79.6	86	60.6
Laser Printers (Color)	43	30.3	33	23.2	20	14.1
Local/Wide Area Network	104	73.2	92	64.8	64	45.1
Modems	115	81.0	97	68.3	31	21.8
Mouse or Rollerball	128	90.1	117	82.4	116	81.7
Multimedia Workstations	107	75.4	84	59.2	87	61.3
Pen-Based Computers	6	4.2	5	3.5	4	2.8
Rewritable Optical Drives	5	3.5	4	2.8	2	1.4
Scanners (Flatbed)	104	73.2	86	60.6	54	38.0
Scanners (Handheld)	58	40.8	53	37.3	46	32.4
Scientific Calculators	97	68.3	75	52.8	89	62.7
Soundcards	80	56.3	64	45.1	63	44.4
Telefascimile (FAX)	97	68.3	92	64.8	6	4.2
VCRs	135	95.1	117	82.4	92	64.8
Videodisc Players	130	91.5	108	76.1	95	66.9

Table 3

Frequency of Computer Applications Used by Faculty, Staff, and Students in Florida's Model Technology Schools Program

Survey participants were asked to respond to the following statement:

> To the best of your knowledge, what computer applications are used in your school by faculty, staff, and students?

	Faculty		Staff		Students	
Equipment or Service	N	% of Total	N	% of Total	N	% of Total
Class Management (grading programs, record keeping)	135	95.1	86	60.6	9	6.3
Computer-Aided Design	87	61.3	66	46.5	75	52.8
Database Management	127	89.4	104	73.2	75	52.8
Desktop Publishing	132	93.0	104	73.2	115	81.0
Drill and Practice Tutoring	97	68.3	59	41.5	133	93.7
Graphics	95	66.9	69	48.6	87	61.3
Programming	90	63.4	59	41.5	81	57.0
Simulations	76	53.5	55	38.7	81	57.0
Spreadsheet	131	92.3	101	71.1	87	61.3
Telecommunications (e-mail)	125	88.0	110	77.5	19	13.4
Tutorials	115	81.0	82	57.7	90	63.4
Word Processing	138	97.2	120	84.5	127	89.4

Table 4

Types of Microcomputers Used in Florida's Model Technology Schools Program

Survey participants were asked to respond to the following statement:

> To the best of your knowledge, what types of microcomputers do you have in your school? Check all selections that apply.
>
> ___ Apple II Series
>
> ___ Apple Macintosh
>
> ___ Apple Newton
>
> ___ Commodore Amiga
>
> ___ IBM or other MS-DOS Compatibles
>
> ___ SUN Workstations
>
> ___ Tandy/Radio Shack
>
> ___ Other (Please specify) _____

Type of Computer	N	% of Total
Apple II Series	114	80.3
Apple Macintosh	136	95.8
Apple Newton	4	2.8
Commodore Amiga	19	13.4
IBM or other MS-DOS Compatibles	138	97.2
SUN Workstations	1	0.7
Tandy/Radio Shack	88	62.0
Other	7	4.9

Table 5

Frequency of Microcomputer Usage in Florida's Model Technology Schools Program

Survey participants were asked to respond to the following statement:

> For the average or typical student in your school, what is your best estimate of frequency of computer usage at school (check one)?
>
> ___ None
>
> ___ 1 to 5 hours per week
>
> ___ 6 to 10 hours per week
>
> ___ 11 to 15 hours per week
>
> ___ More than 15 hours per week

Frequency of Microcomputer Usage	N	% of Total
None	3	2.2
1 to 5 hours per week	86	63.2
6 to 10 hours per week	38	27.9
11 to 15 hours per week	8	5.9
More than 15 hours per week	1	0.7

Table 6

Location of Microcomputers Used in Florida's Model Technology Schools Program

Survey participants were asked to respond to the following statement:

> Where are computers located in your school? Check all selections that apply.
>
> ___ Computers are placed in administrative offices.
>
> ___ Computers are placed in teacher planning areas.
>
> ___ Computers are placed in classrooms, with grade-level and subject-matter teachers.
>
> ___ Computers are placed in a central computer laboratory.
>
> ___ Students are able to use computers placed in the library.
>
> ___ Other (Please specify) _____

Location of Computer	N	% of Total
Computers are placed in administrative offices	142	100.0
Computers are placed in teacher planning areas	134	94.4
Computers are placed in classrooms, with grade-level and subject-matter teachers	140	98.6
Computers are placed in a central computer laboratory	141	99.3
Students are able to use computers placed in the library	140	98.6
Other	27	19.0

Table 7

How Central Computer Laboratories are Used in Florida's Model Technology Schools Program

Survey participants were asked to respond to the following statement:

> If you have a central computer laboratory in your school, please describe how it is used. Check all selections that apply.
>
> ___ Teachers take their students to the laboratory, with instruction provided by the regular classroom teacher.
>
> ___ Teachers take their students to the laboratory, with instruction provided in a team setting by the regular classroom teacher and a computer specialist.
>
> ___ Teachers take their students to the laboratory, with instruction generally provided by a computer specialist.
>
> ___ Other (Please specify)
> _____

Location of Computer	N	% of Total
Teachers take their students to the laboratory, with instruction provided by the regular classroom teacher	139	97.9
Teachers take their students to the laboratory, with instruction provided in a team setting by the regular classroom teacher and a computer specialist	38	26.8
Teachers take their students to the laboratory, with instruction generally provided by a computer specialist	17	12.0
Other	14	9.9

Table 8

Response by Participants in Florida's Model Technology Schools Program as to Why Computers and Other Forms of High Technology are not Used on a More Regular Basis

Survey participants were asked to respond to the following statement:

> Assume that computers and other forms of high technology have a role in American education. From your perspective, why are computers and other forms of high technology not used on a more regular basis? Please check all selections that reflect computer usage in your school.
>
> ___ There is an insufficient number of computers available to teachers and students.
>
> ___ Teachers and students do not have convenient access to computers.
>
> ___ Teachers and students receive insufficient training on computer usage.
>
> ___ There is not enough time to use computers in regular classroom activities.
>
> ___ There are those who feel that computers are an inappropriate teaching tool.
>
> ___ Other Reasons (Please specify)

Statement	N	% of Total
There is an insufficient number of computers available to teachers and students	74	52.1
Teachers and students do not have convenient access to computers	51	35.9
Teachers and students receive insufficient training on computer usage	43	30.3

Table 8 (Continued)

Statement	N	% of Total
There is not enough time to use computers in regular classroom activities	63	44.4
There are those who feel that computers are an inappropriate teaching tool	15	10.6
Other reasons	24	16.9

Table 9

Professional Position of Survey Respondents

Statement	N	% of Total
Administrator	6	4.3
Computer Coordinator	0	0.0
Media Specialist/Librarian	3	2.1
Parent or Guardian	0	0.0
Student	0	0.0
Teacher	124	88.6
Other	7	5.0

Table 10

School Affiliation of Survey Respondents

School	N	% of Total Respondents
L. D. McArthur Elementary, Pensacola	34	24.1
Webster Elementary, St. Augustine	20	14.2
Chamberlain High School, Tampa	35	24.8
John I. Leonard High School, Lake Worth	33	23.2
Mainland Senior High School, Daytona Beach	19	13.4
Total	141	

Table 11

Home Ownership of Microcomputers by Professional Staff in Florida's Model Technology Schools Program

Survey participants were asked to respond to the following statement:

Do you have your own computer at home?

___ YES

___ NO

Statement	N	% of Total
Yes — has a computer at home	81	57.9
No — does not have a computer at home	59	42.1

MTS Program Coordinators' Response to Survey Prepared by Legislative Aides

Section I: Technology Location and Costs

A. Question Area: Where is the technology located and how much does it cost?

Measurement Factors:

1. Percent of the total Model Technology School (MTS) information technology (e.g., computers, printers, networks, etc.) in a lab setting, by discipline.

McArthur, Escambia	Computers	9 %
	Printers	5 %
	Networks	25 %
	Scanners	0 %
	Laserdisc	9 %
Webster, St. Johns	20 % overall	
Chamberlain, Hillsborough	59 % overall	
	Science	6 %
	Business	17 %
	Mathematics	7 %
	Multidisciplinary	10 %
	Media Center	9 %
	Exceptional Ed.	10 %
Leonard, Palm Beach	41 % overall	
Mainland, Volusia	7 % overall	

2. Percent total MTS information technology in individual class rooms, by discipline.

McArthur, Escambia	Computers	80 %
	Printers	69 %
	Laserdisc	51 %
	Scanners	50 %
	CD-ROM	61 %
Webster, St. Johns	75 % overall	
Chamberlain, Hillsborough	English	5 %
	Mathematics	5 %

	Science	6 %
	Social Studies	3 %
	Foreign Language	2 %
	Fine Arts	1 %
	Physical Ed./Health	2 %
	Business	1 %
	Distributive Ed.	5 %
	Home Economics	3 %
	Exceptional Ed.	2 %
Leonard, Palm Beach	51 % overall	
Mainland, Volusia	91 % overall	

3. Percent total MTS information technology in administrative use.

McArthur, Escambia	Computers	11 %
	Printers	13 %
	Laserdisc	0 %
	Scanners	50 %
	CD-ROM	0 %
Webster, St. Johns	5 % overall	
Chamberlain, Hillsborough	7 % overall	
Leonard, Palm Beach	9 % overall	
Mainland, Volusia	4 % overall	

4. Percent of total information technology in similar other district schools (ODS) in a lab setting, by discipline — i.e., similar to the MTS elementary schools and similar to the MTS high schools.

McArthur, Escambia	NR
Webster, St. Johns	10 % overall
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	70 % overall
Mainland, Volusia	NR

5. Percent of total information technology in similar ODS schools in individual classrooms, by discipline.

McArthur, Escambia	NR
Webster, St. Johns	40 % overall
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	5 % overall
Mainland, Volusia	NR

6. Percent of total information technology in administrative use for similar ODS schools.

McArthur, Escambia	NR
Webster, St. Johns	2 % overall
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	25 % overall
Mainland, Volusia	NR

B. Question Area: Overall, is there more information technology in the MTS than in similar other district schools (ODS)? How much more (or less) and what type?

Measurement Factors:

7. The ratio of computers, CD-ROMs, etc., to students in the MTS.

McArthur, Escambia	Computers	1:3
	Printers	1:11
	Laserdisc	1:49
	Scanners	1:227
	CD-ROM	1:52
Webster, St. Johns	1:4 overall	
Chamberlain, Hillsborough	1:9 overall	
Leonard, Palm Beach	1:4 overall	
Mainland, Volusia	1:3 overall	

8. The ratio of computers, CD-ROMs, etc., to students in the similar ODS.

McArthur, Escambia	NR
Webster, St. Johns	1:4 overall
Chamberlain, Hillsborough	1:11 overall
Leonard, Palm Beach	1:10 overall
Mainland, Volusia	NR

C. Question Area: What is the cost of the MTS information technology compared to ODS? Compared to the state average?

Measurement Factors:

9. Percent of total MTS information technology expenditures for hardware; for software; for networking; for printers; for system maintenance; for system infrastructure; for system administration.

McArthur, Escambia	Hardware	20 %
	Software	11 %

	Networking	10 %
	Maintenance	1 %
Webster, St. Johns	Hardware	20 %
	Software	15 %
	Networking	100 %
	Printers	15 %
	Maintenance	5 %
	Infrastructure	5 %
	Administration	40 %
Chamberlain, Hillsborough	NR	
Leonard, Palm Beach	Hardware	50 %
	Software	10 %
	Maintenance	5 %
	Salary/Travel	25 %
	Training	10 %
Mainland, Volusia	NR	

10. Percent of total information technology expenditures by the same categories for similar ODS.

McArthur, Escambia	NR	
Webster, St. Johns	NR	
Chamberlain, Hillsborough	NR	
Leonard, Palm Beach	Hardware	75 %
	Software	20 %
	Maintenance	5 %
	Salary/Travel	25 %
	Training	10 %
Mainland, Volusia	NR	

11. Expenditures for technology per FTE student in MTS.

McArthur, Escambia	$224/year
Webster, St. Johns	NR
Chamberlain, Hillsborough	$79/year
Leonard, Palm Beach	$175/year
Mainland, Volusia	NR

12. Expenditures for technology per FTE student in similar ODS.

McArthur, Escambia	NR
Webster, St. Johns	NR
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	$20/year
Mainland, Volusia	NR

13. Percent of total MTS funding that is from private sector donations.

McArthur, Escambia	5 % overall
Webster, St. Johns	NR
Chamberlain, Hillsborough	10 % overall
Leonard, Palm Beach	8 % overall
Mainland, Volusia	NR

14. Percent of total similar ODS funding from private sector donations.

McArthur, Escambia	NR
Webster, St. Johns	NR
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	1 % overall
Mainland, Volusia	NR

Section II: Use and Outcomes

A. Question Area: What proportion of time do the students spend using the computers and other technologies (e.g., CD-ROMs, FIRN, etc.) in the MTS compared to the ODS? In what curriculum areas?

Measurement Factors:

15. Percent of available instruction hours the technologies are used by students per day, by discipline, in MTS.

McArthur, Escambia	20 % overall
Webster, St. Johns	75 % overall
Chamberlain, Hillsborough	68 % overall
Leonard, Palm Beach	95 - 100 % overall
Mainland, Volusia	Up to 100 % overall

16. Percent of available instruction hours technologies are used by students per day, by discipline, in ODS.

McArthur, Escambia	NR
Webster, St. Johns	50 % overall
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	NR
Mainland, Volusia	NR

B. Question Area: What are the differences in standardized test scores between MTS and similar ODS? Are there differences in test scores for technology intensive curriculum between the two groups?

Measurement Factors:

17. Percent of MTS students using computer-delivered programmed instruction passing standardized tests, by discipline, by grade level.

McArthur, Escambia	NR
Webster, St. Johns	NR
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	100 % overall
Mainland, Volusia	NR

No responses were provided by any coordinator to items 18 through 22.

18. Average standardized test score for MTS students using the computer-delivered programmed instruction, by discipline, by grade level.

19. Percent of students, within the MTS, not using the programmed instruction passing standardized tests, by discipline, by grade level.

20. Average standardized test scores, within the MTS, for students not using the computer-delivered programmed instruction, by discipline, by grade level.

21. Percent of ODS students using computer-delivered programmed instruction passing standardized tests, by discipline, by grade level.

22. Average standardized test score for ODS students using the computer-delivered programmed instruction, by discipline, by grade level.

23. Percent of total MTS students passing standardized tests, by discipline, by grade level.

McArthur, Escambia — NR

Webster, St. Johns — NR

Chamberlain, Hillsborough

High School Competency Test

1989-1990	Communications	89 %
	Mathematics	80 %
1990-1991	Communications	95 %
	Mathematics	87 %
1991-1992	Communications	91 %
	Mathematics	84 %
1992-1993	Communications	93 %
	Mathematics	84 %

Grade Ten Assessment Test

1992	Reading	54
	Mathematics	55
1993	Reading	53
	Mathematics	58

Scholastic Aptitude Test

1989-1990	Verbal	433
	Mathematics	488
1990-1991	Verbal	425
	Mathematics	480
1991-1992	Verbal	433
	Mathematics	489
1992-1993	Verbal	440
	Mathematics	498

American College Test

1989-1990	Composite Score	22.0
1990-1991	Composite Score	21.8
1991-1992	Composite Score	22.2
1992-1993	Composite Score	22.8

Leonard, Palm Beach

Advanced Placement Scores Over 3

State	52.3 %
Leonard	62.7 %

Mainland, Volusia — NR

24. Percent of total ODS students passing standardized tests, by discipline, by grade level.

McArthur, Escambia — NR

Webster, St. Johns — NR

Chamberlain, Hillsborough

High School Competency Test

1989-1990	Communications	89 %
	Mathematics	78 %
1990-1991	Communications	93 %
	Mathematics	84 %
1991-1992	Communications	92 %
	Mathematics	84 %
1992-1993	Communications	93 %
	Mathematics	85 %

Grade Ten Assessment Test

1992	Reading	46
	Mathematics	53
1993	Reading	50
	Mathematics	58

Scholastic Aptitude Test

1989-1990	Verbal	425
	Mathematics	479
1990-1991	Verbal	422
	Mathematics	474
1991-1992	Verbal	423
	Mathematics	480
1992-1993	Verbal	426
	Mathematics	486

American College Test

1989-1990	Composite Score	21.5
1990-1991	Composite Score	21.7
1991-1992	Composite Score	21.5
1992-1993	Composite Score	21.8

Leonard, Palm Beach — NR

Mainland, Volusia — NR

25. Percent of MTS graduating class passing standardized test scores by discipline.

McArthur, Escambia	NR		
Webster, St. Johns	NR		
Chamberlain, Hillsborough	NR		
Leonard, Palm Beach	High School Competency Test, 1993		
	English	Leonard	93 %
		District	90 %
	Mathematics	Leonard	81 %
		District	79 %
Mainland, Volusia	NR		

26. Percent of graduating class passing standardized tests by discipline for similar ODS.

No response was provided by Coordinators.

Section III: Attendance, Awards, & Demographics

A. **Question Area: Are there differences in attendance, disciplinary actions, tardiness, expulsions, drop-outs, students who go on to college, school zones, etc. between MTS and ODS?**

Measurement Factors:

27. Attendance rate of MTS.

McArthur, Escambia	95 % overall
Webster, St. Johns	95 % overall
Chamberlain, Hillsborough	1989-90 90%
	1990-91 89%
	1991-92 87%
	1992-93 89%
Leonard, Palm Beach	96 % overall
Mainland, Volusia	92 % overall

28. Attendance rate at similar ODS.

McArthur, Escambia	NR
Webster, St. Johns	92.9 % overall
Chamberlain, Hillsborough	1989-90 90% 1990-91 91% 1991-92 90% 1991-92 90%
Leonard, Palm Beach	NR
Mainland, Volusia	NR

29. Percent of students receiving disciplinary actions, expulsions, etc. in the MTS.

McArthur, Escambia	11 % overall
Webster, St. Johns	NR
Chamberlain, Hillsborough	19 % overall
Leonard, Palm Beach	21 % overall
Mainland, Volusia	NR

30. Percent of students receiving disciplinary actions, expulsions, etc., for similar ODS.

McArthur, Escambia	NR
Webster, St. Johns	NR
Chamberlain, Hillsborough	16 % overall
Leonard, Palm Beach	NR
Mainland, Volusia	NR

31. Percent of students who start in the MTS and graduate from the same MTS (or go on to the next school level in the case of elementary schools).

No response was provided by Coordinators.

32. Percent of similar ODS students who start in the same school and graduate in the same school (or go on to the next school level in the case of elementary schools).

No response was provided by Coordinators.

33. Percent of MTS students who receive academic awards, honors, etc., by discipline, by grade level.

McArthur, Escambia	NR
Webster, St. Johns	50 % overall

Chamberlain, Hillsborough

National Merit Scholars

1989-1990	10
1990-1991	6
1991-1992	5
1992-1993	6

Commendations for National Merit

1989-1990	6
1990-1991	9
1991-1992	11
1992-1993	18

Florida Academic Scholars

1989-1990	67
1990-1991	65
1991-1992	88
1992-1993	104

Leonard, Palm Beach — NR

Mainland, Volusia

Florida Academic Scholarships	N = 17
Vocational Gold Seal	N = 14
1992-93 Scholarships	N = 97
	$ = 1,598,630

34. Percent of similar ODS students who receive academic awards, honors, etc., by discipline, by grade level.

No response was provided by Coordinators.

35. Percent of MTS students who plan to attend college.

McArthur, Escambia	NR
Webster, St. Johns	NR
Chamberlain, Hillsborough	69 % overall
Leonard, Palm Beach	75 % overall
Mainland, Volusia	68 % overall

36. Percent of similar ODS students who plan to attend college.

No response was provided by Coordinators.

37. Number of times the MTS school zone has changed during the past eight (8) years, date of change(s).

McArthur, Escambia	1 Time
Webster, St. Johns	2 Times
Chamberlain, Hillsborough	0 Times
Leonard, Palm Beach	2 Times
Mainland, Volusia	0 Times

38. Number of times similar ODS school zones have changed during the past eight (8) years, date of change(s).

McArthur, Escambia	NR
Webster, St. Johns	1 Time
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	NR
Mainland, Volusia	0 Times

39. Dropout rate, by grade level, for MTS.

McArthur, Escambia	NR
Webster, St. Johns	NR
Chamberlain, Hillsborough	5 % overall
Leonard, Palm Beach	8 % overall
Mainland, Volusia	2.2 % overall

40. Dropout rate, by grade level, for similar ODS.

McArthur, Escambia	NR
Webster, St. Johns	NR
Chamberlain, Hillsborough	3 % overall
Leonard, Palm Beach	4 % overall
Mainland, Volusia	NR

41. Average family income in MTS school zone; percent change in the past eight years.

McArthur, Escambia	NR
Webster, St. Johns	NR
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	Middle to Low Income
Mainland , Volusia	$29,563

42. Average family income in similar ODS school zone; percent change in the past eight years.

McArthur, Escambia	NR
Webster, St. Johns	NR
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	Middle to Low Income
Mainland , Volusia	NR

43. Average cost of single family housing in MTS school zone.

McArthur, Escambia	NR
Webster, St. Johns	$30,000
Chamberlain, Hillsborough	$82,000
Leonard, Palm Beach	Middle to Low Income
Mainland, Volusia	NR

44. Average cost of single family housing in similar ODS school zones.

McArthur, Escambia	NR
Webster, St. Johns	$65,000
Chamberlain, Hillsborough	$61,900
Leonard, Palm Beach	Middle to Low Income
Mainland , Volusia	NR

45. Percent of total MTS students who have computers at home.

McArthur, Escambia	NR
Webster, St. Johns	10 % overall
Chamberlain, Hillsborough	47 % overall
Leonard, Palm Beach	NR
Mainland , Volusia	NR

46. Percent of total similar ODS students who have computers at home.

McArthur, Escambia	NR
Webster, St. Johns	15 % overall
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	NR
Mainland, Volusia	NR

Section IV: Instructors and Technology

A. Question Area: What are the training and teaching experience differences between the MTS and ODS?

Measurement Factors:

47. Average number of years teaching by discipline, by grade level, for MTS teachers.

McArthur, Escambia	2 1-3 Yr. 4 4-9 Yr. 14 10-19 Yr. 14 > 20 Yr.
Webster, St. Johns	8-10 Years
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	10-12 Years
Mainland , Volusia	16% 1-3 29% 4-9 25% 10-19 29% >= 20

48. Average number of years teaching by discipline, by grade level, for similar ODS teachers.

McArthur, Escambia	NR
Webster, St. Johns	4-5 Years
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	NR
Mainland, Volusia	NR

49. Teacher turnover, by discipline, by grade level in MTS.

McArthur, Escambia	10 % overall
Webster, St. Johns	NR
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	NR
Mainland , Volusia	10 % overall

50. Teacher turnover by discipline, by grade level, in similar ODS.

No response was provided by Coordinators.

51. Percent of MTS teachers using the available technology (computers, FIRN, etc.) to plan courses, record grades, communicate with other teachers (e.g., e-mail), etc.

McArthur, Escambia	100 %	
Webster, St. Johns	100 %	
Chamberlain, Hillsborough	98 %	
Leonard, Palm Beach	100 %	
Mainland, Volusia	Electronic Gradebook	85 %
	District E-Mail (PROFS)	20 %
	FIRN	10 %

52. Percent of similar ODS teachers using the available technology (computers, FIRN, etc.) to plan courses, record grades, communicate with other teachers (e.g., e-mail), etc.

McArthur, Escambia	NR
Webster, St. Johns	10 % overall
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	20 % overall
Mainland, Volusia	NR

53. Percent of MTS teachers who have certification in computer literacy or other computer training, by discipline.

McArthur, Escambia	0 % overall
Webster, St. Johns	2 % overall
Chamberlain, Hillsborough	98 % (It is questioned if this statistic instead reflects training, not certification)
Leonard, Palm Beach	NR
Mainland, Volusia	2 % overall

54. Percent of similar ODS teachers who have certification in computer literacy or other computer training, by discipline.

McArthur, Escambia	NR
Webster, St. Johns	1 % overall
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	NR
Mainland, Volusia	NR

55. Percent of total staff development/continuing education training hours devoted to using technology in instruction for MTS staff.

McArthur, Escambia	58 % overall
Webster, St. Johns	75 % overall

Chamberlain, Hillsborough	55 % overall
Leonard, Palm Beach	NR
Mainland, Volusia	NR

56. Percent of total staff development/continuing education training hours devoted to using technology in instruction for ODS staff.

McArthur, Escambia	NR
Webster, St. Johns	50 % overall
Chamberlain, Hillsborough	33 % overall
Leonard, Palm Beach	NR
Mainland, Volusia	NR

57. Percent of MTS teachers using the available technology (computers, CD-ROMs, FIRN, etc.) to deliver classroom instruction, by discipline.

McArthur, Escambia	100 % overall
Webster, St. Johns	60 % overall
Chamberlain, Hillsborough	75 % overall
Leonard, Palm Beach	60 % overall
Mainland, Volusia	100 % overall

58. Percent of ODS teachers using the available technology (computers, CD-ROMs, FIRN, etc.) to deliver classroom instruction, by discipline.

McArthur, Escambia	NR
Webster, St. Johns	20 % overall
Chamberlain, Hillsborough	NR
Leonard, Palm Beach	NR
Mainland, Volusia	NR

59. Number of other district school teachers that have visited the MTS for observation, training, or instruction in how to use the available technologies.

McArthur, Escambia	200
Webster, St. Johns	500
Chamberlain, Hillsborough	570
Leonard, Palm Beach	1,500
Mainland, Volusia	760

60. Number of seminars, training sessions, or workshops that MTS staff have provided for ODS staff during the past fiscal year.

McArthur, Escambia	10
Webster, St. Johns	7-10
Chamberlain, Hillsborough	37
Leonard, Palm Beach	12
Mainland, Volusia	NR

National Comparative Data

Table 12

Mean Percent of Computers for Instruction in U.S. Elementary and Secondary Schools for 1989 and 1992 by Type of Computer within School Level

	1989	1992
Grade Level and Type of Computer	Mean Percent	Mean Percent
Elementary		
Apple II	68	74
Apple Macintosh	3	4
IBM PC & compatible	7	12
Other	22	10
Lower Secondary		
Apple II	61	57
Apple Macintosh	2	10
IBM PC & compatible	11	21
Other	26	12
Upper Secondary		
Apple II	52	37
Apple Macintosh	4	12
IBM PC & compatible	20	42
Other	24	10

Table 13

Percent of All English Teachers Who Reported That Students Use Computers in Class during a Typical Week by Frequency of Use within Grade Level, 1992

Frequency of Use	Grade 5	Grade 8	Grade 11
No use	27	55	58
Less than once a week	23	18	26
1-3 times per week	42	20	12
Most days or every day	8	7	4

Table 14

Percent of All English Teachers Who Reported Substantial Software Use by the Typical Student "At Any Time" on School Computers during 1992 by Software Type within School Level

Software Type	Grade 5	Grade 8	Grade 11
Keyboarding skills practice	27	22	17
Word processing (essays or reports)	19	20	16
Graphics printing program	13	11	14
Spelling checker	07	14	26
Programming language (Logo, etc.)	07	08	05
Outliner or prewriting software	06	05	13
Desktop publishing (newspapers, etc.)	06	04	04
Electronic thesaurus	00	04	10

Table 15

Percent of Computer-Using Students (U.S.) Who Reported Considerable Computer Use during 1992 by School Subject within Grade Level

Software Type	Grade 5	Grade 8	Grade 11
Computer Education	51	67	83
Mathematics	28	07	06
Science	05	02	04
Social Studies	10	03	02
English	10	09	04

Table 16

Percent of U.S. Students Ever Taught Each Type of Computer Education within Grade Level, 1992

Type of Computer Education	Grade 5	Grade 8	Grade 11
Percent ever taught			
to run programs	65	65	65*
to use word processor or to write an essay	52	63	65
to calculate with a spreadsheet	--	32	42
to use a database program	31	48	48
to send messages to another computer	14	15	14
to write programs in languages like Pascal or BASIC	16	31	32
to run programs AND use word processing AND use either databases or spreadsheets	20	46	48

* These identical percentages at each level accurately reflect the original table

Table 17

Percent of U.S. Students Who Report Out-of-School Computer Access, a Computer in the Home, and Mean Hours of Non-School Computer Use during 1992 by Sex and Socioeconomic Status within Grade Level

Student Characteristic	Any Computer Access Outside School (This Year)	Computer in the Home	Hours per Week Using Non-School Computer	
			Mean	SD
Grade 5				
Sex				
Male	83	40	2.9	6.2
Female	82	37	2.2	4.3
SES				
Low	70	12	2.0	5.6
Medium	85	38	2.2	4.7
High	96	74	3.6	6.0
All	83	38	2.5	5.3
Grade 8				
Sex				
Male	83	51	2.7	4.8
Female	82	45	1.7	3.1
SES				
Low	66	15	1.2	2.5
Medium	82	44	1.9	3.9
High	94	77	2.9	4.7
All	82	48	2.2	4.0

Table 17
(Continued)

Student Characteristic	Any Computer Access Outside School (This Year)	Computer in the Home	Hours per Week Using Non-School Computer	
			Mean	SD
	Grade 11			
Sex				
Male	81	57	3.0	5.7
Female	79	46	1.7	3.1
SES				
Low	59	14	1.5	2.7
Medium	81	48	2.0	3.8
High	92	82	3.1	5.8
All	80	51	2.0	4.6

Table 18

Microcomputers for Student Instruction in Public Elementary and Secondary Schools: 1981 to 1990

Year	Percent with Micros			No. of Micros (1,000)	Students Per Micro
	Elem.	Junior	Senior		
1981	11.1	25.6	42.7	(NA)	(NA)
1982	20.2	39.8	57.8	(NA)	(NA)
1983	68.4	80.5	86.1	324.4	92.3
1984	82.2	93.1	94.6	569.8	63.5
1985	91.0	97.3	97.4	842.6	45.5
1986	94.9	98.5	98.7	1,081.9	36.5
1987	96.0	98.6	99.0	1,354.0	30.8
1988	96.8	98.8	99.1	1,522.9	26.9
1989	96.8	98.5	99.1	1,706.4	24.1
1990	97.3	98.4	98.8	2,028.7	20.9

Table 19

Microcomputers for Student Instruction in Private Elementary and Secondary Schools: 1981 to 1990

Year	Percent with Micros	No. of Micros (1,000)	Students Per Micro
	Junior		
1981	(NA)	(NA)	(NA)
1982	(NA)	(NA)	(NA)
1983	23.8	(NA)	(NA)
1984	53.0	62.2	56.2
1985	70.3	101.2	41.6
1986	77.1	129.2	33.7
1987	78.7	151.1	28.8
1988	82.8	185.5	23.5
1989	81.8	222.8	20.1
1990	88.2	341.8	19.5

Table 20

Comparison of Microcomputers for Student Instruction in Private and Public Elementary and Secondary Schools: 1981 to 1990

Year	Percent with Micros		Students Per Micro	
	Public	Private	Public	Private
1981	18.2	(NA)	(NA)	(NA)
1982	30.0	(NA)	(NA)	(NA)
1983	68.4	23.8	92.3	(NA)
1984	85.1	53.0	63.5	56.2
1985	92.9	70.3	45.5	41.6
1986	95.6	77.1	36.5	33.7
1987	96.4	78.7	30.8	28.8
1988	97.1	82.8	26.9	23.5
1989	97.0	81.8	24.1	20.1
1990	97.2	88.2	20.9	19.5

Discussion

A comprehensive review of all documents relevant to the MTS Program, including self-studies, school improvement plans, newsletters, as well as previous MTS evaluation and project reports, was conducted by the evaluators. This review, coupled with the on-site visits and analysis of survey results by the evaluators at participating Model Technology Schools, revealed the significant strides the MTS Program has achieved in fulfilling the intent and mandate of the original legislation through which it was established.

It was abundantly clear to the evaluators that five years after the initial implementation of the MTS Program, the level of enthusiasm and commitment to the project by the individuals most directly involved in its implementation — administrators, teachers, and students in the schools — remains very high. These participants are generally quite supportive of the program, although support is not unanimous. Many teachers invest hundreds of hours of their own time to enhance their skills; enthusiasm for the availability of computers moved one teacher on the verge of retirement to stay on, invigorated by the possibilities she saw for improved student learning. Attendance is up, discipline problems down, and community support is high. Teachers and administrators alike report improvement in classroom management and virtually all who were asked during interviews with the evaluators said they would be "at a loss" in the absence of their current technological tools. Efficaciousness of management is basically a perceptive event; therefore participant judgments are quite appropriate as a measurement tool.

Findings available from this study support the proposition that the expenditure of resources for the MTS Program has, by and large, achieved what was intended. The major exception relates to the question of enhanced student learning. Teachers report their perception that students learn better with computers. Self-assessments by students suggest a similar conclusion. Substantial hard evidence, however, beyond testimonials, is not available. High levels of enthusiasm and commitment, reported enhancement of student motivation, and facilitated management, though important, may or may not lead to a demonstrable improvement in learning.

The overall mission of the MTS Program is not "computerization," but the ends which may be achieved through that means, e.g., enhanced teaching and learning. Technology, used with planning prudence, personnel training, and patience is an important tool for teachers, students and administrators alike. It borders on triteness to observe that these children live and will eventually work in a world dominated by technology. So it is not an important question to ask whether Florida's schools should move forward with computers and other technologies; we will. Accordingly, there is a need for the identification of student learning outcomes associated with the use of technology and the design and application of outcome measures to assess levels of achievement. In the interest of ensuring consistency of approach and allowing direct comparability among participating schools, a research initiative should be centrally administered rather than only conducted separately for each school. Further, the length of the project should be sufficient, at least 3-5 years, to generate meaningful data and analysis. Questions such as the following require attention:

- What are the most efficacious means for enhancing sound, productive usage?
- What structures for personnel (teachers and staff) development work best?
- How modern (current) does the equipment need to be and for which purposes?
- How can a thorough study of the use of computers in the design and development of curriculum be best approached?
- What needs to occur in the assessment of student learning to capture the impact of computers?
- To what specific educational ends are these tools most accomodating?

It appears appropriate and prudent to incorporate further planning for the MTS Program, including consideration of program expansion and initiation of a research endeavor, under the umbrella of the Year 2000 Plan. This will help sustain the progress accomplished to date and provide sound educational leadership throughout the duration of the MTS Program.

In summary, there is a momentum evident within the schools and a sense of mission that has promoted collaboration among those involved at disparate levels and disciplines. From intensive conversations with participants across levels and disciplines, there appears to be little question as to the need for continued "computerization" of teaching, learning, educational management, and administration. Indeed, there is widespread acknowledgement that the MTS Program represents the future and not only can educational processes "not go home again," as the sub-title of this document suggests, but that to do so is to turn away from progress and improvement. Students, parents, staff, the work-place, and communities at large will demand that graduates of our high schools be ever more sophisticated in their use of computers and other technologies.

Recommendations

- *Continue funding for the five schools currently participating in the MTS Program:* The five Model Technology Schools should continue with the project and receive special funding for an additional five-year period. There has been a great deal of progress in creative uses of technology at the Model Technology Schools and this progress should be continued.
- *Broaden the scope and diversity of the MTS Program:* The number and diversity of Model Technology Schools should be expanded. Significant effort should be devoted to ensuring that schools selected for project participation reflect the widest possible representation of schools based on a number of factors, including: size, funding base, geographic location, community setting, socioeconomic status of the student body, experience with the use of computers, academic performance measures, and extent of exceptional student education and other specialized programs. Based on the current composition of the Model Technology Schools, and the need to expand diversity, consideration should be given to adding the following types of schools:
  - At least one middle school. Children in this age group are very adept in the use of technology, and their curiosity and enthusiasm should be captured by participation in a Model Technology School.
  - At least one school in a predominantly rural area. Florida has many rural areas and it is imperative that the state make attempts to assure equity in opportunity for rural residents and their children. Technology has the promise to meet this challenge.
  - At least one school in a heavily urban area, where there is broad diversity in race and language. As reported by teachers, individual students who were in English for Speakers of Other Languages (ESOL) programs appeared to show positive improvement when instruction was offered through the use of technology. It is important to determine if this positive effect can be duplicated on a larger scale.

- At least one vocational training center, ideally a center that serves adult students as well as secondary students. Training and retraining of the workforce are essential to Florida's economic future.

- *Expand the project to incorporate a formal research phase:* The Department of Education should request a proposal to conduct research on the complex issues of the impact of technology on student learning.
  - Established Model Technology Schools are now ready for implementation of a formal research project.
  - This research phase of the Model Technology Schools project should be of sufficient length (3-5 years) and sophistication to yield hard data at the end of the project.
  - The research design should incorporate both qualitative and quantitative measures.
  - The RFP for the research phase should include a series of questions to be addressed in conducting evaluation/research.
  - The research design should incorporate methodologies to distinguish the approach applied to schools in-process, i.e., those with a five-year history in the project, from those being examined from the point of implementation.
  - The research design should examine the impact of technology use on student learning relative to other means of impacting learning outcomes and not solely relative to the absence of technology. For example, could comparable outcomes be achieved through similar investment in other initiatives, such as a significant reduction in the student/teacher ratio?

- *Develop assessment tools that reflect how technology is used in the curriculum:* Among the outcomes of the MTS Program, it was noted that technology improves classroom management tasks and communication among faculty. It was also observed that students in MTS Program were highly motivated when technology was incorporated in the curriculum. However, students tended to exhibit

parity in standardized test scores when compared to their peers at other district schools. There is reason to question the validity of paper-and-pencil standardized testing for students who have been trained in innovative problem solving experiences based on methodology that demands group interaction and implicit interaction with computing machinery and other forms of technology.

- *Expand parent and community involvement in the MTS Program:* Although there is effort in this direction and awareness of the need, more intense focus should be directed at disseminating information to parents and the community at large and to promoting and facilitating their increased involvement in the program.
- *Develop a training model for use by non-Model Technology Schools in incorporating technology into the curriculum:* The five Model Technology Schools have achieved an impressive record of project dissemination, one of the three program goals. Even so, five Coordinators are simply not sufficient to offer guidance in the use of technology in education to every teacher in the state of Florida. The DOE, MTS Program Coordinators, and other participants should develop a standardized training model for how other schools can best incorporate leading edge technology into the curriculum. Based on the large numbers of potential participants, a series of videotapes, curriculum guides, or similar media may be viewed as appropriate means of dissemination for this task.
- *Develop mechanisms to ensure flexibility in the application of project components:* A driving principle of continued project implementation should be that not all aspects of the MTS Program are universally applicable at other schools. Replication should not be conducted on a rote basis, but should incorporate latitude for accommodation to the unique needs and capacities of individual schools.
- *Ensure a primary focus on learning outcomes:* Immersion in technology use as an end in itself is not the intent of the program. The focus should not be on technology per se, but on technology as it affects student learning and teacher management efficiencies.

Previous evaluation by outside consultants, annual reports from the coordinators, judgments by teachers, students, and the evaluators' own observations support the conclusion that the Model Technology Schools have carried out their tasks in a manner that has permitted improvement in classroom management, disseminated information to their colleagues, and enhanced student motivation in the classroom.

Bibliography

Anderson, R.E. (Ed.). (1993). Computers in American schools 1992: An overview. A national report from the International Computers in Education Study. Minneapolis: University of Minnesota, Department of Sociology.

Blanchard, S. (1992). Model Technology Schools, Chamberlain Senior High School 1991-1992 evaluation. Tampa: Hillsborough County Public Schools.

Bork, A. (1981). Learning with computers. Bedford, MA: Digital Press.

Bozeman, W.C., Dziuban, C.D., & Hynes, M.C. (1992). Model Technology School evaluation report: Mainland High School. Orlando, FL: University of Central Florida.

Brewer, S. (Ed.). (1992). Technology in education: Florida's Model Technology Schools project report, 1992. Orlando, FL: University of Central Florida, College of Education, Instructional Technology Resource Center.

Coffee, R., Hutchins, C., & Eggen, P. (1992). Webster Elementary School: A Florida Model Technology School: Year three report. St. Augustine, FL: Webster Elementary School.

Florida Department of Education. (1991). Innovators & innovations. Tallahassee: Author.

Huth, T.J. (1992). School improvement plan 1993-1994. Daytona Beach, FL: Mainland High School.

Koppel, D. (1993). An Ivy League of their own: Getting your kid into the Big Eight. South Florida Magazine.

L.D. McArthur Elementary School. (1992). Model Technology School end of year report September 29, 1992. Pensacola, FL: Escambia County School District.

Mainland High School. (1993). School improvement plan: 1993-1994. Daytona Beach, FL: Author.

McArthur Elementary School newsletter. (1993, September). McArthur Eagle. 20(3).

Papert, S. (1993a). The children's machine. New York: BasicBooks.

Papert, S. (1993b). Mindstorms: Children, computers, and powerful ideas. New York: BasicBooks.

Roblyer, M.D. & Barron, A. (1993). Technology and changing teacher roles — a Florida perspective [Special issue]. Florida Technology in Education Quarterly. 5 (1&2).

Schilit, J., Morris, J.D., & Shutrump, G. (1990). An evaluation of the implementation of the Model Technology Program at John I. Leonard Community High School, Lake Worth, Florida. Boca Raton, FL: Florida Atlantic University, Institute for Research and Development in Teacher Education.

Snyder, T. and Palmer, J. (1986). In search of the most amazing thing: Children, education, and computers. Reading, MA: Addison-Wesley.

Stakenas, R.G., Tishken, D.P., Ota, C.C., & Resnick, M.M. (1991). A formative evaluation of Florida's Model Technology Schools. Tallahassee: Florida State University, Center for Policy Studies in Education.

U.S. Bureau of the Census. (1992). Statistical abstract of the United States: 1992. Washington, D.C.: Author.

Wolk R.A. (Ed.). (1994). Focus on technology [Special issue]. Education Week. 13 (16).