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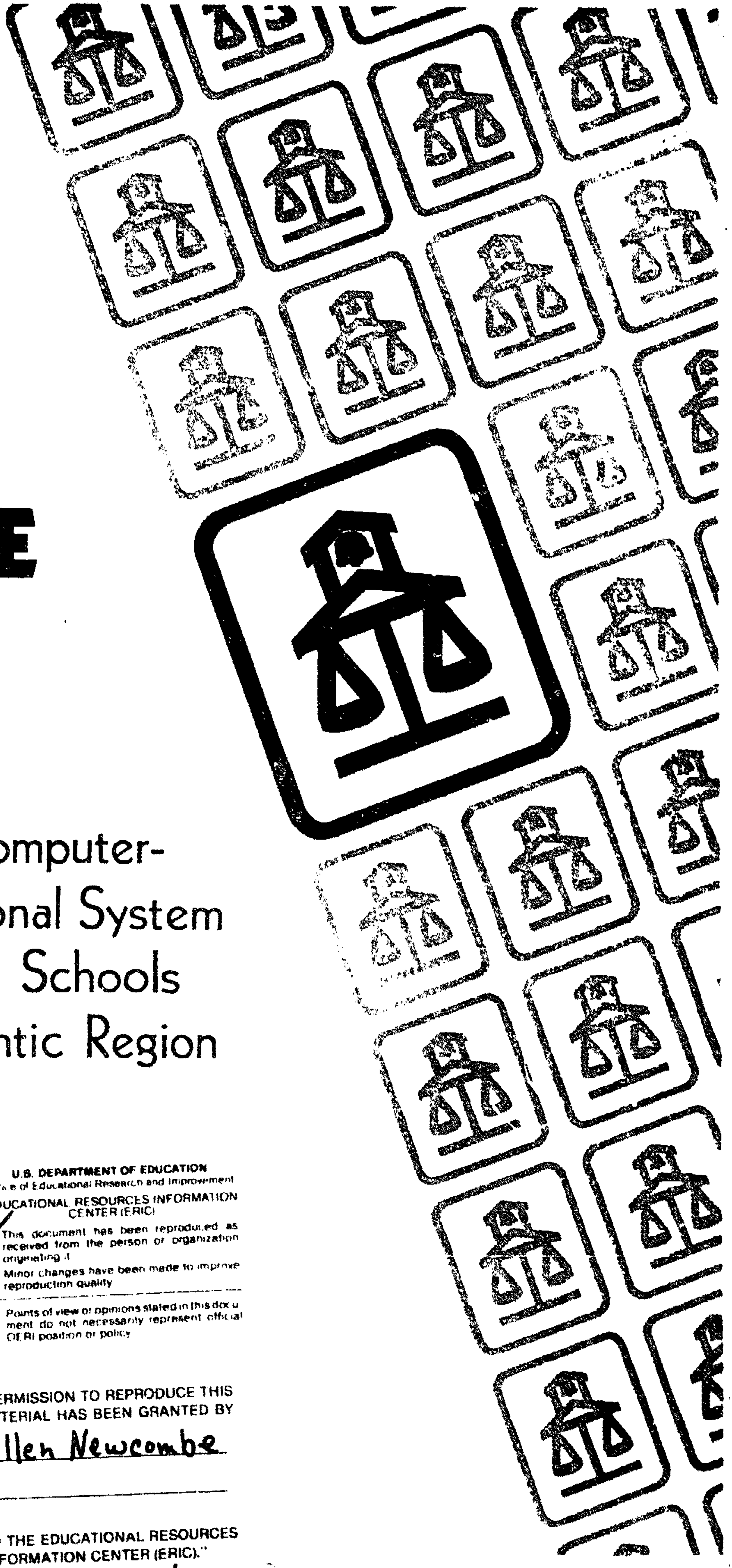
ABSTRACT

In 1987-88 three small, rural elementary schools were demonstration sites for implementation of a computer-managed instructional (CMI) program. The schools were located in Anne Arundel County, Maryland; Palmyra, New Jersey; and northern York County, Pennsylvania. Implementation costs were supported by the school districts, federal grant money, and a CMI-system vendor. Implementation process involved: (1) negotiations with the school districts; (2) facilities modification; (3) hiring of full-time laboratory managers; (4) development of guides to correlate district curriculum objectives with CMI learning activities; (5) hands-on training of laboratory managers and teachers; (6) laboratory use by all regular students 30 minutes daily, in remedial summer programs, and in adult literacy instruction; and (7) planning for school district funding of program continuation. Program evaluation showed: (1) modest student achievement gains; (2) overwhelmingly positive student attitudes; (3) teachers' initial use of the system as a supplement; (4) widespread interest in exploring the system's capacity to individualize instruction; and (5) readjustment of the schedule of the school day, teachers' instructional sequences, and student grouping patterns. Recommendations for districts considering a CMI system are included. Appendices contain objectives in the basic skills for grades 2-6 (reading, language arts, and mathematics); student attitude surveys and item analysis; staff interview protocols; and a school observation form. (SV)

RURAL SMALL SCHOOLS INITIATIVE



The Impact of a Computer-Managed Instructional System on Two Small Rural Schools in the Middle Atlantic Region

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Guidelines

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PREFACE

The goal of this report is to provide perspectives on the impact of a computer-managed instructional system as implemented in two small, rural schools. It is hoped that these perspectives can serve as guidelines for educators considering the potential feasibility of CMI for their schools. Contributors to this report were Joseph J. D'Amico, Joan Buttram, Russ Dusewicz, and David Helms.

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Introduction

Responding to a national concern over the quality of educational opportunities available to students attending America's small, rural schools, the 1987 United States Congress passed a continuing resolution providing special funds for America's nine regional educational laboratories. These funds were earmarked to address the special promise and challenge involved in improving the quality of educational services to children in rural, small schools. The conference committee report which was incorporated into this resolution stipulated that any programs undertaken in response to this challenge should attempt to focus on "promising practices and activities that had a direct effect on students." In addition, the House Appropriations Committee strongly urged that these projects feature "innovative uses of technology."

With these stipulations and urgings in mind, Research for Better Schools, Inc. (RBS), planned a demonstration of the potential that computer-managed instruction (CMI) has for meeting the needs of at-risk and other students in small, rural school settings. To show this potential and viability, RBS planned to help each of three small schools in the Mid-Atlantic region install a generously equipped computer learning laboratory and carry out a program of computer-managed instruction which would affect all students in the school every day. As the schools implemented this computer-managed instructional program, RBS planned to:

- examine the impact of daily computer-managed instruction on the achievement of students
- examine the impact of daily computer-managed instruction on instructional delivery
- examine the impact of daily computer-managed instruction on school organization and culture

- examine the economic, instructional, and organizational viability of computer-managed instruction for small, rural schools.

The following document, meant to accompany the administrative report of RBS' Rural Education Iniative (FY 87), details the results of these examinations. Its purpose is to help guide others who are considering the installation of a computer-managed instructional system by describing RBS' and the schools' experiences with such a system. It must be emphasized that this report is not a recipe. Strategies for successful implementation of education innovations -- particularly ones as complex as a CMI system -- are difficult to generalize. They depend too much on a variety of forces idiosyncratic to settings and situations. Thus, we describe our CMI implementation experiences and the impact of CMI on the schools, but we stop short of offering prescriptions. Rather, we outline some lessons we and the schools learned during these CMI implementations.

The report of these experiences is organized in five major sections:

- Initiating the Computer-Managed Instructional System
- Implementing the Computer-Managed Instructional System
- Impact of the Computer-Managed Instructional System
- Lessons of the Computer-Managed Instructional System Implementation
- Conclusion.

INITIATING THE COMPUTER-MANAGED INSTRUCTIONAL SYSTEM

The first section details the pre-planning and planning stages of CMI implementation. It includes descriptions of RBS' unique joint venture approach to CMI introduction as well as the terms of that joint venture. It oulines the criteria RBS used to select the CMI system and the demonstration schools. Finally, it explains the nature of the CMI system and courseware used by the demonstration schools and profiles these schools and their communities.

The Joint Venture Approach

The first step RBS took in launching its CMI demonstration project was to develop a joint venture approach which would maximize limited resources and build commitment to the project. The approach stipulated that first year implementation costs for the CMI project would be split among three partners: RBS (using money provided by the federal grant), each of the school districts where the CMI sites would be located, and a CMI vendor.

RBS staff reasoned that small, rural schools, operating on tight budgets, would most likely be unable to participate if they had to bear the full cost of a CMI system as comprehensive as RBS felt was needed to show impact. By a similar token, it was reasoned, a company producing and selling such a comprehensive -- and probably expensive -- system would most likely be unwilling to bear the full cost, either. RBS was both unable and unwilling: unable because its resources were limited; unwilling because there was a strong conviction among staff that a financial commitment from the schools and the computer vendor would strengthen the commitment of both to work hard for successful implementation.

RBS' next steps were to select a CMI vendor and system and to select three demonstration sites. These steps were carried out more or less simultaneously.

In reviewing CMI vendors and systems for the project, RBS staff considered the following.

- The system hardware needed to be designed specifically for school use; that is, it had to be reliable and able to take a lot of punishment.
- The system courseware needed to be comprehensive, covering basic skills for a wide range of students.
- The system needed a high degree of flexibility both in terms of memory and delivery capacity and in terms of the variety and scope of its courseware.
- The system needed a high degree of classroom flexibility. Teachers had to be able to arrange to have students work on differing items of courseware simultaneously without noticeable diminution in the speed, efficiency, or instructional integrity of the system.
- The system courseware needed to have the potential to to be sequenced, paced, and articulated according to local site curricular decisions and to fit local school objectives, textbook series, and scope and sequence charts as well as standardized state or national tests.
- The system had to have the capacity to serve a wide variety of school and non-school populations to enable sites to broaden use of the system effectively.
- High quality, responsive technical assistance, training, and support for teachers, administrators, and other associated staff had to be included with the system.
- The system needed to be easy to operate, not requiring a great deal of staff time and technical expertise to learn or operate.
- The continuing (i.e., after year one) maintenance and courseware costs for the system needed to be reasonable enough not to burden or exceed the capacity of the participating school districts.

RBS staff selected a WICAT 300XA as the CMI system to be installed in the demonstration sites because it met the above requirements. In addition, this system had been thoroughly tested both experimentally and in field situations, and test results showed gains in the achievement of students using these systems. Moreover, the system vendor, WICAT, Inc., had more than 20 years of experience in designing and installing computers and computer software products in schools throughout the world. There are approximately 1,000 WICAT installations across the United States. Also, WICAT has distribution and service facilities throughout the country. Two of these are in RBS' region.

Equally important, WICAT was willing to enter into a joint venture with RBS and the participating school districts. This joint venture was based on an agreement that stipulated the company would share the cost of three CMI systems complete with 32 student work stations, six courseware packages, two testware packages, and a management package. It further stipulated that the company would deliver and install the systems to three demonstration schools and provide on-site training and maintenance for one full year of operation. These products and services were to be provided at a discount of approximately 25 percent. Lastly, WICAT management guaranteed that it would move quickly enough to approve the terms of the joint venture, create the financing arrangements, settle contracts, tailor the courseware, deliver and install the machinery, and train staff within a time period consistent with the provisions of the federal grant.

The 300XA system itself consists of a five megabyte parity RAM mini computer with hard disk storage. This central processing unit (CPU) can support up to 64 student work stations -- although the initial installation included only 32 stations. Additional peripherals for each system consist of disk subsystems, a tape drive, a master control terminal, and a dot matrix printer. The courseware selected to be used with this system was primary (K-3) reading with audio, reading comprehension (4-8), language arts (2-6) with audio, writing (K-6) with audio, mathematics (K-8) with audio, and typing (K-6) with audio. In addition, two testware programs, the Reading Abilities Test (2-adult) and the Waterford Test of Basic Skills (2-8), were included.

Meanwhile, to help determine which might be the most appropriate sites for this CMI demonstration project, RBS staff developed the following criteria.

- District and school administrators must demonstrate a willingness to initiate and conduct a major change effort.

- The school and district must exhibit characteristics commonly applied to rural or small schools and referenced in the funding guidelines, e.g., small enrollments, remote location, resource scarcity, shrinking community tax base, small community population and geographic size, etc.

- District, school, and community representatives must support RBS' project objectives, activities, and processes and be willing to have their school serve as a demonstration site.

- District, school, and community representatives must demonstrate a capacity to contribute financial and other resources necessary to install, maintain, and expand a CMI system.

- District and school administrators must demonstrate an ability and willingness to move quickly to gain required approvals for the project so as to enable implementation to begin the first month or so of the 1987-88 school year.

- The school location must be sufficiently accessible to make it easy for others to visit the demonstration sites.

- There must be clear potential for participation by significant numbers of students at risk of educational failure.

- Staff must be computer knowledgeable to some degree and motivated to become part of a project emphasizing computer-managed instruction.

RBS brought these criteria to the chief state school officers of Maryland, New Jersey, and Pennsylvania and requested their assistance in identify g potential demonstration sites. Each did so and RBS staff entered into negotiations with the superintendents of three school districts: Anne Arundel County, Maryland; Palmyra, New Jersey; and, later, Northern York County, Pennsylvania. During these negotiations, RBS staff described the project, the agreement that had been reached with WICAT, and the criteria for site selection. They also described the school districts' financial responsibilities:

- the district would bear approximately 40 percent of the first year purchase, installation, and maintenance costs of the CMI system, but would own the system
- the district would bear the costs of all subsequent years' operation and expansion, including maintenance and courseware leasing
- the district would bear all incremental costs such as salary expenditures for additional staff, costs for facilities modifications, in-service remuneration for teachers, and the like.

Lastly, they outlined RBS' role in the joint venture. RBS would contribute approximately 35 percent of the cost of the first year of implementation. It also would provide technical assistance services to WICAT and the participating districts, particularly in the areas of organizational planning, community development, and curriculum alignment. Finally, it would provide process and impact evaluations of the CMI project for use by school and district staff.

The Communities and Schools

All three districts agreed to participate and named the following elementary schools to be demonstration sites: Sacred Heart Elementary, a public school in Palmyra, New Jersey; Eastport Elementary in Eastport, Maryland; and Wellsville Elementary in Wellsville, Pennsylvania.

Sacred Heart Elementary

Sacred Heart Elementary School is located in Palmyra, New Jersey, which is a small community in the southern part of the state approximately 15 miles from Philadelphia. Palmyra is basically a white, lower middle class community of about 7,000 people. Although it is not an economically depressed community, there are pockets of poverty in the town. Six percent of Palmyra's citizens are unemployed and nine percent of the families living in Palmyra are without working members. The average per capita income is less than $8,000 and seven percent of Palmyra's residents live below the poverty level. Recently, families of young professionals, many with children, have begun moving into Palmyra. Its proximity to Philadelphia has made it an attractive bedroom community.

Palmyra's school district budget is an austere one and most of the voters in the community are conservative enough to have prevented any major school tax increases for the past decade or so. The superintendent predicts that this will be the case for another decade. He describes school operations as "bare bones and getting barer."

There is a rather severe school facilities problem in Palmyra. The last school was built more than 40 years ago and all existing school buildings are inadequate to serve the growing student population. Despite this, the prospects for a program of building or even of significant renovation are slim as the community is reluctant to raise taxes or initiate bond actions. As a result, the district currently houses its second, third, and fourth graders in a vacated school rented from a local Catholic diocese. This school is Sacred Heart Elementary.

There are about 180 students enrolled in the three grades (two, three and four) at Sacred Heart. There are three classes of each grade and there is a transitional second grade for children who have fallen substantially behind their peers in the first grade. Forty Sacred Heart students are Chapter 1 students and 16 are in special education. Ethnically, the student body is fairly diverse: 21 percent are black and 79 percent are white. All students in the school take standardized tests (Iowa Test of Basic Skills) each year; although their aggregate scores are slightly above the national average, there are many students who score very poorly on these tests. And it is not only the Chapter 1 and special education children who do so.

There are 10 teachers at Sacred Heart School and they would have to be considered veterans. On average, all have been teaching for nearly 20 years with some having taught almost 30. Most have been teaching in Palmyra at the second through fourth grade level for more than 15 years. Sacred Heart's principal, on the other hand, is brand new; this was his first year. He was not really a stranger to the area, however, as he had spent a number of years as an administrator in a neighboring district.

Parenthetically, it should be noted that this principal is in charge of two school buildings: Sacred Heart which houses second, third, and fourth graders, and Delaware Avenue which houses kindergartners and first graders. He literally divides his time between the two buildings, commuting the eight or so blocks separating them at regularly scheduled times daily. He typically spends his mornings at Delaware Avenue, where he has his office, and afternoons at Sacred Heart.

Although assigned to specific grades or homerooms, the teachers at Sacred Heart break their students into specialized, cross-grade homogeneous reading and mathematics groupings. These groups are achievement-based and teachers keep reconstituting them as the year progresses and students move to new achievement levels. Homeroom groupings at each grade level of Sacred

Heart are heterogeneous and children receive instruction for other, non-basic skills subjects in these groupings. The majority of the special education students and those in the transitional second grade are taught in self-contained classrooms. However, school policy encourages efforts to mainstream these students.

The school's curriculum and the instructional plan calls for the same instruction at the same time for each grade level. This enables Sacred Heart's teachers at each grade level to regroup the students across classrooms: one teacher takes high reading and low math; another teacher takes low reading and high math; a third takes middle reading and math.

Although there are variations from teacher to teacher, most follow a common strategy of direct instruction: warm-up, exploration or demonstration, questioning, practice, and eventually some form of evaluation. Most evaluate students by observing them, scrutinizing work samples, having them recite, or giving tests and quizzes. The special education and compensatory education teachers work a bit differently with their students, stressing more individualized instruction and using games or contests to gauge progress.

When asked, all teachers at Sacred Heart reported that they used textbooks and supplemental materials associated with the textbooks -- either commercial or homemade -- as their major medium of instruction. They also reported that typically the district made sure they had plenty of these materials for their classes. They were happy with the district's staff development policy, too, and thought it was effective for their needs.

Most were unable to judge how involved the principal was or would be in their daily instructional programs because he was new. They seemed to be adopting a "wait and see" attitude. Most rated parents as being "very" involved in school activities, either as volunteers or through the local parents association, and they seemed to welcome this involvement.

Eastport Elementary

Eastport Elementary School in Eastport, Maryland, is across the Spa Creek from the state capital, Annapolis. It is approximately 60 miles from Washington, DC, and 30 miles from Baltimore. Annapolis and Eastport are rich in history. Both were founded in the seventeenth century and were considered strategically vital ports during the Civil War. Eastport, legend has it, was a stop on the underground railroad.

As is the case in Palmyra, neither Eastport nor its across-the-creek neighbor, Annapolis, could be considered economically depressed. Yet there is unemployment (five percent) and poverty (more than ten percent), and the average per capita income, at $8,700, is not extravagant.

Annapolis and Eastport have recently been discovered by young professionals working in the Washington, DC, and Baltimore areas. They see these small cities as within reasonable commuting distance to the large ones. As a result, there has been quite a bit of population growth in both Eastport and Annapolis over the last five years. This growth is a mixed blessing. On the one hand, it has meant an influx of revenue for these small communities, but it also has meant rising property values and rising property taxes. Old time residents of the communities, many of whom are seasonal laborers or retirees, are now having trouble keeping up.

Thus, both Eastport and Annapolis are really two communities: an affluent one of young professionals, recently arrived; and one considerably less affluent made up of senior citizens, welfare recipients, and seasonal workers who are, in some cases, living close to or below the poverty level. The children of both populations attend Eastport Elementary.

Eastport Elementary School is truly a neighborhood school, with nearly all of its students walking to and from it every day. It is housed in an old school building -- originally constructed in 1906 -- that has been added to over the years to help it accommodate ever-increasing student enrollments. Currently, this K-6 school, where there are two-first grade classes and one each of the other grades, has 216 students. This is a 21 percent increase from three years ago. When it is not being used by the elementary school children, the school offers several programs for others in the community. There is an external diploma program which serves 65 adults, an adult basic education program (23 adults), a before-and-after school latchkey program (58 children), and a special Chapter 1 program (22 parochial school students).

Reflecting the community, Eastport Elementary has a 36 percent minority enrollment. Chapter 1 s rvices are provided for 27 percent of the students and about ten percent participate in special education programs. Third and fifth grade students take standardized tests each year at Eastport (California Achievement Test). Generally speaking, the results indicate the students at grade level when compared to national scores, but many Eastport students are well below grade level on a variety of sub-tests. The principal says that five or so excellent students in each class test very well and so bring up the aggregate scores.

At Eastport, the kindergarten, first, second, and third grades are self-contained and children receive virtually all of their instruction from the homeroom teacher. Students in grades four through six receive their reading/language arts instruction from their homeroom teachers. They are departmentalized, however, for instruction in mathematics, science, and social studies. That is, the fourth grade teacher teaches science to all students in grades four through six, the fifth grade teacher teaches them mathematics, and the sixth grade teacher teaches them social studies. A Chapter 1 basic skills compensatory education teacher comes to Eastport every day, working in classes as well as providing some pull-out instruction. The school's special education teacher has all pull-out classes which are mostly multi-grade.

Eastport's 11 teachers have been teaching at the school an average of only three years despite having been in teaching an average of about 11 years. Two were brand new and just one had more than five years' experience at the school. The principal had 20 years in education, six of which were in administration. He had been principal at Eastport four years.

The teachers at Eastport said they were expected to follow a curriculum standardized for the entire school district, Anne Arundel County. They also said they usually followed a number of district guidelines for organizing and delivering instruction to their students. Most employed a similar instructional strategy in their classrooms, no matter what grade or what subject: warm-up, direct instruction, guided practice, independent practice, and evaluation. They monitored student progress by looking at work samples, listening to recitations, observing class activities, and giving tests and quizzes. The special education teacher followed her students' individualized learning plans (IEPs) and measured their progress according to those plans.

All but the kindergarten teacher used basal texts and supplements with their students. The kindergarten teacher made many student materials but also used commercial audiovisuals and manipulatives. All of the teachers at Eastport felt they had sufficient materials and guidance from the principal. All reported that he was very involved in their daily instructional program and in monitoring their classroom performance. They all thought their formal in-service training was adequate to keep them abreast and current in their field. They also felt there was a great deal of supportive parent involvement in the school.

Wellsville Elementary

Wellsville Elementary School is in Wellsville, a very small, rural town in Warrington Township, Pennsylvania. It is situated in the south central portion of the state about 20 miles from both Gettysburg and Harrisburg, the state capital. It is also about 60 miles from Baltimore.

The Wellsville Elementary School, however, serves all of Warrington Township -- an area of about 40 square miles and nearly 4,000 people. Warrington Township is primarily farm and orchard land. The residents are farmers whose economic status rises and falls with the nation's farm economy. Currently, there is no extreme economic hardship among Warrington's farmers, but there is an unemployment rate of nearly five percent and more than eight percent of Warrington's families have no working members. The average per capita income in the township is about $7,000 and over four percent of the population live below the poverty level. In dramatizing the area's economic situation, the assistant superintendent said the only thing ever stolen from Wellsville Elementary School has been food.

Financially speaking, the school district (Northern York County School District, which covers Franklin, Carroll, and Monaghan Townships as well as Warrington) is in good shape. Years of austere spending have had a positive effect and there is currently a budget surplus. However, the superintendent is anticipating the day when this surplus will be absorbed by the major asbestos removal program he has been postponing.

Students at Wellsville Elementary ride school buses, for the most part. The current enrollment is 275 students, K-5. There are 10 teachers teaching two sections at each grade level with one part-time Chapter 1 teacher serving 30 students (this teacher delivers Chapter 1 services in all district elementary schools). Most have been teaching for 10 years and their average tenure at Wellsville is about nine years.

The students in grades two through five at Wellsville take nationally normed standardized tests each year (Metropolitan Achievement Tests). In addition, students in grades three and five take the state-mandated achievement tests (Tests of Essential Learning and Literacy Skills -- TELLS). By and large their scores in both of these sets of tests appear to be on a par with national and state norms; however, there are sub-areas where Wellsville students are significantly below average.

All students at Wellsville, with the exception of the fifth graders, are in self-contained classrooms where they receive all of their academic instruction. The fifth graders are compartmentalized for English and science; one teacher teaches all students for each of these subjects. There is a traveling district cultural arts teacher who provides the Wellsville students with their art and music instruction once a week; physical education also is taught by a traveling teacher.

Wellsville has just adopted a modified version of the Joplin Plan whereby some students are grouped homogeneously in their grades according to their ability and achievement in reading and mathematics. This grouping pattern occurs in grades three, four, and five where there are four reading and two math groups per grade level. For most subjects, the teachers use commercially produced textbooks and materials. Their instructional strategy is based on the one provided by the textbooks: introduction, guided practice with questions, review of content or skills, independent practice with teacher assistance, and assessment (tests, quizzes, classwork, etc.).

For non-basic skills subjects, the students are hetereogeneously grouped by grade. First and second graders are grouped for all subjects by grade. In these heterogeneous grade groups, the instruction is largely whole-group with some individualization.

Chapter 1 services are provided to Wellsville by a district resource teacher. She pulls the children out of their regular classes for targeted assistance in reading on a daily basis. Her instructional approach stresses worksheets, but she also uses a personal computer (PC) with students for some drill and practice lessons.

There is a standard Northern York County district curriculum that Wellsville's teachers are expected to follow. This curriculum includes suggested topic-by-topic time allocations and a pacing schedule for each subject area and grade. The teachers at Wellsville, however, seem to feel free to set their own pace for the students.

Wellsville's principal is in his second year at the school and quite a few teachers are uncertain of the role he plays or would like to play in the life of the school. Almost all see him as an administrator first, but they all point out that he is a good one and seem ready to support them. There is less unanimity regarding parental support. About half the teachers see it as there and active, and about half see it as there but more passive (as home reinforcement, for example). As for their opinion of their district's staff development program, most give it high marks for organization and low marks for relevance.

IMPLEMENTING THE COMPUTER-MANAGED INSTRUCTIONAL SYSTEM

The following section contains a step by step description of the first year of CMI implementation at the three demonstration sites, Sacred Heart Elementary, Eastport Elementary, and Wellsville Elementary. Since each school began the CMI project at different times and progressed through implementation at different paces, it is divided according to phases that correspond to the major activities occurring at each site: adoption, introduction, initial implementation, and continuation planning. It begins just before RBS first initiated negotiations with the school districts in the spring of 1987 and ends with the commencement of the 1988-89 school year.

Adoption

As noted earlier, RBS began its CMI project with the establishment of a joint venture among a CMI vendor, three school districts, and itself (using federal funds). Although three superintendents (from Palmyra, Anne Arundel County, and Northern York County) agreed to participate and named elementary schools to be potential demonstration sites, they still needed to gain support from the staff at these schools and to obtain approval for their participation from their boards of education.

In Palmyra, there proved to be some difficulty. Some teachers in the school, Sacred Heart Elementary, were uncertain about the need for a CMI system and somewhat hesitant to become part of a project that they saw as being potentially more work for them. They agreed to participate, however, due, in part, to reassurances from their principal and Chapter 1 coordinator that CMI would produce positive results for their students. The board of education in Palmyra also had reservations about participation. They were concerned that the installation and continuation costs for which the district was responsible would be a burden on their already tight budget and, therefore, might result in new taxes.

To allay school board concerns, the superintendent put together a financing proposal that combined existing sources of revenue with what he saw as the moneymaking potential of the CMI system. Funds for year one, he proposed, would come from a combination of the district's Chapter 1 and Chapter 2 allocations and the general budget Funds for subsequent years would come from the same sources plus about $18,000 in fees for CMI services to out-of-district and non-public school students and from adult learners. This proposal convinced the majority to affirm participation, but the vote was not unanimous.

In Anne Arundel County, adoption approval was less of a problem. Teachers, administrators, and school board members saw participation as an opportunity and -- after some discussion -- all agreed to become partners in the joint venture. Perhaps helping the decision process go smoothly here was the fact that Anne Arundel is a more affluent school district than Palmyra. Administration here was able to fund the project's first year using existing revenues. Subsequent years' funding was added to their ongoing operating budget with little trouble. In fact, the financing issue never seemed to come up in their deliberations. In Anne Arundel County, the issue was which school would benefit most by participation, not the cost of participation. As noted earlier, the school selected was Eastport Elementary.

There were no serious concerns about year one funding in Northern York, either. They were prepared to use a combination of existing budget dollars, state grants, and carry-over money from previous surpluses. Likewise, they were not concerned about continuation because they were willing to incorporate CMI costs in their subsequent yearly budgets. Nor were they concerned about a likely school site. They already had earmarked Wellsville Elementary for a curriculum improvement project, and had alerted the staff, the board of education, and community that some kind of new project was imminent. Thus, they felt they would have no trouble gaining approval and commitment. Their main concern was timing.

Timing was an issue because this school district was the second Pennsylvania district asked to participate. Originally, RBS and representatives from the Pennsylvania Department of Education had identified Eastern York County School District as the site of the Pennsylvania CMI demonstration. Unfortunately, after seemingly successful preliminary discussions, the district superintendent had informed RBS that Eastern York was forced to withdraw from consideration. This was disappointing because the deliberations had extended to within a month of the start of school. Upon hearing the district would not be able to participate, RBS staff realized they would not be able to select and complete negotiations with another district in time to start the Pennsylvania demonstration within the 1987-88 school year.

RBS staff opened negotiations with Northern York County School District, but these negotiations took the better part of three months and were not complete until late in the first half of the school year. As noted, Northern York did agree to participate, but, with good reason, they did not want to start such an ambitious undertaking in the middle of a school year. Therefore, project implementation was planned for the 1988-89 school year. However, it was agreed that Northern York would initiate a special CMI program as part of their summer school in 1988, and that the CMI system would be ready for use in this program.

The three demonstration sites -- Sacred Heart Elementary School in Palmyra, New Jersey; Eastport Elementary School in Anne Arundel County, Maryland; and, Wellsville Elementary School in Northern York County, Pennsylvania -- now were ready to be introduced to the CMI system.

Introduction

As soon as the joint venture agreements were solidified and the contracts signed, the superintendents and principals at each of the three demonstration sites had their facility manager begin modifying classroom space to create the CMI laboratories. They installed heavy duty electrical wiring, a dedicated telephone line, air conditioning units to maintain temperature control, a series of power surge protectors and kill switches, and furnished the rooms with tables suitable as student CMI work stations. Where necessary, they added or removed walls. At Sacred Heart, these modifications were carried out in a portion of the instructional media center. At Eastport and Wellsville, classrooms were converted for use as CMI laboratories. As soon as these modifications were completed, the CMI systems were installed at each site.

As the facilities modifications were proceeding, district administrators began interviewing prospective laboratory managers. All partners in the joint venture agreed that for the CMI project to meet its goals, and for the CMI system to function with a minimum of breakdowns, it would be essential to have on site a full-time staff member whose sole responsibility was management of the CMI system and laboratory. In fact, WICAT specifications required such an individual with the following responsibilities:

- prepare the CMI system for operation
- maintain system security
- make daily, weekly, and monthly copies of files
- manage necessary system files and utilities
- perform recovery procedures to retrieve data in the event of a malfunction
- perform the shutdown procedure to safely turn off the system
- provide technical assistance to students and teachers in the use of the computer system
- execute all curriculum management tasks, as prescribed by teachers
- conduct orientations for teachers and students
- provide assistance to teachers in interpreting the data collected for each student record and identifying specific instructional problems
- maintain a computer log.

At the end of the interview process, each site hired its own laboratory manager. All were hired as paraprofessionals. None of the three was a certified teacher, but all had school experience. Two of them had experience with computer education and one was enrolled in a teacher preparation program and was expecting her certification within the year.

In addition, back-up managers were named in each site. These back-ups were individuals already employed in the district. They were responsible for operating and maintaining the laboratory when the regular laboratory manager was out. For Sacred Heart, the superintendent served as back-up; at Eastport, the back-up was a central office staff person; and, at Wellsville, the district elementary Chapter 1 teacher assumed the back-up role.

Concomitant with these activities, WICAT curriculum development staff created curriculum correlation guides for the demonstration sites. These guides contained lists of the county or local mathematics, reading, and language arts objectives. Matched to these were parallel lists of the CMI learning activities and activities from the textbooks being used at the sites. Teachers were to use these correlation guides to integrate CMI lessons with their classroom activities and with their yearly scope and sequence charts. Administrators were to use them to align the CMI activities with state, district, and local requirements.

With the rooms prepared, the machinery installed, and the curriculum correlations completed, the demonstration sites were ready for staff training. The first staff to be trained were the laboratory managers.

While it had been the intention of RBS, WICAT, and the districts to train all three laboratory managers at one [illegible] in late summer (1987), in fact, three laboratory manager training sessions were conducted. The first was held, as intended, at the end of August (1987) at Sacred Heart. Laboratory managers and back-ups from Eastport and Sacred Heart attended this session. Another training session had to be conducted in late December (1987) for a new laboratory manager and additional back-ups at Sacred Heart. The person originally hired for the school became ill and was forced to resign around Thanksgiving. Finally, because their CMI implementation was late in starting, Wellsville's laboratory manager and her back-up were trained in June (1988).

All of the training sessions for the CMI laboratory managers lasted four days and were conducted by WICAT training personnel. Each session was hands-on and featured a different trainer, but basically the following training agenda was used.

Day One

I. Orientation to the project and to the laboratory manager's role and responsibilities

II. Introduction to the system 300 hardware and its basic use

III. Use of supermanager CMI curriculum management system

IV. Use of typing curriculum

Day Two

I. Review of laboratory manager responsibilities

II. Use of the CMI system registration manager

III. Use of the primary reading curriculum

Day Three

I. Review of system 300 hardware and supermanager management system

II. Use of the reading comprehension curriculum

III. Use of the CMI operating system

Day Four

I. Use of the K-8 math curriculum

II. "A DAY IN THE LIFE OF A LAB MANAGER . . ."

III. Review

There were a number of additional laboratory manager training sessions spread throughout the year, as well. At these sessions, run by WICAT staff, the laboratory managers were acquainted with new curriculum packages (especially as they related to placement and prescription idiosyncrasies) and were introduced to system updates and modifications as these became available.

The next step in the introduction phase was teacher training. It was anticipated that the teachers would be comfortable with the CMI system once they had undergone this training because they would be: informed about the CMI curriculum and its relationship to their own instructional program and strategies; able to keep track of and assess their students' CMI progress; and capable of writing student CMI prescriptions. To help teachers accomplish these goals thoroughly and at a reasonable pace, the decision was made to introduce the CMI curriculum packages one at a time during the course of the first semester. As a result, teacher training also occurred in phases and often occurred while students were already working on-line. For example, while students did CMI mathematics, their teachers might be learning how to use the CMI reading program; while they did mathematics and reading lessons, their teachers might be learning the language arts package, and so on. Thus, both students and teachers were learning the system together, so to speak.

The first teacher training activity was an orientation to the CMI system and the courseware in general. At Eastport and Sacred Heart, the teachers were introduced to the system by way of the typing curriculum, which was the first one introduced to students. They were shown student activities and advised as to how they might approach typing instruction both in the laboratory and the classroom. This half-day session included all teachers as well as the principal, laboratory manager, and some central office personnel (there to observe more than anything). It was run by WICAT staff and included the following topics:

- overview of the demonstration project
- overview of the CMI system and all courseware
- structured demonstration of the typing curriculum with hands-on practice
- unstructured, hands-on experimentation with typing and samples of other curriculum packages.

At Wellsville, this orientation session was somewhat different because they were starting with a summer program of remedial reading instruction.

Here the orientation was only for those teachers staffing the summer school. Also, the reading curriculum rather than typing was the focal point of this orientation. The training objectives, for the most part the same as they were for the Eastport and Sacred Heart orientations, stressed proficiency with the reading curriculum.

The next training session at Eastport and Sacred Heart dealt with administration and interpretation of the WICAT Test of Basic Skills, and the pre-posttest instrument used to measure student achievement. The teachers were shown on-line samples of test items and given a chance to go through parts of the test. They were provided guidance in scheduling the test. They also were shown how to interpret test results to place students properly in the CMI curriculum. At Wellsville, this training was incorporated into the training session for the curriculum area being introduced first to the students -- reading. At Eastport and Sacred Heart, the session included special instructions for administering the test in a paper-and-pencil format. (Students from these schools -- and two comparison schools -- were not taking the test on-line. In accordance with RBS' impact evaluation design, off-line testing of all students was required to keep the testing situations for students using CMI as similar as possible to the testing situation for those not using CMI.)

Each subsequent training session (i.e., for each of the basic skills curriculum areas) consisted of one full day of training and one full day of follow-up held about two weeks afterwards. These training sessions involved all teachers and were conducted by WICAT staff. Different staff from WICAT led these various training sessions, but the agenda was similar in each case. The full day training sessions consisted of:

- introduction of the curriculum content and the scope and sequence of the learning activities
- on-line sampling of the curriculum activities
- description of student management options and discussion of placement reports and procedures
- prel minary placement of students based on WTBS or other assessment instrument results.

The follow-up sessions were much less formal. WICAT training staff came to the schools, visited with the teachers individually, answered their questions, and gave them advice. Typically, these follow-up days occurred about two weeks after the formal training sessions. All teacher training was spread out during the course of the year.

Students began using the CMI system almost as soon as their school year started. Although rostered differently at each school, the students all were to take CMI for a total of 150 minutes per week. This time allotment was recommended by WICAT as being optimum for significant learning gains. Research also seemed to suggest 150 minutes per week of CMI as an optimum time allotment. At each site, students began the year typing for about 30 minutes a day, five days a week. This was their introduction to the system and a way to get them used to the CMI keyboard. Once the teachers were satisfied the students were sufficiently familiar with the keyboard, they administered a pretest, the WICAT Test of Basic Skills (WTBS). In Wellsville, the test was taken on-line; at Sacred Heart and Eastport, it was paper-and-pencil. As their teachers were trained in each of the curriculum content areas, the students inserted activities from these areas within their 150 minute per week time block. In each content area they were placed at a level of difficulty according to their scores on the WTBS pretest.

Implementation

As noted, initial student CMI use began at different times in the different schools. Full use -- that is, all students taking all CMI subject areas -- likewise began at different times in each school. Eastport and Sacred Heart students began using the CMI system within a month of the opening of school in the fall of 1987. All students in these schools were engaged in all CMI subject areas by February 1988, spending 150 minutes per week in the CMI laboratory at each school. The way those minutes were divided, however, differed from school to school and class to class.

Sacred Heart students were scheduled into the CMI laboratory for 30 minutes each day, five days a week. Second and third grades went to the laboratory during their morning reading periods. Once there, the teachers allocated 15 minutes to reading or language arts and 15 minutes to math. The fourth grade went to the CMI laboratory in the afternoon during reading and homeroom periods. These teachers used the full 30 minutes for either reading, language arts, or math. They did not break up laboratory time, but alternated subjects weekly. One week they gave three CMI periods to reading and two to math; the next week they reversed the pattern.

At Eastport, the students also attended the CMI laboratory for 30 minutes a day, five days a week. Here, however, all teachers typically used an alternating subject approach, i.e., they allocated three days to reading/language arts and two days to math one week, and then reversed the pattern the following week. Special education students attended the laboratory with their regular classes and in their special education sections. Thus, these students received more laboratory time than their peers.

Due to the late start at Wellsville, student use began in June 1988 with a summer school program for Chapter 1 remedial students. These students had only CMI in the reading portion of their program. The CMI program was introduced to all other Wellsville students at the start of the 1988 school year. Reading and typing were introduced in October 1988. Mathematics was introduced in January 1989, and language arts in February 1989. The Wellsville first through fifth graders worked in the laboratory for 30 minutes each day, five days per week, attending during part of their reading period. As mathematics was introduced, the students attended during a portion of their math period, as well.

In addition to their use as part of the three demonstration schools' regular instruction programs, the CMI system and curriculum packages were used in ways that went beyond the regular school programs.

At Eastport, the system was used for three programs of remedial instruction. One was a summer work-study program called Summer Team '88. This program was funded by the Anne Arundel County Private Industry Council (PIC) and was offered to high school students who had failed the Maryland state mathematics graduation test. The students learned job skills and studied mathematics, on-line, during the morning. They went to work sites in the afternoon and were paid minimum hourly wages for both their classroom and work site participation.

Another remedial program at Eastport involved Chapter 1 students from a nearby Catholic elementary school. These children came to Eastport once a week during the school year for a 40 minute session of on-line reading instruction. These sessions were part of their Chapter 1 individual learning plans as prescribed by the county Chapter 1 liaison to the parochial schools.

The third remedial use of the CMI system at Eastport was literacy training. Several adult learners regularly came to the laboratory and worked through on-line literacy lessons. These adults were not part of any particular program; they had been informed of the CMI system by the county adult basic education coordinator and had asked Eastport's principal if they could use it. He agreed and they set-up a schedule of daily two-hour morning sessions during the summer.

At Sacred Heart, CMI activities also were incorporated into summer school programs. Chapter 1 summer school students from Palmyra and other surrounding districts combined 30 minutes of on-line lessons with 30 minutes of teacher-directed tutorials in mathematics or reading. These remedial programs had been in operation for years in the district, but this was the first year that a CMI component had been added. The district Chapter 1 teacher was responsible for the content of the programs. She and the laboratory manager developed the schedules.

In addition, Sacred Heart hosted a portion of the district's Job Training Partnership Act (JTPA) summer school. JTPA students used the laboratory daily for one hour of CMI lessons in reading and mathematics. These lessons supplemented their classroom activities and work experiences. There were also a number of high school students who took a special on-line summer course to help them prepare for the New Jersey state graduation test. Programs for the JTPA and graduation test-preparation students were designed by the laboratory manager working in coordination with these students' regular teachers.

In addition to these programs, the Sacred Heart CMI laboratory was used by adult learners throughout the year and in the summer. Some of these adults were there for literacy training; they came for one hour each day, four days per week during the summer. Others came to study typing or other personal enrichment subjects. Working with either the laboratory manager or adult basic education staff, these individuals set their own programs and schedules. Usually they spent about two to three hours a week on-line.

Finally, during the school year, a group of third graders from a nearby school district -- Riverton -- took CMI mathematics, reading, and language arts. Twice a week, Thursday and Friday, they walked to Sacred Heart with their teacher and used the laboratory for the last 30 minutes of their school day. Their teacher worked with Sacred Heart teachers and the laboratory manager to identify appropriate lessons for them.

At Wellsville, as outlined earlier, they began implementation with a summer program for Chapter 1 students in need of remediation. The program was developed and run by the district Chapter 1 teacher working with the laboratory manager. The program itself had always been offered at the school; this was the first year it included CMI, though.

Continuation Planning

The terms of the joint venture that made it possible for the demonstration districts to purchase their CMI systems at a fraction of the regular cost stipulated that all subsequent financial responsibility for these systems would revert to the districts and schools at the conclusion of the year. With this in mind, RBS staff worked with decisionmakers in each of the demonstration site communities during the course of the first year to help them formulate plans for continuation of their CMI programs. This planning resulted in the sites adopting two approaches to insure funds for CMI continuation: marketing CMI services, and incorporating CMI into district budgets.

The superintendent in Palmyra, where Sacred Heart is located, was the most aggressive in developing marketing possibilities for the CMI system. Faced with an austere school budget, he knew that he would have to sell CMI to others in order to secure funds for continuation. His first offer went to surrounding districts. To these, he offered and sold Chapter 1 summer and after-school programs, programs for the academically advanced, and testing and screening services. In his own district, he convinced a number of local businesses to sponsor students in either remedial or accelerated programs featuring CMI coursework. He added CMI to many of his adult education programs and to some in vocational education, as well. All of these experiments in marketing were successful, but they still did not generate the $20,000 or so that was needed for the second year. Therefore, as he had done for the first year, the superintendent earmarked a certain amount of his district's state Chapter 1 allocation for the CMI laboratory.

In Anne Arundel County (Eastport), there was no pressure to create novel ways of funding subsequent years of CMI operation. The costs associated were merely added to the district's budget. Central office administrators felt confident these costs would not be challenged, particularly when the expected benefits of CMI became apparent. Moreover, they projected that the costs of CMI would be pro forma, within the next couple of years, perhaps even a regular line in the district budget. Thus, they felt they would not need to pursue marketing options aggressively.

The Eastport principal, however, felt that it was symbolically important for his school community to contribute something. He asked his parents' organization to raise $1,250 towards the CMI laboratory. They did so with little trouble for years one and two. Beyond this, he successfull· sold CMI services to the PIC for the Summer Team '88 program described above. He did not need the $3,500 the PIC paid to use the CMI laboratory, so he used it to carpet classrooms.

The situation was similar in Northern York County (Wellsville). District administrators there incorporated year two CMI operations into their school district budget. Likewise, they believed there would be no problem keeping these costs as part of the budget in future years. They, too, predicted that CMI operations would become a part of standard operating costs in the district budget, and saw no need to develop novel sources of funds.

IMPACT OF THE COMPUTER-MANAGED INSTRUCTIONAL SYSTEM

The following section describes RBS' evaluation of the effect that CMI had on two of the demonstration site schools -- Sacred Heart and Eastport -- and the students and staff in them during their first year of implementation (1987-88). Wellsville, having begun implementation September 1988, has not been a CMI demonstration site long enough to be included.

There were three components to this evaluation: an impact study focusing on the achievement of students using the CMI system; an attitude survey to gauge student attitudes toward their CMI experience; and a process study focusing on implementation of the CMI system. The impact study proceeded from the hypothesis that computer-managed instruction -- because of its unique potential to offer highly engaging, sustained, and individualized instruction and reinforcement -- would contribute positively to student learning and achievement in reading, language arts, and mathematics in the demonstration schools. Or, put another way, the CMI intervention would enable the students in these schools to do better in their basic skills learning than comparable students who were not articipating in CMI. The attitude survey was intended to ascertain whether computer-managed instruction had a positive affective impact on participating students. It also was expected that this survey would reveal whether there were any racial, ethnic, or gender differences in students' attitudes toward CMI.

The major hypothesis guiding the study of the implementation process was that the CMI systems would have a significant influence on a number of key instructional, organizational, and cultural features at the schools since they represented a significant innovation to the staff and structure of these small schools. A secondary hypothesis was that local school organization, prevalent instructional approach, and culture would play a reciprocal role and influence the nature of the CMI implementation.

Impact on Students' Achievement

All of the partners in the CMI joint venture demonstration project were keenly interested in finding out what effect CMI participation would have on student achievement. The schools and districts were anxious to learn whether achievement outcomes justified the expense of continued CMI operation. They also wanted to know if these outcomes might justify CMI expansion to other populations and subject areas. Management at WICAT, the CMI vendor, wanted to know to what degree they could claim that increased achievement was related to students' use of WICAT hardware and software. At RBS, staff wanted to test whether CMI was a viable way to boost achievement among at-risk rural and small school students. Thus, as part of the demonstration project, RBS included an assessment of CMI students' achievement. This achievement was measured by changes in student performance on the criterion-referenced WICAT Test of Basic Skills (WTBS) among students participating in CMI versus students not participating. What follows is a description of that assessment with specific information on student samples, administration of the WTBS, and statistical analyses of student WTBS results.

The student sample from Sacred Heart consisted of all children from the school's four second grades, three third grades, and three fourth grades. These classrooms typically ranged in size from 17 - 23 students, but there were some classrooms with smaller numbers. Although special education students were mainstreamed into these classrooms, they are not included in any of the analyses reported below. Starting year enrollments, by grade, appear in Table 1.

Table 1
Starting Year Enrollments
at CMI and Comparison Schools

Grade	Sacred Heart Elementary School	Comparison Elementary School	Eastport Elementary School	Comparison Elementary School
K (a.m.)	-	-	20	NA
K (p.m.)	-	-	22	NA
1	-	-	23	NA
2	79	89	32	24
3	74	82	27	22
4	51	71	20	26
5	-	-	25	19
6	-	-	17	21

Standardized achievement tests are given to Sacred Heart students in the spring of each year. The Iowa Tests of Basic Skills (ITBS) are used for this purpose. Standardized achievement test scores on the ITBS for the spring of 1987, the year prior to start of the CMI program, indicated achievement levels well above the national average. Total battery scores above the 60th percentile were achieved by grades one, two, and three (i.e., grades two, three, and four during the program year).

The Eastport student sample included all children from the school's second, third, fourth, fifth, and sixth grades (one section each) which ranged in size from 17 - 23 students. As was the case with Sacred Heart, even though special education students were mainstreamed into all classes, none appear in any of the analyses. Table 1 presents starting year enrollments.

The California Achievement Test (CAT) is given to Eastport's third and fifth graders only as a standardized means for assessing student achievement. Standardized achievement scores for the preceding years indicated that those grades scored near the national average but were extremely bi-polar.

Three schools not participating in the CMI programs were identified to serve as schools where the performance of students would provide a standard, or basis, for comparing the performance of students who were participating at the demonstration sites. The comparison schools were selected because their students had similarities to the demonstration school students insofar as their demographic characteristics and overall achievement scores were concerned, according to district administrators.

Two comparison schools were picked for Sacred Heart. These schools were located in a neighboring district where students in different grades attended different school buildings. Therefore, second and third grade students were in one building and fourth graders were in another. Four second grade classrooms, four third grade classrooms, and three fourth grade classrooms were selected for comparison purposes. Class sizes varied, but generally ranged from 20 - 24 students. Special education students mainstreamed into these classrooms were not used in any of the analyses.

The Comprehensive Test of Basic Skills (CTBS) is used by the district to assess student achievement in the two comparison schools. For the prior school year, standardized achievement test results on this measure indicated mean percentile rankings for grades two and three to be well above the national average.

The Eastport comparison school was another elementary school in Anne Arundel County. This school had the same grade configuration as Eastport -- K-6, one section at each grade level. As was the case with all other schools included in the study, their mainstreamed special education students were not included in the analysis.

The California Achievement Test is used as the standardized measure for assessing student achievement in this school. Standardized achievement test scores for students in grades three and five, for the prior school year, indicated grade equivalents somewhat above grade level.

In order to assess student achievement, the WICAT Test of Basic Skills (WTBS) was administered to students in the second grade and above in all of the schools. WTBS subtests are not available for kindergarten or first grade. The WTBS consists of criterion-referenced reading and mathematics subtests for each grade level. Each subtest addresses between 18 - 36 objectives in reading or mathematics, depending on the grade level, and generally there are four items per objective on the subtest. Reading or mathematics subtest objectives for each grade level were selected by the test publisher to provide maximum coverage of nationally accepted curriculum objectives. It should be noted that there is not a complete overlap between the WICAT curriculum and test objectives, some test objectives are not addressed in the WICAT curriculum. Table 2 summarizes the number of objectives and items contained in the WTBS reading and mathematics subtests.

Table 2

Number of Objectives and Items
in WTBS Reading and Mathematics Subtests

	Reading		Mathematics	
Grade	Sacred Heart and Comparison	Eastport and Comparison	Sacred Heart and Comparison	Eastport and Comparison
2	17/ 68	18/ 72	19/76	19/ 76
3	22-20/ 84	22/ 88	18/72	18/ 72
4	25/100	25/100	24/96	24/ 96
5	-	25/100	-	34/132
6	-	28/112	-	36/144

The WTBS is usually administered to students on-line. However, in order to control for administration effects, that is to help insure the testing situations were as similar as possible for CMI and non-CMI students, the test was given in paper-and-pencil form to students at all schools. The type size of the written test for lower grade levels was enlarged to facilitate student reading; this enlarged type version was given to students at Sacred Heart and its comparison schools at both pretesting and posttesting and at posttesting in Eastport and its comparison school. In addition, students in the second grades were allowed to mark their answers in the test booklets; their answers were later transferred to optical scanning sheets. Students in grades 3 - 6 marked their answers directly onto optical scanning sheets.

Since the test is criterion-referenced, stringent time limits were not imposed on students during the WTBS testing. Students were allowed to work at their own speed and the subtests were spaced over several days. Teachers were available to answer questions concerning test direction. When most students had finished answering the items, the test booklets and answer sheets were collected and returned to RBS and WICAT for scoring.

There are no norms for the WTBS. For prescriptive purposes, teachers were provided with information on students' mastery of subtest objectives in the late fall (based on pretest results). In terms of analyses to assess the impact of the CMI program, the number of items answered correctly on the pretest and posttest was used. The same form of the test was administered as a pretest and posttest.

Student scores (i.e., number of items answered correctly) on the WTBS reading and mathematics subtests on the pretest and posttest were matched and analyzed using an analysis of covariance procedure. Students who did not complete both the pretest and posttest for either subtest were excluded from the analyses of covariance for that particular subtest. Approximately 14 percent of the student sample was excluded from the reading analyses and 16 percent from the mathematics analyses because of missing subtest scores. Another six percent had enrolled in the schools after the opening of the school year and so were excluded from all of the analyses. Table 3 summarizes these statistics.

The pretest means for the students included in the analyses of covariance were compared to the pretest means for the students excluded from these analyses, because of missing posttests, to determine if there were any systematic differences between the two groups. With three exceptions there were fewer than five points separating the reading or mathematics group means for any of the grade level by school comparisons (the third grade mathematics scores at Sacred Heart Elementary, 8.73 pts.; the fourth grade reading scores at the Sacred Heart Elementary comparison school, 14.83 pts.; and the fourth grade mathematics scores at the Eastport Elementary comparison school, 7.36 pts.). These findings, in conjunction with pretesting observations, support the absence of any systematic differences among the sample of students included in the analyses.

Separate analyses of covariance were conducted for each grade and subject area (i.e., reading and mathematics) for each CMI school and comparison school. Due to differences in the implementation of the CMI programs at the two schools, student scores were not aggregated across schools. As a result, a total of 16 separate analyses of covariance were

Table 3

Student Samples Included and Excluded from Achievement Analyses

	Reading			Mathematics		
School	Included	Missing Test	Late Enrollee	Included	Missing Test	Late Enrollee
SH	182	24	7	183	23	7
C	210	37	22	189	58*	
E	108	16	7	108	16	7
C	92	24	12	93	23	12

*One of the four third grade classrooms in the comparison school was unable to complete the WTBS mathematics subtest due to scheduling difficulties at the end of the school year.

conducted. In these analyses, the posttest reading or mathematics scores were adjusted for initial differences, as measured by their matched pretest scores, and the adjusted posttest scores for the CMI program and comparison school students were then statistically compared. It was hypothesized ($p<.05$) that once initial pretest differences were controlled, students in CMI program classrooms would achieve higher reading and mathematics scores than students in non-CMI program classrooms.

Tables 4 and 5 summarize the results of these analyses at the two sets of schools, respectively. The analyses provide moderate support for the effectiveness of the CMI program in increasing student achievement at Sacred Heart Elementary School. CMI program students in the second grade showed significantly greater gains in reading and mathematics than non-CMI program students. In addition, fourth grade CMI program students achieved higher gains in mathematics than did non-CMI program students. However, this gain was not duplicated in reading. The performance of third graders in CMI versus non-CMI programs did not differ markedly.

At the second set of schools, Eastport and its comparison school, the second grade CMI program students outscored non-CMI program students in mathematics and third grade CMI program students achieved greater scores than non-CMI program students in reading. None of the other eight comparisons produced significant results.

Table 4

Analysis of Student Achievement Scores in Sacred Heart Elementary CMI Program Versus Comparison Non-CMI Program

Grade/			Pretest		Posttest		Adj.		
Subject	School	Number	Mean	SD	Mean	SD	Mean	F	P
2 Rdg	SH	67	40.40	10.39	55.96	7.27	56.27	13.588	.00
	C	77	41.62	10.40	52.96	8.05	52.68		
2 Math	SH	71	47.79	9.68	64.61	6.05	62.99	10.10	.00
	C	76	41.26	10.54	58.24	8.83	59.74		
3 Rdg	SH	67	60.09	14.20	67.12	11.72	64.54	0.37	.55
	C	72	50.96	15.99	63.17	13.28	65.56		
3 Math	SH	64	49.58	10.55	60.50	7.97	58.93	0.76	.39
	C	51	41.18	9.65	55.43	11.33	57.40		
4 Rdg	SH	48	68.67	14.40	76.98	11.19	74.83	3.43	.07
	C	61	62.13	15.90	69.10	16.16	70.79		
4 Math	SH	48	50.67	12.42	70.58	9.52	68.56	36.33	.00
	C	62	45.35	10.48	55.23	14.35	56.79		

Table 5

Analysis of Student Achievement Scores
in Eastport Elementary CMI Program
Versus Comparison Non-CMI Program

Grade/ Subject	School	Number	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Adj. Mean	F	P
2 Rdg	E	31	32.97	12.02	56.16	8.92	56.80	0.24	.63
	C	21	36.19	14.13	56.71	10.92	55.76		
2 Math	E	31	36.68	12.50	61.48	8.73	61.39	13.97	.00
	C	21	36.29	13.02	54.05	12.44	54.19		
3 Rdg	E	24	45.92	15.23	66.46	15.20	62.60	4.97	.04
	C	17	35.06	11.70	48.59	18.07	54.04		
3 Math	E	23	36.04	8.91	52.74	8.79	49.41	0.83	.37
	C	17	24.94	10.04	41.59	14.82	46.09		
4 Rdg	E	20	51.60	17.40	59.55	18.33	56.28	0.81	.37
	C	19	42.74	19.47	56.42	18.50	59.88		
4 Math	E	19	31.37	7.50	47.05	10.76	47.46	0.00	.99
	C	20	32.30	10.18	47.80	15.03	47.42		
5 Rdg	E	17	58.76	19.17	67.24	18.93	64.23	0.04	.85
	C	17	52.41	17.48	60.47	21.82	63.47		
5 Math	E	20	35.15	14.86	61.85	21.02	61.33	1.07	.31
	C	16	33.56	12.13	52.44	30.16	53.09		
6 Rdg	E	16	50.00	18.25	59.00	19.54	63.34	0.06	.82
	C	18	59.72	23.71	66.17	23.59	62.30		
6 Math	E	15	42.60	14.03	62.33	22.07	66.39	0.04	.84
	C	19	49.00	30.02	70.84	38.71	67.64		

In summary, the first year results from these sets of schools (Sacred Heart Elementary School and Eastport Elementary School and their respective comparison schools) provide only modest support for the effectiveness of the CMI program in improving student achievement in reading and mathematics during its first year of implementation. Of the 16 possible statistical comparisons, five clearly favored the CMI program students. These findings are not altogether surprising since this was the first year of implementation of the CMI program the full CMI program was not in effect for the full year, and one school suffered a significant interruption in program participation in the late fall. In addition, the similarity of the instructional programs at the CMI and comparison schools was not examined, so there is no way to determine how appropriate these schools were as comparisons.

Nevertheless, the first year results do provide some support for the potential of CMI to improve student reading and mathematics achievement. The promise of CMI is shown most clearly in the first set of schools, in which three of the six comparisons showed statistically significant gains favoring the CMI program students, and a fourth comparison, although not statistically significant, showed stronger performance for the CMI than the non-CMI program students. Only one of the comparisons resulted in the non-CMI program classrooms outperforming the CMI program classrooms. In the second set of schools, two of the comparisons clearly favored the CMI program and another two showed differences in favor of the CMI program; only one comparison resulted in greater gains for the non-CMI program classroom. Student performance will continue to be monitored another school year or two to determine whether these trends continue as teachers and students become more familiar with the system.

As a final note, the above student impact findings may reflect primarily the dangers of assessing student achievement outcomes after the first year of implementation of a new and fairly complex instructional program such as the CMI program. In order to measure the true potential of CMI programs, initial implementation issues must be addressed and resolved. It may be that consistent student achievement gains are not likely to occur during the initial year of implementation of CMI programs. However, once hardware and software problems are resolved, teachers become experienced with the software, and students develop the necessary typing and other skills, consistent and significant gains in student reading and mathematics performance may be possible. Perhaps then the impact of CMI in the classroom can be validly assessed.

Impact on Students' Attitudes

Students participating in computer-managed instruction at the two demonstration sites were surveyed as to their attitudes toward their experience in using computers as part of their instruction during the 1987-88 school year. The students at Eastport and at Sacred Heart were administered survey forms at the close of the school year in June. Students in grades K-2 were administered one form containing eleven items with a "yes-no" response format. Students in grades 3-6 were administered a 20 item form with items having a "yes," "sometimes," and "no" response format. Survey data were coded and then analyzed separately by grade level (form) and school site. Descriptive statistics for individual items, including frequencies, are included.

A total of 397 students responded to the attitude survey questionnaires. Of those, 195 were from the Eastport site and 202 were from Sacred Heart. At Eastport, responding students at the K-2 level were fairly evenly distributed across the grades, with first grade having the most (39%) and second grade having the least (28%). More boys (56%) than girls (44%) were represented. Ethnically, the K-2 students were 68% White, 28% Black, and 4% Asian, Hispanic, or Other.

In grades three to six, the responding students were also evenly distributed across the grades, with a range of 22-26%. About the same number of boys (51%) as girls (49%) responded. Ethnic composition was 54% White and 46% Black.

At Sacred Heart, responding students at the K-2 level were all at the second grade level. Boys represented 51% and girls 49%, with ethnic composition at 80% White, 15% Black, and 4% Asian, Hispanic, or Other.

At the grade three to four level, 53% of the respondents were at grade three and 45% at grade 4. Boys represented 48% of the respondents and girls 52%. Ethnically, students were 69% White, 23% Black, 2% Asian, 1% Hispanic, and 5% Other.

Attitude findings for students across both sites and all grade levels were quite similar and appear in Table 6. They indicated that the computers were fun to work with, made learning fun, and were relatively easy to use. When asked whether they had worked on a computer in school before this year, the responses were mixed. At Sacred Heart, only half of the K-2 students reported they had worked on a computer in school before, while less than half in grades three to six had. At Eastport, less than half of the students in grades K-2 had, while a majority (75%) of those in grades three to six had worked with a computer in school before. The majority of students in all grades at both sites reported that they did not have a computer at home.

Other analyses by sex and ethnic groups yield similar findings with only a few exceptions due to small numbers in some groupings. These are presented in Tables 7 and 8. For example, at Sacred Heart, slightly more girls than boys like school, but slightly more boys than girls have used a computer in school before this year. In Eastport, some ethnic, inter-group differences were found but these are probably attributable to small group sizes.

In summary, the findings indicate clearly that the attitude of the students at all grade levels was highly positive toward their experience with computers during their participation in the CMI project. There seem to have been no significant variations of these positive attitudes related to either the sex or ethnicity of the students (with the exception of one student in Eastport in the "Other" category who did not find the computer "easy to use").

Table 6

CMI Student Attitude Results
(Percent Combined "Yes" and "Sometimes" Responses)

	Eastport		Palmyra	
Item	K-2	3-6	K-2	3-6
Do you like school?	89	90	78	91
Is the computer easy to use?	94	98	86	100
Is working on the computer fun?	96	100	96	98
Do computers make it fun to learn?	96	99	96	98
Do you learn a lot on the computer?	93	98	93	98
Have you worked on a computer in school before this year?	41	75	50	43
Do you have a computer at home?	40	48	45	38

Table 7

CMI Student Attitude Results by Sex
(Percent Combined "Yes" and "Sometimes" Responses)

Item	Eastport		Palmyra	
	(N=104) Boys	(N=90) Girls	(N=99) Boys	(N=103) Girls
Do you like school?	89	90	82	93*
Is the computer easy to use?	96	94	93	97
Is working on the computer fun?	98	98	97	97
Do computers make it fun to learn?	96	99	96	99
Do you learn a lot on the computer?	93	97	97	95
Have you worked on a computer in school before this year?	54	58	57	34
Do you have a computer at home?	46	40	41	40

*Indicates statistically significant difference between genders.

Table 8

CMI Student Attitude Results by Ethnic Group (Percent Combined "Yes" and "Sometimes" Responses)

Item	Eastport					Palmyra				
	(N=2) A	(N=70) B	(N=1) H	(N=119) W	(N=1) O	(N=5) A	(N=41) B	(N=2) H	(N=147) W	(N=7) O
Do you like school?	50	90	100	90	100	100	83	100	88	86
Is the computer easy to use?	100	96	100	96	0	80	100	100	94	100
Is working on the computer fun?	100	100	100	97	100	100	93	100	98	100
Do computers make it fun to learn?	100	99	100	97	100	100	98	100	98	86
Do you learn a lot on the computer?	0	94	100	97	100	100	98	100	95	100
Have you worked on a computer in school before this year?	100	77	0	44	0	40	37	50	48	57
Do you have a computer at home?	50	38	100	47	0	40	29	50	44	29

A = Asian
B = Black
H = Hispanic
W = White
O = Other

Impact on School Instruction, Organization, and Culture

In addition to their interest in CMI effects on student achievement, the joint venture partners had questions concerning the effects that CMI implementation would have on the schools and the way they operated instructionally and administratively. There also were questions of how local school context, organization, and culture would influence the process of CMI implementation. To help answer these questions and gauge the degree to which effective implementation of the CMI systems occurred, RBS conducted a process study in which CMI implementation was followed at the demonstration schools throughout the school year. There were two components to this process study: interviews and observations.

Interviews were the most central component of the process study and served as the primary source of information regarding CMI implementation. Three sets of interviews were conducted at each demonstration site. The first occurred shortly after the CMI system had been installed; the next about mid-year; and the last at the end of the school year. They were conducted by site interviewers using interview protocols. There were different protocols for each category of adult participant: teacher, laboratory manager, and building administrator. Each focused on different aspects of CMI implementation.

Teachers whose students were taking CMI lessons were interviewed to find out how they were using CMI and integrating it with their approach to education and their regular classroom instruction. They also were asked in these interviews to share their perceptions of:

- the CMI system's effectiveness
- how CMI was affecting them and their school

- the adequacy of the CMI training they had received
- their view of the benefits of CMI for their students.

In addition, each school's principal was interviewed to ascertain how (and how well) the CMI system was fitting into both the organizational aspects of the school, such as rostering and scheduling, and the instructional aspects, such as program articulation and student placement decisions. The principal's opinions regarding effectiveness, benefits, and training were solicited in these interviews, as well.

Lastly, the CMI laboratory managers at the three sites were interviewed to gain their perceptions about system effectiveness, instructional integration, training, and benefits for students. In addition, the laboratory managers were asked questions relating to technical efficiency and thoroughness of vendor support. The major objective of the interviews was to map staff perceptions of the first year of CMI implementation and to capture what staff saw as the instructional and organizational modifications which CMI had precipitated over the course of that year. A secondary objective was to gather qualitative, implementation process information that might contribute to a better understanding of the quantitative, student outcome information. Sample interview forms are appended.

Besides interviewing school staff, the site interviewers conducted semi-structured observations periodically throughout the year. Information gained as a result of observations at the demonstration site schools was used mainly as a way of triangulating interview data and verifying its accuracy. Although observations focused on activities in the CMI laboratory, some chronicled classroom lessons, too. Observers did not use formal observation forms, but rather took notes and gathered information in the following pre-determined categories:

- student attention to learning activities
- teacher involvement in learning activities
- pace of learning activities
- teacher role in learning activities
- degree of individualized attention.

Initial Interviews, Teachers and Laboratory Managers

Generally speaking, the responses to the first set of interviews, designed to set the stage and to find out about each school's context, showed many similarities between the staffs at the schools. For instance, the staff at both schools were fairly well experienced with computers. At Eastport, all but two teachers had been using Commodore 64 personal computers (PCs) in their classrooms. The two who had not were brand new to the school. At Sacred Heart, all of the teachers had used Apple personal computers which they shared. Some were in the library and others were on carts that rolled through the school. Nearly all of the teachers in both schools had had some exposure to computers out of school, as well. The principals and laboratory managers at both schools, likewise, were computer literate. They, too, were familiar with PCs as instructional tools and, to some degree, had used them at school and home.

In both schools, the teachers had been using the PCs mainly as drill and practice support mechanisms for their reading and mathematics programs. Most of the teachers at the two schools clearly considered computers best suited for drill and practice use, but about half at Eastport and half at Sacred Heart said they saw a potential for computers to introduce material or teach developmental lessons. At both schools, the teachers were excited about the prospect of implementing a CMI project. Some even indicated they were looking forward to the attention it would bring to the school. All saw it as the only innovation they would be involved with that year. Moreover, the teachers at the two schools all felt the project was a high profile district and school priority. Yet, no Eastport teacher and only one Sacred Heart teacher said they had any input regarding adoption of the project. And few at either school said they saw it as a high priority for themselves or their students.

Mid-Year Interviews, Teachers and Laboratory Managers

At mid-year, the staff at the two schools were interviewed a second time. These second interviews focused on perceptions and opinions about the early stages of implementation, questions about staff roles, use of the CMI system, and the degree of CMI integration with regular instructional and organizational operations at the schools. Some differences began to appear at this point.

It should be noted that implementation was stopped at Sacred Heart for approximately two months while a new laboratory manager was hired and trained. Despite this hiatus, most teachers there reported that they were familiar enough with the CMI system to use it to generate learning prescriptions for the laboratory and, according to them, some classroom activities. In contrast, the teachers at Eastport said they still felt somewhat uncomfortable with the CMI system. Few reported having investigated it on their own and many said they watched their students in order to learn the system.

In spite of this, the Eastport teachers were nearly unanimous in saying that they believed there was a good fit between the CMI curriculum and the school curriculum (with the exception of the topics of time, money, and measurement, which were not included in the CMI curriculum). Furthermore, most indicated they were coordinating laboratory and classroom activities efficiently and with little trouble, although observations were not able to verify this claim. At Sacred Heart, the teachers were less satisfied with the fit between the CMI and school curriculums. Most pointed out the same gaps in the math curriculum that the Eastport teachers noted (i.e., time, money, and measurement). However, a few went on to point out gaps in content at the specific lesson level (as opposed to the general unit level) and also in some skill areas (particularly ones related to problem-solving).

By mid-year, at both schools, the teachers had developed good working relationships with the laboratory managers and, in their minds, had established clearly defined roles and responsibilities for the CMI portion of their students' instruction. At both Eastport and Sacred Heart, the teachers reported they were the ones mainly responsible for instruction in and out of the laboratory. Among the specific CMI-related instructional tasks they listed for themselves were: making placement determinations and planning student activities; monitoring students; coaching them; and helping them when they had learning problems in the laboratory. At both schools, they saw the laboratory manager as mainly responsible for the technical aspects of the children's CMI work and as a helper in teachers' instructional decisionmaking.

The Eastport laboratory manager did not see it this way. Almost from the start she had seen herself as much more intimately involved in instructional decisionmaking and, to a large degree, observations and interviews with the principal indicated this was true. As the year went on, she became even more involved. Weekly planning meetings between the laboratory manager and teachers were an example. These meetings, which the principal said he usually attended, had been instituted at the laboratory manager's suggestion about two months into the project. At these meetings, the laboratory manager and teacher would review print-outs of student progress generated by the CMI system. From these reviews would come prescriptions for the next week's student CMI activities. Some teachers prepared for these meetings by scrutinizing the reports beforehand, but quite a few did not. They let the laboratory manager take the lead in interpreting the weekly reports and making the weekly prescriptions. By mid-year, the district Chapter 1 teacher also was participating in many of these weekly meetings. In their year's end interviews, many, but not all, Eastport teachers saw these meetings as a very important part of their CMI involvement. The principal thought they were important, too, and indeed they were important for at these meetings the students' instructional priorities were set for the upcoming week. In addition to her instructional involvement in these planning meetings, the Eastport laboratory manager was observed continually helping students in the laboratory with their concept and skill development as well as their technical problems.

The situation at Sacred Heart was somewhat different at mid-year. When first interviewed, the laboratory manager described her role as the teachers did, as a technician, and said she was very careful not to engage in what she considered to be instructional tasks while in the laboratory. Yet, the teachers here were not totally independent in analyzing the student progress reports and making student prescriptions. She helped many of them interpret these reports and make their prescription decisions. In addition, she often worked with the Chapter 1 teacher to adjust their prescriptions. So, although her instructional role was not as obvious as was the Eastport laboratory manager's, it was equally central at Sacred Heart. Despite this, even at year's end, she was careful to describe herself as only an aide.

At mid-year, the opinions of the teachers at the two schools were similar about the value of the project and the work involved in carrying it out. They were beginning to show more enthusiasm for the system's potential for instructional impact. Both sets of teachers saw the CMI system's capacity to provide individualization as a big asset. They especially liked the way it made drill and practice activities interesting for their students and less drudgery for them. Likewise in both schools, a number of the teachers were beginning to see and report that CMI was having positive effects on their students' work habits and interest levels. Although none was ready to attribute achievement gains to the CMI system at this point, they found the high levels of student individualization, interest, motivation, and engagement at mid-year exciting, and in both schools most teachers were anxious to explore the system's potential to individualize drill and practice.

Despite this enthusiasm, both sets of teachers said their participation in the CMI project was taking more time and causing more work than they had been led to believe. They mentioned as a mixed blessing the increased amount of planning time required by the system. It helped them attend to individual needs more efficiently, but it took away time they might spend on other things. At Eastport, they reported they were losing great chunks of time they spent preparing in other subject areas. At Sacred Heart, they saw the extra time as coming from their classroom instructional time. But no matter where they saw it coming from, almost all of the teachers at both schools saw the project as stealing time from some portion of their regular instructional duties. Virtually no teacher yet saw use of the system as an integral part of those duties.

Observations and informal interviews revealed other interesting developments at the two schools at mid-year. For one thing, the district Chapter 1 resource specialists began spending a great deal of time at the two schools monitoring and coordinating CMI activities for their Chapter 1 students. They also had increased their familiarity with the CMI system beyond any other teacher by mid-year. Partly because of this, they expanded their role at the two schools from dealing solely with Chapter 1 students to working closely with the laboratory manager, and to some degree the principal, monitoring and coordinating CMI activities for all students.

At Eastport, as noted, the Chapter 1 teacher joined many of the weekly planning meetings. Between these meetings, she conferred frequently with the laboratory manager and with other teachers about prescription options and placement decisions. Eastport's principal often said it was like having an additional full-time staff member.

At Sacred Heart, the Chapter 1 teacher teamed mainly with the laboratory manager to review teachers' prescription and placement choices though she frequently met with them, one-to-one, to discuss these decisions. She also overrode their decisions, from time to time, if she thought they were not appropriate, again working with the laboratory manager to create alternatives. Sacred Heart's principal said he appreciated her time and efforts, but he also wondered whether it might be more effective for her and the laboratory manager to train the teachers to make better choices.

Observations and informal interviews also showed that both schools had become focal points of publicity in their respective districts by mid-year. A number of special events, revolving around showcasing the CMI systems, had been held at each school. In addition, large numbers of visitors, including local and national legislators, came to see the CMI laboratory, to talk to the staff, and to watch the students using it. Television stations and newspapers ran stories about the systems. Each system also became a focal point among parents and community members. It was not unusual to see them visiting the laboratory to watch or experiment with CMI activities. Likewise, the CMI systems were becoming the basis of a kind of new mythology at the schools. Almost every teacher interviewed had a CMI story to tell: the way certain students were excelling, the way staff had overcome technical adversities, the way principals or laboratory managers had become local celebrities -- all became part of the schools' repetoire of anecdotes.

End-of-Year Interviews, Teachers and Laboratory Managers

At year's end, the staff at the two schools were asked to sum up their experiences with the CMI system. They were asked questions about training, about their implementation experiences, and about their views regarding the impact of the CMI program in their school.

When asked about the strengths and weaknesses of the training they had received over the course of the year, the teachers' responses were quite diverse. Overall, they saw quite a few pluses to their training experiences and it seems they liked what was done, particularly the hands-on aspect. They seemed to feel that more was needed, however. For example, at Eastport they said they would have liked training to include more detailed information about their CMI responsibilities and more practice dispensing those responsibilities. A couple of teachers indicated that the formal sessions seemed to have been too long for the expected outcomes.

In contrast, the Sacred Heart teachers believed there had been too little time devoted to training, in general, and training focused on solving student problems, in particular. Many expressed disappointment that more in-service time was not allotted for them to explore the system and the CMI curriculum on their own during the year.

When asked what changes they might make in their training, the teachers at both sites suggested ones that reflected the need for more targeted, individualized instruction for themselves. Perhaps because of weaknesses that they saw in their training, or perhaps because they had not devoted very much of their own time to learning about the system, the teachers at both sites gave themselves poor marks for their knowledge of the courseware. Most teachers indicated that their knowledge revolved only around what their students were doing. Further, the majority at Sacred Heart said they gained their knowledge mainly by watching what their students did in the laboratory and from the process of prescribing their CMI lessons. Almost all of the teachers at both schools indicated that they needed more training, coaching, and hands-on time to become as fluent in the CMI system as they desired.

The laboratory managers had reverse opinions about their training. At Eastport, the laboratory manager expressed satisfaction with the training but felt that it had not really prepared her for many of her responsibilities. She indicated that she had learned a lot of things on her own, and said she would have liked to have had more hands-on, practical training activities.

According to the Sacred Heart laboratory manager, the training was just right to prepare her for her work and responsibilities. She said she especially like the practical nature of the activities. She felt it was comprehensive, and that it provided her with all of the information she needed to set up the system for the students and teachers. In her final interview, she rated it "very good," the highest rating.

Despite the uncertainty they said they felt regarding their knowledge of the CMI courseware even at year's end, the teachers at both schools believed that, by and large, they had integrated CMI well with their classrocm instruction. At Eastport, the laboratory manager shared this view. She gave the teachers the highest rating in this regard and went on to note that their CMI experiences had encouraged them to use diagnosis and prescription in their teaching across the board. In contrast to their opinions of themselves, she applauded the teachers for their growing facility with both the machines and the curriculum programs. She did point out in all of her interviews, however, that she played a vital role as a coach in their development. As an illustration, she estimated that planning with teachers (8 hours per week) was her second most time-consuming responsibility after organizing and supervising the CMI classes (10 hours per week).

The Sacred Heart laboratory manager, on the other hand, gave the staff mixed reviews with regard to their knowledge and use of the CMI system. She indicated that some were extremely familiar with the courseware and some were trying hard to get familiar. In her opinion, a couple were not terribly excited about the project as a whole and thus not interested in learning the system. She did note, though, that all of the teachers saw the system's utility and potential and believed they would begin learning to use it more efficiently. Her hope was that in the coming year she would no longer have to convince reluctant teachers; but could begin helping them actually maximize the system's capabilities. She also indicated she was looking forward to moving from a situation where she had to talk teachers into using the system to one where she would be helping them use it better.

When asked about implementation, the teachers and laboratory managers revealed some interesting information as they looked back on their CMI experiences. For example, many teachers at Eastport indicated that they set limits on the CMI instruction to prevent their students from getting too far ahead in the laboratory, so that they could introduce content themselves rather than let the CMI system do it. Still, there were a few instances where students did get ahead. In these instances, the teachers acknowledged that the CMI system had done a fine job of introducing concepts or skills. One teacher even suggested that he planned to alter his CMI strategy to allow the system to handle more concept and skill introduction.

Ten Sacred Heart teachers concluded that during the year at least some children had learned something -- typically something in mathematics or language arts -- from their CMI lessons before it was taught in the classroom by a teacher. Some said this happened even though they had been trying to prevent it. Nine of these teachers reported that the CMI system had done an okay-to-good job, but three said they felt it necessary to follow-up in the classroom.

In a very few cases, teachers reported having made some pacing adjustments because of their students' CMI work. For example, Eastport's Chapter 1 teacher allowed students to progress more rapidly than was customary when she saw they were covering their material faster than expected. As a result, they seem to have finished the planned work for the year about three months ahead of where the school's Chapter 1 students typically finished. A few teachers at both sites reported they were allowing students to progress more rapidly than their peers if they seemed able.

Data from observations and interviews at the end of the year showed that most of the teachers in both schools still viewed drill as the CMI system's most productive use. These data also showed that some grouping adjustments had been made at the two schools during the year. At Eastport, for example, special education students were receiving extra CMI time. They went to the lab for two-30 minute sessions each day, once in their special education classes and again with the classes into which they were mainstreamed.

At Sacred Heart, rosters had been adjusted to allow teachers to take their own mathematics students to the CMI laboratory. Originally Sacred Heart students were grouped and regrouped according to reading and mathematics achievement and went to the laboratory in reading groups with reading teachers. This arrangement was changed over the course of the year to enable teachers to make more accurate mathematics prescriptions.

As for the impact that the first year of CMI participation had on students, the two staffs were mixed in their opinions. At Eastport, they were extremely positive. With only one or two exceptions, people who wanted to reserve their judgment until they saw test results, teachers were confident that the CMI system had promoted increased coverage of material and higher student achievement. They were particularly impressed with the volume of lessons that CMI could provide their students efficiently, and said this, as well as the individualization that CMI could offer students, helped promote the increase in achievement and coverage. The laboratory manager concurred and praised the system's capacity for allowing the children to work independently and experience success at their own speed and level. She credited this aspect with improving student participation and attitude. She pointed to the immediate, positive feedback received by students when on-line as contributing, as well.

When describing the effect of the CMI program on their teaching, there was strong consensus among the Eastport teachers that their first year experience had made them better teachers. Again, they noted the value of the student progress reports and the weekly planning meetings in helping them target their efforts to student needs. A few also suggested that their informal interactions had begun including CMI-related discussions: about problems, prescriptions, ways to adjust content or pacing, and so forth. This, they indicated, was helpful to their efforts, too. Not one of them wa negative toward the experience and all said their classroom teaching was richer for it. They went on to note that student participation in learning activities increased as a result of the CMI experience. Most said the increase was evident in the CMI laboratory, but many indicated that participation also had increased in their classroom and even in other subject areas as a result of CMI in mathematics and reading/language arts. This was particularly true for those Eastport teachers who said they made a special effort to link classroom and laboratory activities. In addition, the teachers here rated the CMI system high in promoting positive student attitudes. In their analysis of this phenomenon, they mentioned the positive reinforcement that even the slowest students received from the CMI system as being a major contributing factor.

Perhaps because they had not seen either their CMI posttest results or their standardized test results when the final interviews were conducted, the Sacred Heart teachers were more cautious. They were still uncertain, in these year end interviews, whether there had been a positive impact on their students' achievement. They also were not sure whether their students' CMI participation had promoted classroom participation very much. Yet, individual Sacred Heart teachers were able to relate stories of high achievement or increased participation brought on by the children's CMI experiences. All were certain that the CMI activities had improved their students' attitudes regardless of whether they were high or low achievers. Most pointed to individualization, quick, positive reinforcement, and the novelty of working with computers as the key elements influencing whatever increases in achievement, participation, or attitude they witnessed.

The laboratory manager at Sacred Heart believed the system and the way it had been used had promoted student achievement, primarily because it gave students additional drill and practice time that they had not had before. She said the students there reacted positively to the CMI lessons, being attentive and interested in most and even excited about some. She was less certain as to whether their use of the CMI system had given students better attitudes toward school. She indicated that some had attitude problems that the CMI system simply could not improve.

When Sacred Heart teachers were interviewed at year's end, they were asked whether their participation in the CMI project over the year had had any positive impact on their teaching. Most said "yes" and pointed to three areas where they felt the impact was the greatest. First, they indicated that the system had forced them to increase the amount of time and attention they paid to planning, preparation, and instructional management both formally and informally. And they felt the increases were making them do these tasks better. Second, they believed they had integrated classroom and CMI laboratory instruction very well -- even claiming to use the CMI activities as a basis for their classroom lessons in some cases -- and that this integration was improving their teaching. Third, the Sacred Heart teachers noted that the introduction of the drill and practice aspects of the CMI instruction had freed them from having to do these tasks in the classroom, thus enabling them to concentrate on diagnosing students and providing individualized instruction for them. Most of the Sacred Heart teachers, however, indicated that there was a downside, too. The insertion of CMI laboratory time in their daily routine had created a schedule that was very difficult for many to work with, and many felt they had lost instructional time in other subject areas trying to make the CMI program work smoothly.

Principal Interviews, Eastport

The principal interviews conducted during the first year provided slightly different perspectives on CMI implementation. Again, although illustrating many differences between implementation at the two sites, they also revealed that the two schools had much in common. Lastly, they showed some changes in attitude and focus on the part of the principals as they saw the systems used over the course of the year.

When first interviewed, the Eastport principal saw the CMI experience as one that could improve things dramatically in his school. At mid-year, he noted that it was meeting his expectations and praised it as helping to focus instructional energies in the school. He praised the individualization that it promoted and said the additional basic skills time in the laboratory really enabled the students to get the most out of their school day.

Yet, at mid-year, the principal, like the teachers, seemed to think of the system as something additional rather than something complementary. In his interview, he noted that the teachers used the CMI system as a back-up to their regular instructional routines. In addition, he said he believed the system was adding to teachers' responsibilities and to the amount of time they spent in preparation. But this, he believed, was a good by-product of the system.

At the end of the year, he rated the CMI system as being very good for promoting student achievement and went on to say that many of his high risk students seemed to be about four months ahead of their last year's achievement levels. He was especially excited about the younger students' achievement gains and saw the CMI system as having its greatest effects on the primary grades. Moreover, he credited CMI with helping the school experience a significant reduction in the number of students moving from kindergarten to to first grade who had to be continued in the Chapter 1 program.

For him, the school's first year of the CMI experience had contributed positively to student participation, also. He described children who had not participated in class very much in the past suddenly becoming active in classroom discussions. In his analysis of this turnaround, he stressed the positive, almost friendly, reinforcement that the CMI activities provided to even the slowest students as a significant contributor to students' self-confidence and willingness to join class discussions.

He went on to credit the CMI system with promoting positive student attitudes in his school. He told of a 68% drop in discipline referrals at Eastport during the school year, noting that the only change in the school's standard operating procedures had been the introduction of the CMI laboratory. And he underscored this point by telling how three major changes in teaching personnel had had little effect. To him, the continuity provided by the CMI activities prevented the trauma which one would normally expect when switching teachers of elementary school students.

Although he still seemed to think the teachers saw the system as something additional, he said he was personally convinced that the system's role went beyond simple classroom back-up. He spoke of trying to get teachers to see this potential and said he saw some beginning to use it as a way to introduce new material, especially in language arts and writing. He still believed the system was adding to teachers' responsibilities and commitments, however.

By year's end, the Eastport principal saw positive impacts on his teachers that outweighed the increased demands the system put on their time and responsibilities. For instance, he saw it boosting the nature and extent of teacher communication and interaction, referring specifically to their weekly meetings with the laboratory manager. He said they had not done this before the introduction of the CMI system. Beyond this, he saw the intermediate teachers, who once had worked more or less in isolation because they were departmentalized, meet and plan together more often in order to insure their students were getting well integrated instruction, both on-line and in the classroom.

He also saw the introduction of another opinion, the laboratory manager who was interpreting the CMI reports, as beneficial in the instructional decisionmaking process. By year's end, he was convinced that this additional communication and linkage, when coupled with the increased ability to diagnose and prescribe that CMI afforded them, had boosted the teachers' effectiveness. This, in turn, boosted the students' achievement.

Despite his positive view of the CMI system's impact on Eastport, the principal saw areas that could be improved. At mid-year, he mentioned that he would like to see more audio in the earliest mathematics and reading activities, and some changes in the way students were scheduled into the CMI laboratory. In his end-of-year interview, he became even more specific with regard to varying the time allocations. He said he would double the amount of laboratory time for each student from 30 minutes to 60 minutes, split into two sessions a day. He also said he would approach implementation a bit differently by organizing his grade three through six staff into teams, and having them teach subject matter clusters. His rationale for proposing this was to open the laboratory for approximately 40 extra minutes per day. This extra time could then be used to help high-need students in reading and language arts.

The Eastport principal also felt that some aspects of the CMI training could be improved even though he rated it very highly. For instance, he said the hands-on aspects were very effective but believed the training activities could be more oriented to adult learners. He appreciated the follow-up included in the training package and wished it could be carried out each year to refresh current staff and h[illegible] new staff become proficient. He said he would like this additional follow[illegible] o deal with refining teachers' and laboratory manager's instructional uses of the system and with helping them integrate CMI and classroom activities more efficiently. He said he could benefit from more of this kind of staff development, too.

Lastly, he said he wanted his staff to begin using the CMI system to its fullest potential and was setting this as a school goal. He said there was a fair amount of consensus about this already. Thus, he saw his major challenge for the coming years as creating organizational and structural mechanisms for meeting this goal.

In summing up his experience, the principal at Eastport expressed confidence that he and his staff had integrated the CMI system into their school life pretty well despite a number of early difficulties and false starts in meshing the CMI program with the school's already-existing programs. He saw the system as an extremely positive educational tool for both students and staff. In fact, he testified before the National Rural and Small Schools Task Force that the combination of CMI and regular classroom instruction was producing extremely positive gains among his students and would forever change their lives.

Principal Interviews, Sacred Heart

When the project began, the Sacred Heart principal was new to the job. He had been hired just before the school year and had little to do with the decision to install the CMI project in his school. His initial interviews show that basically he was learning about it as he went along, although he had received some exposure to it during the summer laboratory manager training session which had taken place in his school. Despite this, he said he was enthusiastic and anxious to give this project a high priority -- but not the highest for him.

When he was interviewed at mid-year the laboratory had just reopened after having been closed for six weeks. This may have influenced his responses. He said he was not certain about the effects of CMI on his staff and students. He did not want to be too specific about student achievement effects, nor did he want to speculate too much about the system's effects on the way teachers were teaching. He was clear, however, that even in the laboratory the teachers should be the ones responsible for instruction and for prescribing the appropriate lessons. They had no responsibility for the technical aspects of the CMI laboratory. For him, that was the laboratory manager's job: bring up the appropriate lessons, make sure the students were on-line, provide reports, and trouble-shoot technical, computer-related problems.

Perhaps because the laboratory had been closed for awhile, the principal expressed doubt as to how well the system was fitting into the school's organizational and instructional routines at mid-year. He did not know how well the CMI curriculum matched the district curriculum and he was not sure whether the teachers had integrated the CMI lessons with their classroom activities. He did point out, though, that the CMI math lessons did not include money and measurements. Moreover, he guessed that there was little integration of CMI and classroom math since the students came to the laboratory with their reading teachers. He reiterated what he said was a complaint expressed by many teachers; that the CMI sessions were "stealing" 30 minutes of classroom time for math, reading, or science.

At mid-year he did not see their CMI responsibilities as having any effect on teachers' preparation time or on their workload. At year's end he had not changed his opinion, but he did wonder in both interviews whether the teachers had made enough effort to understand the system sufficiently to take advantage of all it had to offer them. In spite of this, he went on to say at year's end that he believed the teachers' experiences with CMI had enhanced their effectiveness over the first year. He believed it had heightened their sense of accountability, as well. He believed their use of the system had increased communication among his teachers, although he was quick to point out that it had always been good.

As for himself, he believed that over the last year he had increased the time he spent communicating with teachers because of the CMI system. Moreover, he felt the time was "good time spent," focused on instructional concerns. He was generally satisfied with the training and preparation he, the teachers, and the laboratory manager had received, yet he would have liked to have had more training in how to deal with what he called the "psychological" aspects of installation and implementation, which may have been a reference to the mechanical and personnel problems encountered before the laboratory became fully operational. He also mentioned that he would like the teachers to be trained to operate the management aspects of the CMI system, and set this as a training goal for the next year. He thought it important for them to learn the system better, because he wanted to avoid having to close the laboratory when the laboratory manager was not there. But he also believed that this training would give them more independence and control when deciding which CMI activities to assign their students. This, he believed, would encourage them to use the system to its full potential.

He felt he knew the CMI courseware well, and that the system was well integrated into the school's operations at the end of the year. He thought the instructional configuration used all year -- 30 minutes of CMI per day, five days a week for all students -- was just fine. He did not see changing it for the next year. He felt that language arts and reading should be stressed more than mathemathics, however. In an earlier interview, he had said he found the latter subject "boring" as taught on the computers.

When asked what he would change about the system, he said he would like to see available as part of the CMI management programs a diagnostic and prescriptive report that applied to clusters of skills. Such a feature was not available; students were assessed according to their performance vis-a-vis objectives or individual skills. He also indicated that he would like to be able to program the computer so it would align the CMI activities with the school's curriculum automatically. This feature was not available either, but he said it would help the staff learn the CMI curriculum more efficiently as they learned the school's curriculum. In his opinion, they were having trouble finding time to do both and perhaps this was why the two curriculums were not better integrated.

Although he noted that he had not seen the final test results, he said in his final interview that he thought the CMI system probably was doing a good job of promoting student achievement. Students with more ability were benefiting more, in his opinion, as they were able to move through the CMI activities more quickly than their less able peers. He had no opinion regarding how much their use of the CMI system had improved his students' participation. He did not have an opinion about the effects that CMI was having on student attitudes, either, other than to say that their behavior in the laboratory was good, so their attitudes must not be negative.

Summary of the Impact of the Computer-Managed Instructional System

Several themes can be seen running through the first year's implementation effects data for the two demonstration sites. The first theme concerns the role assigned to the CMI system at each school and the role the system played in the life of each school.

In both schools, the teachers tended to see and use the CMI system as a supplement to classroom instruction. For most it was a supplement to the more tedious aspects of classroom instruction -- drill and practice. Few teachers at either school seemed to have integrated their students' CMI experiences with their classroom experiences to any great extent, and neither the laboratory managers nor principals pushed them very hard to do so until the year's end. Some indicated that the large number of lessons included in the CMI courseware made it difficult for them to become sufficiently well acquainted with these activities to carry out such integration. Others felt they just did not have the expertise to do this kind of integration. A few seemed content to stay uninformed as to what the

CMI activities were and how they might fit into standard classroom offerings. A number pointed to their training as being responsible fo: this situation. And although nearly all of the teachers in both schools liked the training they received, most felt that there had not been enough of it and that it had not focused enough on the integration issue. Laboratory managers and principals saw it similarly, and, indeed, this had been the case.

Consistent with their view of CMI as supplementary, the majority of the teachers at both schools likewise viewed the CMI system and its activities as subordinate to their classroom instruction. In only a very few cases was the CMI system used to introduce concepts or skills to the students. Most teachers in both schools insisted on introducing these themselves, and then letting the system reinforce and provide practice. This was not totally inconsistent with the message they had received during their training sessions so to some extent they were following what they thought had been stressed as a good use of the system.

Yet, in both schools teachers were convinced that the CMI system could play a larger role and that it had great potential to change their instructional responsibilities. For example, many teachers in both schools were fascinated with the system's capacity to individualize instruction and generate student learning prescriptions. These two features were noted almost universally by the staff in both schools as the most impressive aspect of the CMI system. Moreover, many teachers in the two schools indicated that they planned to explore the possibilities of these two features in their second year of operation. In fact, several were doing just that towards the end of the first year.

Another related theme of year one implementation in the two schools was the way in which teachers and laboratory managers defined and carried out their roles vis-a-vis the CMI system. Staff at both schools began the year uncertain of the most appropriate roles to play, but ended it with more focus on what they should do. Teachers, in particular, were unsure of how they could prepare their students to make the best use of the CMI system, both while they were on-line and out of the laboratory. Their initial responses were passive on both counts. Many let the laboratory managers take the lead in monitoring the students while in the laboratory. And most let her, sometimes in coordination with the Chapter 1 teacher, take the lead in using the CMI reports to develop their students' CMI prescriptions.

As they became more familiar with the capabilities of the CMI system, and more comfortable with it, however, staff began to look at their CMI roles differently. By year's end, most of the teachers were emphasizing their tailored student learning prescriptions. Many acknowledged the influence of the CMI system in giving them this capacity and gave the CMI system high marks for making them more effective in carrying out the tasks of diagnosis, planning, and individualization. Most also pointed out that these new roles, particularly diagnosis and planning, were adding to their preparation time, but conceded that this was time well spent.

The laboratory managers at both schools likewise be--n the year uncertain over their roles, and one of the areas of greatest contrast between the two schools was the way in which the role of the laboratory manager was sorted out and factored into the instructional process. At Sacred Heart, the laboratory manager was considered to be an aide, albeit one with a very high degree of technical expertise. As such, she was considered an important helper in the laboratory, but not a co-partner in educational decisionmaking. Basically, the teachers asked her to print reports, help them read and interpret the reports, and boot-up the lesson prescriptions they requested (after having analyzed the reports).

However, these lesson prescriptions were routinely reviewed by the Chapter 1 teacher at Sacred Heart, who changed them in many instances to conform to her assessments of the students' needs. She did this in close consultation with the laboratory manager (and presumably with the teachers' permission and principal's sanction). Thus, because she was working in tandem with the Chapter 1 teacher to alter many teachers' lesson prescriptions, it seems that the laboratory manager was exerting a strong, indirect influence which was not readily seen (or acknowledged) by the Sacred Heart teachers.

The laboratory manager's influence was much more direct at Eastport. Here she was seen as the expert in the technical aspects of the CMI system and in its uses as a support for instructional decisionmaking. This role put her squarely in the middle of all report analysis and prescription activities. She and the principal would meet with each teacher, on the average of once a week, to read and analyze class reports and develop student lesson prescriptions. Over the course of the first year, these meetings became rather formal. They also ranged widely as the laboratory manager began introducing suggestions for classroom lessons and approaches based on her experiences with the students in the laboratory and her reading of CMI information.

None of the Eastport teachers had a problem with this expanded role for the laboratory manager. Most appreciated the guidance, particularly since many were not very comfortable with the nuances of the CMI reports and what they meant. The principal thought it was a good use of her expertise and valued her opinions.

Toward the end of the year, there were indications that the roles of the laboratory managers would be changing. At Sacred Heart, the principal was clear that the laboratory manager, and the Chapter 1 teacher, soon would shift their roles. He wanted them to teach the teachers how to operate the system and de-emphasize their own involvement in developing student prescriptions. He even put these new responsibilities to them formally. The Eastport principal set a similar goal for the laboratory manager, but made it less formal. He suggested she use the regular weekly CMI meetings to exercise this new staff development role.

The final theme of year one implementation concerns the nature of the CMI system's effects on the students and schools. At the end of the first implementation year, it appeared that the system had a greater impact on school context than it did on student achievement.

Results of the outcome study show only modest achievement gains for demonstration site students. Moreover, it cannot be said that CMI was responsible for them. The results of the student survey show that students in both sites viewed their CMI experiences as extremely positive. Moreover, interviews in both sites indicate that student interest in and motivation to work with the CMI system was very high. Again, however, it cannot be said that CMI alone precipitated this.

As for the instruction students received, it seems that the CMI system had only moderate impact during the first year. Demonstration site teachers do not appear to have modified their instructional approaches very much during the first year Its major instructional impact seems to have been that it increased the amount of time teachers devoted to drill and practice exercises and it seemed to make those exercises more interesting for the students. In addition, it caused many of the teachers to devote more time to instructional planning related to their students' CMI involvement. This planning seemed more organized and focused as much of it was based on the diagnostic reports generated by the CMI system. There was also an increase in the amount of individualization, primarily in the CMI laboratory. A few teachers seemed to have made adjustments in the way they structured and paced instruction, but this seemed mainly to accommodate the amount of time students were spending in the CMI laboratory.

However, interviews and observations at both sites showed that the CMI system had an immediate and significant impact on school context. Its greatest impact was on organization. For instance, the way the school day was divided had to be dramatically adjusted to accommodate 30 minutes of CMI instruction for every student. This, in turn, caused some adjustment in the way teachers scheduled and sequenced their classroom instruction.

The CMI system also had a significant impact on teachers' roles and responsibilities in both schools. It increased the amount of time they spent planning student assignments. It also focused that planning more directly on creating prescriptions keyed to individual student needs, and the CMI reports gave them added resources to determine those needs. Finally, the CMI system increased the amount of time teachers spent interacting with each other and with the principal about instructional issues and decisions.

There were other areas of contextual impact, as well. Student grouping patterns were changed in both schools. Eastport changed the way students were grouped to enable higher need students to spend more time in the CMI laboratory; Sacred Heart made a change to enable teachers to be in the laboratory with their students for mathematics as well as reading. There were changes in each school's staff development program. Use of the system became the major emphasis of staff development for the year, and CMI training activities dominated the school's staff development schedule. At Sacred Heart, the principal included CMI fluency as a personal improvement goal for every teacher in the coming year. Moreover, some teachers seem to have made pacing adjustments because of their students' CMI work and a large number of teachers at both sites said they planned to allow the CMI system to play a bigger role in setting their students' pace next year.

In addition, staffing patterns were altered. Each school received a new staff member, the laboratory manager. At Eastport, this new member quickly became a key instructional decisionmaker; at Sacred Heart she was a key instructional decisionmaker by the end of the year. The role of the district Chapter 1 teacher also changed in each school. They both began spending great amounts of time helping plan CMI activities for the Chapter 1 students and for the other children. As a result, they were at the demonstration schools more than they ordinarily would have been.

The CMI systems had an almost immediate impact on the culture at both schools. They became focal points of publicity in their respective districts, and among parents and community members. Likewise, the CMI systems became the source of a kind of new mythology at the schools as staff and students began repeating anecdotes relating how they had changed school life, had an impact on especially needy students, had become a source of envy among other district teachers, and so forth.

Lastly, using the CMI systems to their fullest potential became an important goal at each demonstration site. There was a fair amount of consensus about this goal at all levels. Nearly everyone interviewed --

district administrators, school administrators, teachers, laboratory managers -- saw ways to improve their use of the system during the second year's implementation. More importantly, the majority expressed a desire to make the school's use of the system more effective. Some looked for more time for students on the system, some for more students on the system, some for more integration of classroom and CMI activities, some for more extensive use of the CMI reports some for more individualization. and some for a combination of these things. But practically all of the demonstration site staff agreed that they would be taking steps to make sure the CMI system would be used more effectively in coming years.

LESSONS OF COMPUTER-MANAGED INSTRUCTIONAL SYSTEM IMPLEMENTATION

Although the CMI demonstration project has been progressing for only one year, some lessons have been learned. It should be emphasized that these lessons are based on experience with a specific CMI system at just two demonstration schools. The experience should be viewed as somewhat unique, probably not so unique that it cannot be helpful to others contemplating the addition of a computer-managed instructional component to their instructional program.

Lesson #1: Set implementation expectations to conform to the realities of the life cycle of an innovation.

A number of writers about educational change and innovation believe it takes four to seven years for something new to become a part of a school's standard operating procedures. The more unusual this something is with respect to current standard operations, the more time is needed to get it institutionalized. Any disruptions, either endemic to it or associated with it, that cause implementation to proceed in fits and starts during its initial stages also add time. Therefore, they caution, when an innovation is adopted in a school, one should not expect quick results in such major outcome areas as student achievement, or widespread, sophisticated use.

RBS' experiences in CMI demonstration project tend to confirm this conclusion. At the end of the first year, the staffs of the two schools were far from sophisticated in their use of the CMI system. Only a few teachers had developed more than a basic understanding of the system and were beginning to use it to what RBS and WICAT considered its full instructional potential as an instrument for introducing new concepts and skills. Likewise, few had integrated it to any extent with other classroom teaching or their instructional programs. Most used the CMI system as they had used other computers previously -- for drill and practice exercises that supplemented classroom instruction.

RBS staff view this as a valid first year accomplishment. It is necessary for demonstration site staff, during a first year, to accustom themselves to the system and, perhaps more importantly, to the new roles the system creates for them. As the comfort level of some grew over the course of the year, so did their willingness to explore the system's potential and start using it for something more than drill and practice. RBS expects more teachers to reach this point in the second year. Indications from the sites are that this will happen, and that more teachers will begin using the system as an integral part of their total instructional repetoire.

The first year student achievement results of this project also tend to confirm that major outcomes should not be judged at the end of one year. Although the results were mostly positive, they were modest. RBS staff see any gains, even modest ones, as encouraging after one year's use of such a dramatic and complex innovation as this CMI system. Staff at the schools were themselves getting used to the system. The students needed time to accustom themselves to the innovation. In addition, between equipment malfunctions, staff turnover (at Sacred Heart), and the incremental introduction of the courseware, no student at either school received a full year's exposure to CMI.

As local staff become more familiar with the system, and begin using it more toward its full potential, it appears likely that students will get more out of it. Likewise, as fewer disruptions interrupt their laboratory time, the students will have more exposure to the system. Finally, additional years of experience with the system and its courseware will enable teachers and students to use it more efficiently and effectively. Therefore, RBS staff expect student achievement to continue to rise in the coming years and intend to continue to assess achievement in terms of yearly performance on the WICAT Test of Basic Skills and in terms of standardized test results.

Lesson #2: Provide a clear vision of long-range implementation outcomes and a plan for achieving them.

Much of the literature on the successful management of change and innovation, both in the private and public sectors, stresses the importance of a clear vision of what the innovation should entail. The value of such a vision, complete with clearly stated goals and a plan for achieving them, is that it provides a target for focusing efforts across the board. It also gives those charged with carrying out the innovation a set of benchmarks by which to measure success.

At the outset of the CMI project, there was a rather loose idea of what might be accomplished at the demonstration sites. Enhanced student achievement was certainly part of it, as was integration of the CMI systems into the schools' daily routines. Beyond this, however, there was no specified vision of the outcomes of the project other than what had been included in RBS' original description: to demonstrate the instructional power of CMI in small school settings.

Likewise, there was only a loose notion of how this demonstration should be accomplished. There would be adoption, installation, and initial implementation activities, and these were to be divided among the joint venture partners with the majority going to RBS and WICAT staff. The conduct of these activities would be guided by principles from the innovation and change literature. There would be a two-component evaluation strategy to gauge both student and school changes during this demonstration. But there was no specific operational plan for implementation.

It was only after implementation was underway that a solid vision of implementation began to emerge. It was one of "full potential use," i.e., teachers sufficiently familiar with the system's capacity to individualize instruction and to manage a wide variety of lessons keyed to specific student needs -- using it as an integral part of their instruction so that what students did in the classroom and CMI laboratory were complementary. From this vision of full potential use emerged an implementation strategy that involved incremental introduction and capacity building. In year one, staff and students engage in "basic" CMI use (i.e., in the way they are most comfortable, as drill and reinforcement) to become familiar with the system while developing their understanding of its potential. In year two, internal and external staff development turns this basic use literacy into more sophisticated fluency while helping staff define new responsibilities for themselves in coordinating classroom and CMI learning. In year three, staff and students use the potential of the system fully. Student and school changes would be followed during this three year period, but the benchmarks for success would be keyed to student, staff, and school progress in going from basic to full potential use.

Since this view emerged late, neither the vision nor the long-range implementation strategy was commonly understood at the sites. Site staff at all levels were unsure of what they were to accomplish or how they should proceed, so they improvised. They set their own objectives, defined their own roles and responsibilities, and established their own vision of successful year one implementation. By the time RBS and WICAT staff had developed a vision and implementation strategy, the demonstration site staff were well along with their own visions and plans. Rather than attempt to replace this local vision and implementation plan, it was decided the demonstration site staff should be helped to work their way through the implementation process as they saw it. The larger vision and implementation plan then would be introduced toward the end of the first year, together with some concrete suggestions for carrying it out in the following two years.

In retrospect, perhaps it would have been better to establish a clear vision of full implementation as part of the initial orientation conducted for demonstration site decisionmakers and staff. It may have been better if the local sites were apprised of the specific implementation goals, activities, and benchmarks related to this vision and given a role in translating it at the operational level. This may have enabled those charged with implementation to have a better understanding of what was supposed to happen over the long run. Moreover, it may have given them the opportunity to define their own project responsibilities and year-to-year objectives. Proceeding in this manner might have taken more time in the beginning, and may have introduced to them more information than they could assimilate at the time, but it might have moved implementation along more smoothly. It certainly would have given the site staff more confidence that they were in control of their part of the implementation process.

Despite this failure to communicate an early implementation vision, the first year experiences at both sites were seen as poistiive for the most part. This was due, in part, to the ability of the staff at these sites to formulate their own vision of successful implementation and carry out the project accordingly. Although the vision they established was not exactly what RBS and WICAT might have set initially, it was a good one for getting the site staff through the first year. More importantly, local site leadership now seem to understand the vision of full potential use and are aiming to achieve it.

Lesson #3: Adopt a turnkey approach which provides balanced training that includes all aspects of implementation.

The focus and content of training is a perennial implementation issue, particularly when a large scale innovation is being implemented. Typically, a well-balanced, thorough program of staff development must be related to the practicalities of resources, time, and the like. In this project, all partners agreed that training was very important and that it should be a major component of the demonstration project. But in the end, training was not as complete as it could have been. Despite this, local demonstration site staff reported that they liked their training and they said it was useful as far as it went. The laboratory managers, in particular, praised its utility.

Many thought it did not go far enough, however. They would have liked it to include information on how to use the system day-to-day, and how to integrate CMI with existing instructional approaches and programs. Many also would have liked it to enable teachers to call-up CMI activities themselves, and generate their own reports. A few indicated they would have liked it to prepare them for the changes in roles and responsibilities which are associated with working with CMI.

Looking back, one can see that many of these topics and skill areas would have been beneficial as part of the training experience. However, due to the amount of training time needed for basic orientation certain priorities had to be set. RBS, WICAT, and district administrators all believed it was most important to train laboratory managers to operate and maintain the system effectively. Their ability to do this was considered key to smooth implementation. Consequently, their training and follow-up experiences were intensive and covered the full range of information and skills needed to run the CMI system.

At the same time, it was felt that sufficient knowledge to enable them to be comfortable with the CMI system should be the primary goal of initial teacher training. As a result, the teachers' initial training and their subsequent follow-up experiences did provide them the information and skills they needed to work comfortably with the system, but they were not taken much beyond the fundamentals. It was hoped they would begin learning more about the system's potential as they and their students spent more time with CMI. This happened in a few cases, but it was not common and may have become more widespread if additional formal training had been provided.

Bearing in mind that training time is always scarce, RBS suggests an approach to training which is based on the development of in-house expertise and the use of turnkey training. The first objective of this approach is to establish a cadre of highly knowledgeable staff at the school. These staff have a series of intensive training sessions that deal with the technical aspects of CMI and its programmatic, curricular, and pedagogical aspects. At the end of this training, these in-house experts assume responsibility for training the rest of the staff and for trouble-shooting CMI problems of all types. They school the entire staff in the subtle areas of CMI operations. They coach the rest of the staff to help them develop their expertise. Eventually, through this turnkey approach, all staff are capable of using the system to its full potential.

Toward the end of the first implementation year, administrators at both demonstration sites were seriously considering a model like this one for their next year's operation. There are in-house experts at both sites, the laboratory managers and the Chapter 1 teachers. Moreover, the administrators at both sites are confident these experts can handle staff development responsibilities. Staff at both sites are calling for more staff development, and the administrators are anxious to give it to them in a way that will help them grow in their CMI capabilities. In addition, there is a desire on everyone's part to move CMI use beyond drill and practice. As the year ended, the only missing piece was the identification and allocation of time for these staff development activities.

Lesson #4: Develop strong in-house expertise.

Whenever an innovation is introduced into a situation, there is always a question of how much expertise site staff need to make its implementation run smoothly. Often there is also a question of whether this expertise should come from external consultants or be developed among the staff themselves. The CMI project was an innovation that required a lot of expertise to carry out effectively. Therefore, the issue for the demonstration sites was to decide whether this expertise should be supplied by outside consultants or developed among selected staff in each school.

Looking back over the first year, it appears that a combination of providing initial outside consultation and developing internal expertise worked well. In the early stages, RBS and WICAT staff provided the expertise almost exclusively. This was done to get the project launched smoothly. Subsequently, RBS and WICAT staff conducted training sessions for the laboratory managers and teachers. As noted earlier, it was hoped these training sessions would provide staff with the skills they needed to operate the CMI system and encourage them to learn more about it on their own. It was further hoped that some in-house experts would emerge at the sites to take over training and consulting activities.

At Eastport, the laboratory manager set out from the start to become an in-house expert with the hardware and software. She worked hard, and quickly developed a solid understanding of the CMI system's instructional potential. With the tacit approval of the staff and the explicit approval of the principal, she used that understanding to begin advising teachers how to read, interpret, and use the CMI reports. Most teachers at Eastport, cognizant of her knowledge of the system, respected her opinions regarding its appropriate use. They usually deferred to her advice, following her suggestions for their students' CMI laboratory lessons.

As her understanding of the system grew, the Eastport laboratory manager began making suggestions about grouping students, managing them in the laboratory's individualized environment, and keeping track of their progress. Soon she started offering recommendations as to how teachers might improve in-laboratory instruction. By this time she had teamed with the school's Chapter 1 teacher. Together, they combined a great deal of technical and pedagogical expertise and legitimacy, so their recommendations carried a lot of weight.

By the end of the school year, the laboratory manager had become key to most of the instructional decisions that involved the CMI system. These decisions came at weekly meetings which nearly all staff saw as crucial for CMI planning. All noted that the laboratory manager's input was a critical element in these meetings. They also noted that these meetings were often a good opportunity for them to learn more about the system and its potential.

The situation was both similar and different at Sacred Heart. Here, as at Eastport, the (second) laboratory manager worked diligently to become expert in the technical and instructional capabilities of the CMI system. As had been the case at Eastport, the laboratory manager teamed with the school's Chapter 1 resource teacher. Working in tandem with her, the laboratory manager became an important part of the instructional decisionmaking process, providing guidance and advice to the Sacred Heart teachers. However, unlike the Eastport laboratory manager, she was not seen as being as central to this process as the Chapter 1 teacher.

At Sacred Heart, the Chapter 1 teacher took the lead in advising teachers as to the best ways to utilize the CMI system with their students. The laboratory manager's input centered almost exclusively on the technical aspects of CMI, but these technical aspects greatly influenced instructional decisions, as year-end teacher interviews revealed. In addition, the year-end interviews at Sacred Heart indicated that plans were underway to have the laboratory manager increase her interactions with teachers and train them in the technical aspects of CMI, thereby giving her a more prominent role in the next phase of implementation.

With the advent of this in-house expertise, RBS and WICAT diminished their consultations without apparent adverse impact. However, more demonstration site staff need to develop their own expertise, and not rely on the laboratory managers or Chapter 1 teachers. Until this happens, the CMI system cannot be considered as having been incorporated into the schools' routines. Until incorporated, it will run the risk of being dropped if the local experts (the laboratory managers and Chapter 1 coordinators) should leave or are reassigned. Furthermore, teachers are unlikely to go beyond the drill and practice use of CMI until they develop their own expertise and lessen their reliance on even the local experts. Therefore, RBS intends to monitor closely the development of expertise among a larger group of local staff in the coming year.

Lesson #5: Analyze local and district context before introduction.

A great deal has been written about the influence of local context on the implementation process. RBS staff fully expected context factors to influence the CMI implementations and, in fact, made that anticipated influence the focus of the project's process study. Judging from the results of this study, the following factors of context influenced CMI implementation positively: strong leadership, tight staff linkages, an absence of serious staff conflict, the absence of competing innovations, positive staff attitudes and perceptions, and the presence of local "advocates." The following had an adverse affect on CMI implementation: disruptions of the implementation process caused by problems with the CMI system, staff turnover, and staff perceptions of CMI as a negative incentive.

Strong administrative leadership can be seen as the most important context factor the first year of CMI implementation. There would have been no CMI project in the demonstration sites if district and school building leaders had not decided in its favor and made it a top priority. In Palmyra, it was the superintendent who provided the central office leadership vital to success in the early stages. In Anne Arundel County, it was the Executive Director of Curriculum.

Both already had a great deal of faith in the power of computer-based instruction and both recognized that the terms of the demonstration project represented a rare opportunity to initiate large scale CMI in their districts. Likewise, both pushed hard to obtain approval of the project and get it started in the demonstration site schools. Once it was approved, they worked to make sure that there would be enough money to cover the district's contributions to the operation and maintenance of the CMI system. They spearheaded efforts to obtain the additional resources needed for building modifications, laboratory manager salaries, staff development, and so forth. They convinced the school principals and their staffs of the value of CMI and of its potential to improve student achievement, and they lent their symbolic presence to initial training and installation activities.

Similarly, the principals exerted strong leadership throughout the year that positively affected the implementation of the CMI systems at their schools. They, too, made the project a high-ranking priority and pumped financial and human resources into it at the school level to insure it was adequately supported. They acted as advocates of the project with their staff and members of the community, and worked with central office staff to identify and obtain long-range funding. Both were instrumental in defining their school's year one implementation goals and in seeing that their staff tried to meet those goals. In addition, each contributed a strong, day-to-day, substantive involvement in CMI operations. Each took an active part in helping their staff adjust to the new demands made by the introduction of the CMI system and helped mediate the staff's frustration and anxiety with it.

Several contextual factors related to staff acted to enable the year one implementation to proceed as successfully as it did. First, staff in each of the schools were tightly linked. That is, they interacted with one other fairly frequently on an informal and formal basis. These interactions were cordial, even friendly, and more often than not centered on instructional issues. There also seemed to be very little horizontal or vertical conflict at either school. Teachers got along well with each other and with the principal. In addition, there was a strong goal consensus among the teachers about the primary goal of their efforts -- effective instruction leading to improved achievement -- and they were (and are) genuinely concerned about doing their best for the students. One might expect tight linkage among staff as small in numbers as those at the two demonstration schools, but tight linkage does not necessarily preclude conflict, nor does it always bring the kind of single-minded interest in boosting the children's achievement that was evident at these schools.

This and the strong goal consensus may explain, in part, why the staff at both sites consented to adopt and work with CMI despite some individual personal reservations about extra time and work. They realized, as a group, that it could help their students meet their achievement goals. This belief, coupled with the tight linkage and low level of conflict, may help to explain why they persisted in working with the CMI system despite their frustrations, and why they succeeded as well as they did. They supported and coached each other through frustrating times, and in so doing kept morale and enthusiasm from disappearing.

The work ethic and optimism of the staff at both sites also contributed to the success of the first year implementation. As a group, none doubted that they would overcome the technical and mechanical problems they encountered. Most believed it was merely a case of working harder. Most did work very hard to master the CMI system and to help their students use it well. They were able to do this partly because of their "can do" attitude and partly because they were willing to devote time and energy to it. The CMI project was the only improvement project at their respective schools, and they were given time to learn about it and to learn to use it with their students.

The CMI system also benefited from having several on-site advocates. They kept promoting the value of the project and encouraging their colleagues to use it. These individuals -- the two laboratory managers, the two Chapter 1 teachers, several other teachers, and the two principals -- helped staff develop their CMI instructional programs and skills directly and by example.

These positive aspects of the demonstration sites' context were all the more important for project success when one considers that there were quite a few negative factors. The most significant of these negative factors was the number of disruptions to the implementation process. During the first month or so of operations, a combination of mechanical malfunctions and user errors caused the CMI system to be down as much as it was up. Having disruptions for this amount of time was bad enough, but there was no way to predict when they would happen. Worse still, it was difficult to discover what had gone wrong so it was difficult to take steps to prevent it from happening again. Thus, in addition to the toll these disruptions took on the flow of implementation, they created increased levels of frustration and decreased levels of morale among staff and students.

This led to skepticism among some staff members as to the value of CMI, in general. The system simply broke down too often to justify the effort they were devoting to it. As they saw it, students were missing both classroom and CMI instruction when the system did not work. In short, the CMI project was "stealing" instructional time. Therefore, it became a negative incentive, something that induced some teachers to withhold commitment and limit involvement. Some maintained this position and their skepticism throughout the entire first year.

At Sacred Heart, there was an even more serious disruption; the laboratory manager left after about 10 weeks. This disruption literally stopped implementation completely and set it back almost to square one. This took an additional toll on students' and teachers' on-line time and set their implementation schedule back about six more weeks. It also served to reinforce the low morale, skepticism, and negativity beginning to permeate perceptions about CMI at the school.

The disruptions at both sites may have had an additional negative impact on the process of implementation. They may have worked to prevent some teachers from fully accepting the CMI system as a partner in instructional delivery. It is possible that the anticipation of system-related disruptions at any moment encouraged teachers to view CMI as an add-on; that is, as something not vital to their teaching. If they were prevented from using it because of some disruption, it would be no great loss It was a mechanism for drill that could be replaced by worksheets. This same reasoning may have prevented many from integrating system activities with their classroom lessons, as well. With too much integration, a disruption to the system could be disastrous for instruction.

In sum, the contextual features enabling smooth implementation in these sites fortunately outweighed those that interferred with smooth implementation. To a degree this was a product of good fortune, but it also represented informed pre-planning. RBS staff recognized in advance that this innovation would require a context that would not put up barriers to implementation. They were able to communicate this understanding to state-level and district-level decisionmakers who, in turn, were able to find schools that had many of the desired contextual characteristics. It was from this group that the demonstration site schools were chosen and, as it turned out, these schools experienced successful implementation the first year. Had the importance of context not been considered, or had schools without an enabling context been selected, the experiences might not have been as successful.

CONCLUSION

Looking back over these experiences with the CMI system, it is clear that in both schools the systems had a positive impact. Student achievement in these schools improved modestly, in a few instances significantly, in comparison to non-CMI students' achievement. Student attitudes toward the system were overwhelmingly positive. Most a' the school level believed the systems improved instruction and teacher effectiveness. And nearly everyone involved in the project was optimistic that subsequent years of use would bring even better results.

Yet, the question remains whether these positive impacts were sufficient to justify the expense and short-term disruption to school operations brought on by the introduction of CMI to these small, rural schools. There is no denying that the CMI system as implemented is expensive. When the room modifications, special electric and environmental conditions, and additional staff costs are factored in, the expense is even greater. Administrators in all three districts were can'ld in saying they probably would not have considered installing such a costly system without the joint venture subsidies. However, none are dissatisfied with the system, all are pleased with the results, and one, Anne Arundel County, is currently investigating the possibility of installing a WICAT system in additional schools. Thus, the question of cost can only be answered by those contemplating installing a CMI system. In this arena as in others, one gets what one pays for. There are many less expensive ways to deliver

CMI to students, but few are as efficient or as comprehensive as the system used in this project.

As for the operational disruptions caused by the project, the disruption was short-lived and certainly not as severe as it could have been. Overall, staff at both schools adapted quickly and well to the technology and are now working with it very comfortably. Few, if any, complain about it and most seem to look forward to extending their students' use of the system. More significantly, staff at both schools feel that whatever inconvenience this innovation caused or causes, it is worth it because the students are benefiting. RBS staff see it similarly. We have seen many innovations cause far greater disruptions to school life with far fewer positive pay-offs.

In conclusion, our experience suggests that computer-managed instruction is indeed a viable, worthwhile way for small, rural schools to meet the needs of their at-risk students. We offer these caveats.

- Buy the most comprehensive system you can afford -- one that covers many facets of all curriculum areas and includes a computerized management system that enables efficient assessment, prescription, and placement of students.
- Be prepared to support the effort both financially and organizationally.
- Staff the effort with committed, enthusiastic individuals who are not afraid to learn the technological skills needed.
- Prepare all concerned for four or five months of disruption while they get used to the system.
- Be certain to have a long-range implementation plan and vision and be sure it is shared with all concerned.
- Defer any expectations of dramatic impact beyond the first year of operation.

Appendices

WICAT Test of Basic Skills Objectives

Student Attitude Surveys and Item Analysis

Staff Interview Protocols

School Observation Form

WICAT Test of Basic Skills Objectives

WTBS Reading/Language Arts-Grade 2

Associate given symbols with their sounds
Identify consonant sounds and decode associated words
Identify blends and clusters and decode associated words
Identify consonant digraphs and decode associated words
Identify vowel sounds and decode associated words
Identify vowel digraphs and decode associated words
Identify diphthongs and decode associated words
Decode familiar words in context
Identify the character's feeling and motives and pronoun referents
Draw conclusions from given information and predict outcomes
Recognize the noun number, inflection, capitalization
Identify the correct meaning of homonyms
Decode inflected words
Identify the correct or incorrect formation of plurals
Identify the correct spelling of words not conforming to spelling generalizations
Decode contractions
Identify fragments, run-ons, complete sentences
Identify the semantic intent of given sentences

WTBS Reading/Language Arts-Grade 3

Identify consonant sounds and decode associated words
Identify vowel sounds and decode associated words
Identify consonant/vowel combinations
Decode familiar words in context
Identify the implied main idea and topic
Identify the character's feelings and motives and pronoun referents
Draw conclusions from given information and predict outcomes
Identify verbs, auxiliaries, inflections
Recognize noun number, inflection, capitalization
Understand the formation of compound words
Decode inflected words
Identify the correct or incorrect formation of plurals
Identify inflected forms
Identify the correct spelling of words not conforming to spelling generalizations
Decode contractions
Identify the correct meaning of homonyms
Identify fragments, run-ons, complete sentences
Identify the semantic intent of given sentences
Complete alphabetical sequences
Paraphrase a given passage
Identify related objects and groups
Understand the function of reference publications

WTBS Reading/Language Arts-Grade 4

Identify vowel sounds and decode associated words
Use syllable identification as an aid to decoding

Identify the main idea and supporting details
Identify plot and cause/effect relationships
Identify the main idea and topic
Identify implied cause/effect relationships, setting, sequence
Identify the character's feelings and motives and pronoun referents
Draw conclusions from given information and predict outcomes
Identify verbs, auxiliaries, inflections
Recognize noun number, inflection, capitalization
Understand the formation of compound words
Decode words by the recognition of prefixes and their meanings
Identify the antonyms of given words
Identify the correct meaning of homonyms
Identify the correct or incorrect formation of plurals
Identify the correct or incorrect formation of possessives
Identify inflected forms
Decode contractions
Identify correct or incorrect punctuation
Identify correct or incorrect capitalization
Identify fragments, run-ons, complete sentences
Identify the semantic intent of given sentences
Complete alphabetical sequences
Identify related objects and groups
Understand the function of reference publications

WTBS Reading/Language Arts-Grade 5

Identify verbs, auxiliaries, inflections
Recognize noun number, inflection, capitalization
Associate abbreviations with their referents
Complete alphabetical sequences
Understand thee function of reference publications
Understand the use of guide words and phonetic respelling
Understand the effective development of paragraphs
Understand the elements of effective writing style and form
Demonstrate a comprehension of given directions
Proofread for mechanics, spelling and grammar
Proofread for content
Use syllable identification as an aid to decoding
Decode words by the recognition of consonant-vowel patterns
Decode words by the recognition of suffixes and their meanings
Decode words by the recognition of roots and their affixation
Identify the synonyms of given words
Identify the antonyms of given words
Identify the correct meaning of homonyms
Identify the main idea and supporting details
Identify the implied main idea and topic
Identify implied cause/effect relationships, setting, sequence
Draw conclusions from given information and predict outcomes
Discriminate between fiction and nonfiction
Determine the author's purpose, point of view, and tone
Discriminate between fact and opinion; recognize persuasion and propaganda

WTBS Reading/Language Arts-Grade 6

Identify the main idea and supporting ideas
Identify plot and cause/effect relationships
Identify the implied main idea and topic
Identify implied cause/effect relationships, setting, sequence
Determine the author's purpose, point of view, and tone
Discriminate between fact and opinion; recognize persuasion and propaganda
Discriminate between literal and figurative usage and idioms
Identify verbs, auxiliaries, inflections
Understand function, person, case; use as compound elements
Identify the parts of speech
Decode words by the recognition of prefixes and their meanings
Decode words by the recognition of suffixes and their meanings
Identify accents in given words
Identify the correct or incorrect formation of possessives
Use syllable identification as an aid to decoding
Identify direct and indirect quotations
Proofread for mechanics
Recognize the correct us of prepositional phrases
Understand the effective development of paragraphs
Understand the elements of effective writing style and form
Identify the correct elements in business correspondence
Proofread for content
Summarize a given passage
Demonstrate a comprehension of given directions
Understand the function of reference publications
Understand the use of guide words and phonetic respelling
Understand the use of maps, charts, tables, graphs, time lines

WTBS Mathematics-Grade 2

Identify odd and even numbers
Identify word names and numerals
Identify numbers before, between, and after
Order and compare whole numbers
Identify missing numbers in sequence -- two's, odd and even, fives
Add single digit whole numbers
Add two digit whole numbers
Subtract one and two digit whole numbers
Multiply one digit whole numbers
Determine length, height, and width
Determine temperature measurement
Tell time by five minutes, by quarter, half, and one hour
Understand calendars and perform operations on time
Determine the value of coins and bills
Make change and perform operations with money
Solve sentences with missing terms and symbols
Identify geometric terms and shapes
Understand graphs and charts
Solve one and two step word problems

WTBS Mathematics-Grade 3

Identify word names and numerals
Round whole numbers
Identify place value of whole numbers
Add two digit whole numbers
Add three or four digit whole numbers
Subtract one and two digit whole numbers
Multiply one digit whole numbers
Multiply two digit numbers
Divide whole numbers
Identify equivalent fractions and fractional parts
Determine length, height, and width in standard and metric measures
Measure temperatures in Fahrenheit and Celsius
Understand calendars and perform operations on time
Make change perform operations with money
Identify geometric terms and figures
Answer questions using graphs and charts
Solve word problems containing two digit numbers
Solve one and two step word problems

WTBS Mathematics-Grade 4

Identify word names and numerals
Round whole numbers
Identify decimal place values
Identify place value of whole numbers
Add two digit numbers
Add three or four digit numbers
Subtract three and four digit numbers
Multiply two digit numbers
Divide whole numbers
Order and compare fractions
Identify equivalent fractions and fractional parts
Add fractions with like denominators
Order and compare decimals
Add decimal numbers
Multiply decimal numbers
Determine length, height, and width using standard and metric measures
Find perimeters of polygons
Make change and perform operations with money
Identify the names of polygons
Answer questions using graphs and charts
Solve word problems containing two digits
Solve word problems containing three digits
Solve word problems containing fractions and decimals

WTBS Mathematics-Grade 5

Identify the place value of decimal numbers
Identify primes and composites; list factors and find greatest common factor

Find multiples, common multiples, and least common multiples of numbers
Add two digit whole numbers
Add three or four digit whole numbers
Subtract three and four digit whole numbers
Multiply two digit numbers
Multiply three and four digit whole numbers
Divide whole numbers
Order and compare fractions
Identify equivalent fractions, decimals, and mixed numbers
Find the least common denominator for fractions
Identify reciprocals for fractions and decimals
Add proper fractions
Subtract fractions and mixed numbers
Multiply proper and improper fractions
Round decimals to tenths
Add decimal numbers
Subtract decimal numbers
Multiply decimal numbers
Identify equivalent ratios
Determine length, height, and width using standard and metric measures
Identify relations among units of measure
Find the perimeter of polygons
Find the area of polygons
Identify the name of polygons
Identify coordinates and ordered pairs on a grid
Answer questions about information on graphs and charts
Solve word problems containing three digit numbers
Solve word problems containing fractions and decimals
Solve word problems dealing with checkbooks and denominate numbers
Solve word problems dealing with measurements

WTBS Mathematics-Grade 6

Identify primes and composites; list factors and find greatest common factors
Find multiples, common multiples, and least common multiples of numbers
Add three or five digit numbers
Subtract four and five digit numbers
Multiply four and five digit numbers
Divide whole numbers
Identify equivalent fractions, decimals, and mixed numbers
Identify reciprocals for fractions and decimals
Add proper fractions
Add mixed numbers
Subtract fractions and mixed numbers
Multiply proper and improper fractions
Divide proper and improper fractions
Identify decimal equivalents
Round decimals to hundredths
Add decimal numbers
Divide decimal numbers
Find the missing term of a proportion
Identify percent equivalents

Find the percentage, given the base and the rate
Simplify expressions containing exponents, roots, and powers
Identify relations among units of measure
Find the perimeter of polygons
Find the area of polygons
Identify geometric terms and shapes
Use protractors to measure angles
Determine missing measures of a circle
Identify and name polygons and their parts
Identify coordinates and ordered pairs on a grid
Find the mean of a set of data
Identify proper steps to solve word problems
Solve word problems containing two or more operations
Solve word problems containing fractions and decimals
Solve word problems containing percents
Solve word problems containing ratios and proportions
Solve problems dealing with checkbooks and denominate numbers

Student Attitude Survey and Item Analysis

STUDENT SURVEY

My Name: ______________________ ____ Date: ________________

My Teacher's Name: ______________________________

Directions: Circle one in each row below.

I am in grade:	K	1	2			
	33%	39%	28%			
I am:	a boy	a girl				
	56%	44%				
I am:	Asian American	Black	Hispanic	White	Other	
	2%	28%	1%	68%	1%	

Directions: The questions below are to find out what you like. Listen carefully to your teacher read each question. Answer each question by circling either Yes or No.

Example

	2	1
Do you like ice cream?	Yes	No

	Question	%	Yes	%	No	$\bar{x}$
1.	Do you like school?	89	Yes	11	No	1.11
2.	Is the computer easy to use?	94	Yes	6	No	1.06
3.	Is working on the comp[illegible] fun?	96	Yes	4	No	1.03
4.	Do computers make it fun to learn?	96	Yes	4	No	1.03
5.	Do you learn a lot on the computer?	93	Yes	7	No	1.07
6.	Do you have to hurry when you work on the computer?	14	Yes	86	No	1.86
7.	Do you like going to the computer room?	95	Yes	5	No	1.04
8.	Would you like to go to the computer room more often?	77	Yes	23	No	1.22
9.	Do you get good grades when you work hard in school?	96	Yes	4	No	1.03
10.	Have you worked on a computer in school before this year?	41	Yes	59	No	1.58
11.	Do you have a computer at home?	40	Yes	60	No	1.59

Eastport (N=85)

STUDENT SURVEY

My Name: ____________________ Date: ____________

My Teacher's Name: ____________________

Directions: Circle one in each row below.

I am in grade:	3	4	5	6
	26%	26%	26%	22%

I am:	a boy	a girl
	51%	49%

I am:	Asian American	Black	Hispanic	White	Other
	0%	46%	0%	54%	0%

Directions: The questions below are to find out what you like. First read each question carefully. Then answer each question by circling either Yes, Sometimes, or No.

Example

	3	2	1
Do you like ice cream?	Yes	Sometimes	No

	Yes	Sometimes %	No	$\bar{x}$
1. Do you like school?	35	55	10	1.74
2. Is the computer easy to use?	66	32	2	1.36
3. Is working on the computer fun?	73	27	0	1.27
4. Do computers make it fun to learn?	79	20	1	1.22
5. Do you learn a lot on the computer?	86	12	2	1.16
6. Do computers make the subject more interesting?	64	28	8	1.44
7. Do you get bored working on the computer by yourself?	14	40	46	2.31

(please turn over)

		%			x̄
8.	Do you need much help when working on the computer?	Yes 2	Sometimes 47	No 51	2.48
9.	Does the computer give you help when you need it?	Yes 77	Sometimes 21	No 2	1.25
10.	Does the computer help you correct your mistakes?	Yes 79	Sometimes 16	No 5	1.25
11.	Do you have to hurry when you work on the computer?	Yes 7	Sometimes 14	No 79	2.71
12.	Do you like computer work better than written assignments?	Yes 82	Sometimes 11	No 7	1.25
13.	Is it important to do well on your computer assignments?	Yes 76	Sometimes 22	No 2	1.26
14.	Does working on the computer help you do better in school?	Yes 70	Sometimes 30	No 0	1.29
15.	Does your teacher know whether you make mistakes on your computer assignments?	Yes 73	Sometimes 26	No 1	1.28
16.	Do you get good grades when you work hard in school?	Yes 78	Sometimes 20	No 2	1.24
17.	Do you like going to the computer room?	Yes 77	Sometimes 20	No 3	1.27
18.	Would you like to go the computer room more often?	Yes 78	Sometimes 10	No 12	1.34
19.	Have you worked on a computer in school before this year?	Yes 70	Sometimes 5	No 25	1.54
20.	Do yc have a computer at home?	Yes 47	Sometimes 1	No 52	2.04

STUDENT SURVEY

My Name: ______________________ Date: ______________

My Teacher's Name: ______________________________

Directions: Circle one in each row below.

I am in grade: K 1 2
100%

I am: a boy a girl
51% 49%

I am: Asian American Black Hispanic White Other
3% 15% 1% 80% 1%

Directions: The questions below are to find out what you like. Listen carefully to your teacher read each question. Answer each question by circling either <u>Yes</u> or <u>No</u>.

Example

	2	1
Do you like ice cream?	Yes	No

	%				$\bar{x}$
1. Do you like school?	78	Yes	22	No	1.21
2. Is the computer easy to use?	86	Yes	14	No	1.13
3. Is working on the computer fun?	96	Yes	4	No	1.04
4. Do computers make it fun to learn?	96	Yes	4	No	1.04
5. Do you learn a lot on the computer?	93	Yes	7	No	1.06
6. Do you have to hurry when you work on the computer?	20	Yes	80	No	1.79
7. Do you like going to the computer room?	97	Yes	3	No	1.02
8. Would you like to go to the computer room more often?	88	Yes	12	No	1.12
9. Do you get good grades when you work hard in school?	96	Yes	4	No	1.04
10. Have you worked on a computer in school before this year?	50	Yes	50	No	1.50
11. Do you have a computer at home?	45	Yes	55	No	1.54

Palmyra (N=129)

STUDENT SURVEY

My Name: ______________________ Date: ____________

My Teacher's Name: ______________________

Directions: Circle one in each row below.

I am in grade: 3 (55%) 4 (45%) 5 6

I am: a boy (48%) a girl (52%)

I am: Asian American (2%) Black (23%) Hispanic (1%) White (69%) Other (5%)

Directions: The questions below are to find out what you like. First read each question carefully. Then answer each question by circling either Yes, Sometimes, or No.

Example

	3	2	1
Do you like ice cream?	Yes	Sometimes	No

	Yes %	Sometimes %	No %	$\bar{x}$
1. Do you like school?	34	59	7	1.72
2. Is the computer easy to use?	55	45	0	1.45
3. Is working on the computer fun?	71	27	2	1.32
4. Do computers make it fun to learn?	83	15	2	1.18
5. Do you learn a lot on the computer?	83	15	2	1.19
6. Do computers make the subject more interesting?	66	29	5	1.39
7. Do you get bored working on the computer by yourself?	10	42	48	2.38

(please turn over)

		%		x
8. Do you need much help when working on the computer?	Yes 2	Sometimes 44	No 54	2.51
9. Does the computer give you help when you need it?	Yes 51	Sometimes 40	No 9	1.58
10. Does the computer help you correct your mistakes?	Yes 54	Sometimes 29	No 17	1.62
11. Do you have to hurry when you work on the computer?	Yes 4	Sometimes 35	No 61	2.56
12. Do you like computer work better than written assignments?	Yes 88	Sometimes 11	No 1	1.12
13. Is it important to do well on your computer assignments?	Yes 90	Sometimes 9	No 1	1.10
14. Does working on the computer help you do better in school?	Yes 67	Sometimes 33	No 0	1.33
15. Does your teacher know whether you make mistakes on your computer assignments?	Yes 77	Sometimes 17	No 6	1.29
16. Do you get good grades when you work hard in school?	Yes 73	Sometimes 26	No 1	1.28
17. Do you like going to the computer room?	Yes 82	Sometimes 16	No 2	1.20
18. Would you like to go the computer room more often?	Yes 85	Sometimes 8	No 7	1.22
19. Have you worked on a computer in school before this year?	Yes 38	Sometimes 5	No 57	2.18
20. Do you have a computer at home?	Yes 36	Sometimes 2	No 62	2.26

Staff Interview Protocols

Classroom Teacher: Interview

Name:______________________ Date:______________________

School:______________________ Interviewer:______________________

A. BACKGROUND INFORMATION (Initial)

1. What grade/subject areas do you teach in this school?

2. How long have you taught in this school? Other schools?

3. Have you used computers as part of your classroom instructional program before this year? If yes, describe briefly.

4. Have you used computers in other ways? If yes, describe briefly.

5. What types of instruction are computers best suited for? What are they least suited for?

6. Did you have any input in the decision to install the WICAT system in your school? If yes, describe briefly.

B. SCHOOL INFORMATION (Initial)

1. How is staffing organized in your school? (e.g. self-contained classrooms, team-teaching)

2. Do you have all the instructional resources needed? (e.g. textbooks, other instructional materials, supplies, equipment)

3. Is there a set curriculum for each subject area and grade? Are teachers expected to follow the curriculum?

4. How involved is the principal in the daily school instructional program? Does s/he monitor the instructional program in your classroom?

5. Is there a formal inservice or staff development program in this school? If yes, describe topics, schedule, and usefulness of these programs.

6. Is this school involved in other innovative programs? If yes, describe briefly.

7. Describe the use of computers in this school prior to the intr_duction of the WICAT system.

8. How are parents involved in this school? (e.g. types of activities, level of involvement)

C. CLASSROOM INFORMATION (Initial)

1. Describe the student composition of your classroom.

2. How do you typically organize students for instruction? (e.g. individualized, heterogeneous, homogeneous groupings)

3. What types of instructional materials do you typically use in:

   a. reading

   b. math

   c. language arts

   d. other

4. What instructional strategies (methods) do you typically use in:

   a. reading

   b. math

   c. language arts

   d. other

5. How do you typically monitor student performance in your class?

D. USE OF TEACHER COMPUTER SYSTEM (Ongoing)

1. How familiar are you with the WICAT instructional software?

2. How do you interpret the WICAT system in your classroom instructional program?

   a. Prescriptions

   b. Reading instructional software

   c. Math instructional software

   d. Language arts instructional software

   e. Typing

   f. Other

3. How do you decide what WICAT lessons/strands to use?

4. How closely do the following WICAT instructional programs fit with your classroom/district curriculum?

   a. Reading

   b. Math

   c. Language Arts

   d. Other

5. Are students in your classroom working on the same or different lessons/strands?

6. How do you prepare students to go to the computer lab?

7. How has the comptuer program affected your preparation time?

8. What do you like best about the WICAT instructional software?

9. What part of the WICAT instructional software needs improvement?

E. ROLES AND RESPONSIBILITIES (Ongoing)

1. What responsibilities do the following individuals have in terms of operating the WICAT system?

   a. Classroom teachers

   b. Instructional aides

   c. Lab manager

   d. Principal and other building administrators

   e. Central office administrators

2. How would you describe your relationship with the lab manager?

3. How do you and the lab manager coordinate students' instructional programs?

4. How do you use your time when students are in the WICAT lab?

F. STUDENT USE OF WICAT SYSTEM (Ongoing)

1. How often do students go to the computer lab?

2. How does this schedule affect your classroom instructional program?

3. Are there any differences between WICAT instructions and classroom instruction in:

   a. student learning rates? Explain.

   b. student coverage of curriculum? Explain.

   c. retention of instruction? Explain.

4. How do students react to the computer system? (e.g. do the lessons hold their attention, are they paced well?)

5. Do students require assistance when they are working on the computer lessons? Who do they tend to ask for help?

6. Do you see any differences in terms of how students respond to the system? (i.e., age, gender, ability level)

7. Do students interact with each other while working in the lab? Describe briefly.

8. What do students like best about the WICAT system?

9. What do students like least about the WICAT system?

CMI TEACHER EXIT INTERVIEW

School: ______________________ Interviewer: ______________________

Teacher: ______________________ Date: ______________________

A. TRAINING

1. Reflecting on your WICAT Training experiences, how would you rate, on a 1-5 scale, those experiences in terms of preparing you for your role and responsibilities in the WICAT project?

Very Poor				Very Good
___	___	___	___	___
1	2	3	4	5

2. Based on your WICAT training experiences:

   a. what do you see as the strengths of that training?

   b. what do you see as the weaknesses of that training?

3. What changes in training would you make? (additions? deletions?)

B. IMPLEMENTATION

4. a. To what extent did your students learn any concepts or skills in the lab (from the WICAT system) before they learned them in your classroom?

b. How effective was the WICAT system at introducing such concepts and skills in this manner?

5. With respect to the WICAT software:

a. how well would you rate your knowledge of the software?

Very Poor — Very Good

___ 1 ___ 2 ___ 3 ___ 4 ___ 5

b. what kind of help do you need to know it better?

6. Based on your experience this year, how much time do you think primary and/or intermediate children could spend comfortably and beneficially on the WICAT system?

	Primary	Intermediate
Minutes per day	___	___
Days per week	___	___

7. What subjects would you want in your WICAT program...in order of preference?

C. PROGRAM OUTCOMES

8. What was the extent of integration of the computer system with the regular classroom instructional program? Explain. (strengths and weaknesses)

Very Poor — Very Good

___ 1 ___ 2 ___ 3 ___ 4 ___ 5

9. How effective was the WICAT system in promoting:

a. student participation?

Very Poor				Very Good
___	___	___	___	___
1	2	3	4	5

Explain (provide examples).

b. student attitude?

Very Poor				Very Good
___	___	___	___	___
1	2	3	4	5

Explain (provide examples).

c. student achievement?

Very Poor				Very Good
___	___	___	___	___
1	2	3	4	5

Explain (provide examples).

10. How has the WICAT system affected your own classroom teaching?

11. What other comments would you care to make concerning the WICAT system and your experiences with it?

Lab Manager Interview

Name:______________________ Date:______________________

School:______________________ Interviewer:______________________

A. BACKGROUND INFORMATION (Initial)

1. How were you selected to be the lab manager at this school?

2. What positions did you hold prior to your appointment as lab manager?

3. How much contact did you have with the principal and faculty in this school prior to your appointment as lab manager?

4. Have you had other experiences with computers before this year? If yes, describe briefly below.

B. TRAINING (Initial and Exit)

1. Describe the WICAT training you have received.

2. What did you like best about the training?

3. In what areas are improvements needed?

4. Are there other areas in which training is needed? If yes, describe briefly.

5. When you have questions about the system, to whom do you go for help?

C. RESPONSIBILITIES AND DUTIES (Ongoing)

1. Describe your "typical" day as a lab manager.

2. What percentage of time do you spend in a typical week on the following activities:

	Hours/Minutes
Planning with classroom teachers	
System maintenance and upkeep	
Backup of students daily work	
Providing student records	
Troubleshooting hardware/software problems	
Supervising students in lab	
Other	

3. In what ways do you typically interact with:

a. classroom teachers?

b. instructional aides?

c. students?

d. principal and other building administrators?

e. central office administrators?

f. WICAT?

g. other?

4. What do you like best about your responsibilities?

5. What changes would you make in your responsibilities? Why?

D. USE OF LAB (Ongoing)

1. How are students scheduled in the lab? Are there any problems with this schedule?

2. What do classroom teachers do when their students are in the lab?

3. How familiar and adept are the teachers with the computer lessons?

4. How do students react to the computer lessons? (e.g. do the lessons hold their attention, are they paced well?)

5. How much assistance do students require when they are working on the computer lessons? Who do they tend to ask for help?

6. What do you do with students when the system is down?

E. MAINTENANCE OF SYSTEM (Ongoing)

1. Is the WICAT computer lab well maintained?

2. Do you have all the WICAT hardware, software, and other supplies needed?

3. How often is the WICAT system down? For how long?

4. What are the most common reasons for the system to fail? Are there any ways to prevent these problems from recurring?

5. What procedures do you follow when the WICAT system is down?

6. Are there any ongoing maintenance issues that need attention? If so, describe briefly.

7. How responsive is WICAT when you're having problems with the system?

CMI LAB MANAGER EXIT INTERVIEW

School: ______________________ Interviewer: ______________________

Lab Manager: ______________________ Date: ______________________

A. TRAINING

1. Reflecting on your WICAT Training and follow-up experiences, how would you rate, on a 1-5 scale, those experiences in terms of preparing you for your role and responsibilities in the WICAT project?

Very Poor ... Very Good

___	___	___	___	___
1	2	3	4	5

2. Based on your WICAT training and follow-up experiences:

a. what do you see as the strengths of that training and follow-up?

b. what do you see as the weaknesses of that training and follow-up?

3. What changes in training would you make? (additions? deletions?)

B. IMPLEMENTATION

4. Based on your experience this year, how much time do you think primary and/or intermediate children could spend comfortably and beneficially on the WICAT system?

	Primary	Intermediate
Minutes per day	___	___
Days per week	___	___

5. What percentage of time do you spend in a typical week on the following activities:

	Hours/Minutes
Planning with classroom teachers	______________
System maintenance and upkeep	______________
Backup of students daily work	______________
Providing student records	______________
Troubleshooting hardware/software problems	______________
Supervising students in lab	______________
Other	

6. How often is the WICAT system down? For how long? For what reasons?

7. How responsive has WICAT been when you're having problems with the system?

8. Are there any ongoing maintenance issues that need attention? If so, describe briefly.

9. What changes have been made in how students are scheduled in the lab? Why?

5. What percentage of time do you spend in a typical week on the following activities:

	Hours/Minutes
Planning with classroom teachers	
System maintenance and upkeep	
Backup of students daily work	
Providing student records	
Troubleshooting hardware/software problems	
Supervising students in lab	
Other	

6. How often is the WICAT system down? For how long? For what reasons?

7. How responsive has WICAT been when you're having problems with the system?

8. Are there any ongoing maintenance issues that need attention? If so, describe briefly.

9. What changes have been made in how students are scheduled in the lab? Why?

10. To what extent have the teachers become familiar and adept with the computer lessons?

11. What changes would you make in your responsibilities as a Lab Manager? Why?

C. PROGRAM OUTCOMES

12. What was the extent of integration of the computer system with school operations? Explain.

Very Poor				Very Good
____	____	____	____	____
1	2	3	4	5

13. How effective was the WICAT system in promoting:

a. student achievement?

Very Poor				Very Good
____	____	____	____	____
1	2	3	4	5

Explain (provide examples).

b. student participation?

Very Poor				Very Good
___ 1	___ 2	___ 3	___ 4	___ 5

Explain (provide examples).

c. student attitude?

Very Poor				Very Good
___ 1	___ 2	___ 3	___ 4	___ 5

Explain (provide examples).

14. What other comments would you have regarding the WICAT system and your experiences with it?

Administrator Interview

Name:______________________ Date:______________________

Position:______________________ Interviewer:______________________

School/District:____

A. BACKGROUND INFORMATION (Initial)

1. How long have you held this position? What other positions have you held in this district? Other districts?

2. Have you been involved in other computer instructional programs before this year? If yes, describe briefly.

3. Have you used computers in other ways? If yes, describe briefly.

4. Did you have any input in the decision to install the WICAT system in your school? If yes, describe briefly.

B. SCHOOL INFORMATION (Initial)

1. How is staffing organized in your school? (e.g. self-contained classrooms, team teaching)

2. Does your school have all the basic instructional resources needed? (e.g. textbooks, other instructional materials, supplies, equipment)

3. Is there a set curriculum for each subject area and grade? Are teachers expected to follow the curriculum?

4. How involved are you in the daily school instructional program? Do you monitor the instructional program in the classrooms?

5. Is there a formal inservice or staff development program in this school/district? If yes, describe topics, schedule, and usefulness of the programs.

6. Is the school/district involved in other innovative programs? If yes, describe briefly.

7. Describe the use of computers in this school prior to the introduction of the WICAT system.

8. How are parents involved in this school? (e.g. types of activities, level of involvement)

C. ROLES AND RESPONSIBILITIES (Ongoing)

1. What responsibilities do the following individuals have in terms of operating the computer system?

   a. Classroom teachers

   b. Instructional aides

   c. Lab manager

   d. Principal and other building administrators

   e. Central office administrators

2. How do the classroom teachers and lab manager work tog:ther?

3. How do you and the lab manager work together?

4. Who takes responsibility for overseeing the computer system in your school/district? Is this arrangement satisfactory?

5. How familiar are you with the WICAT instructional software?

6. How responsive is WICAT to your school's needs and requests?

7. How responsive is RBS to your school's needs and requests?

D. USE OF WICAT SYSTEM (Ongoing)

1. How often do students go to the computer lab?

2. How does this schedule affect your school's instructional program?

3. How do teachers use the computer system in their classrooms' instructional program?

4. How closely does the WICAT instructional program fit with your school/district curriculum?

   a. Reading

   b. Math

   c. Language arts

5. How do teachers integrate the computer lab work with their classroom work?

6. What impact has the computer program had on teachers' preparation time?

7. What do you like best about the WICAT instructional software?

8. What part of the WICAT instructional software needs improvement?

9. Is the WICAT computer lab well maintained?

10. How often is the WICAT system down? For how long?

11. Are there ongoing maintenance issues that need attention? If so, describe briefly.

12. Does your school have all the WICAT hardware, software and other supplies neeeded?

CMI ADMINISTRATOR EXIT INTERVIEW

School: ______________________ Interviewer: ______________________

Administrator: ______________________ Date: ______________________

A. TRAINING

1. With relevance to the WICAT training of your teachers, how would you rate, on a 1-5 scale, their training in terms of preparing them for their roles and responsibilities in the WICAT project?

   Very Poor — Very Good

   ___ 1 ___ 2 ___ 3 ___ 4 ___ 5

2. Reflecting on the WICAT training of your teachers:

   a. what do you see as the strengths of that training?

   b. what do you see as the weaknesses of that training?

3. With respect to the WICAT training of the lab manager, how would you rate this training and follow up visits in terms of preparing the lab manager for that individual's role and responsibilities in the WICAT project?

   Very Poor — Very Good

   ___ 1 ___ 2 ___ 3 ___ 4 ___ 5

4. With respect to the WICAT training and follow up visits of the lab manager:

   a. what do you see as the strengths of that training and follow up?

b. what do you see as the weaknesses of that training and follow up?

5. Should there be special training in the WICAT system provided to administrators? Explain.

6. What changes in training would you make? (additions? deletions?)

B. IMPLEMENTATION

7. What subjects would you want in your WICAT program...in order of preference?

8. With respect to the WICAT software:

   a. how good do you feel your knowledge is of the software?

   Very Poor ___1___ ___2___ ___3___ ___4___ ___5___ Very Good

   b. what kind of help do you think you need to know it better?

9. Based on your experience this year, how much time do you think primary and/or intermediate children could spend comfortably and beneficially on the WICAT system?

	Primary	Intermediate
Minutes per day	_____	_____
Days per week	_____	_____

10. To what extent has the WICAT system affected the amount of time you spend interacting with teachers on instructional matters? Explain.

Decreased time Considerably	Decreased Time	About the Same	Increased Time	Increased Time Considerably
_____ 1	_____ 2	_____ 3	_____ 4	_____ 5

11. What has been the most challenging to you in implementing the WICAT system?

12. What changes would you make in implementation of the WICAT system?

C. PROGRAM OUTCOMES

13. What was the extent of integration of the computer system with school operations? Explain.

Very Poor				Very Good
_____ 1	_____ 2	_____ 3	_____ 4	_____ 5

14. How effective was the WICAT system in promoting:

a. student achievement?

Very Poor				Very Good
___	___	___	___	___
1	2	3	4	5

Explain (provide examples).

b. student participation?

Very Poor				Very Good
___	___	___	___	___
1	2	3	4	5

Explain (provide examples).

c. student attitude?

Very Poor				Very Good
___	___	___	___	___
1	2	3	4	5

Explain (provide examples).

15. To what extent has the WICAT system enhanced teacher effectiveness? Explain.

Very Little				Very Much
___	___	___	___	___
1	2	3	4	5

16. To what extent has the WICAT system enhanced teacher communication and cooperation? Explain.

Very Little				Very Much
___	___	___	___	___
1	2	3	4	5

17. What other comments would you have regarding the WICAT system and your experiences with it?

School Observation Form

School Observation Form

School: ____________________ Observer: ____________________

Date: ____________________

A. SCHOOL BUILDING

1. Describe the general upkeep and maintenance of the school.

2. Describe the atmosphere and condition of the hallways and offices. Are they clean and attractive?

3. How quiet/noisy is the school?

4. What is the general climate/atmosphere in the school?

5. How do staff relate to each other?

6. Are parents present in the school? What are they doing?

B. CLASSROOMS

1. Which classrooms did you visit?

2. Describe the general condition and upkeep of the classrooms you visited.

3. Are the classrooms attractive? Is student work displayed?

4. How quiet/noisy were the classrooms you visited?

5. What is general climate/atmosphere in the classrooms?

6. Are there sufficient resources visible in the classrooms? (e.g. textbooks, instructional materials, supplies and e(.pment)

7. What types of groupings are used for instruction? (e.g. individual, heterogeneous, homogeneous)

8. What instructional strategies (methods) are used for instruction? (e.g. workbooks, lecture, small groups, boardwork)

9. How do the classroom teachers integrate the computer program with their classroom instructional program?

   a. Preparation before lab.

   b. Ongoing classwork

   c. Follow-up

   d. Other

10. Other comments:

C. COMPUTER LAB

1. Where is the WICAT lab located in the school?

2. Is the lab clean and well-maintained? Is the lab attractively decorated?

3. What is the general climate/atmosphere in the lab?

4. How quiet/noisy is the lab?

5. How do students work in the computer lab?

   a. Individual/small group

   b. Independently

   c. On task/off task

   d. Involved/enthusiastic/bored

   e. Guessing

6. Do classroom teachers accompany and remain with their students in the lab?

7. How does the lab manager interact with:

   a. teachers?

   b. students?

8. How are student records maintained?

9. Does the lab have all the necessary hardware, software, and other equipment? Please explain.

10. Does the WICAT system operate smoothly? Are there any problems? Explain.

11. Other observations: