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ABSTRACT

This document presents the third year evaluation of the CAI/Cooperative Learning Project. The purpose of this project is to develop a national model for integrating computer-assisted instruction (CAI) through an integrated learning system. The project is a collaborative effort by two Pennsylvania school districts, Hatboro-Horsham and Pittston Area, and Research for Better Schools (RBS). This report begins wit an introduction that provides background information on the project and the evaluation questions addressed by the study. Next, the evaluation design and procedures are described including design, student sample, instrumentation, and data collection and analysis. The findings of the evaluation questions for year three are presented in two sub-sections: program implementation and program outcomes. Finally, general conclusions which relate to the project's evaluation questions as well as implications of the evaluation's findings and conclusions are presented. Included in the appendix are the surveys used in the evaluation as well as the mean survey responses for rated items. (JLB)

# THE CAI/COOPERATIVE LEARNING PROJECT

## Third Year Evaluation Report

by
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# Introduction

This report represents a third-year evaluation of the "CAI/Cooperative Learning Project." The three-year project is a collaborative effort by two Pennsylvania school districts, the Pittston Area School District and the Hatboro-Horsham School District, and Research for Better Schools (RBS). It is federally supported by an Innovation in Education Program Grant.

The introductory section of the report provides some background information on the project and the evaluation questions addressed by the study; later sections of the report describe the evaluation design and procedures, findings, and some conclusions and implications based on these findings.

## Background

Both the Pittston and Hatboro-Horsham School Districts had previously been involved in successful efforts to implement computer-assisted instructional technology. In order to further adopt this technology, in combination with innovative educational practices, the two districts jointly proposed this collaborative project to the Fund for Innovation in Education. Specifically, the project proposed to integrate advanced integrated learning system (ILS) technology with cooperative teaching in the classroom and collaborative learning in the home. It was anticipated that the project could potentially serve as a model for effective computer-assisted instruction that could be nationally validated, disseminated, and adopted by school districts across the nation. To realize this potential, the project needed a sound evaluation plan capable of demonstrating the full extent of its effectiveness. Because of its history in evaluating computer-assisted instructional programs, RBS was invited to collaborate with the two districts in the project, serving as a third-party evaluator.

The project was to include the acquisition of computer hardware and software, initial and on-going teacher training, achievement and attitudinal data collection and analysis, and dissemination. For their software, the two school districts selected a computer-based learning system marketed by Jostens Learning Corporation.

Evaluation Questions

The purpose of the CAI/Cooperative Learning Project is to develop a replicable, independently validated, national model for integrating computer-assisted instruction through an integrated learning system that includes inquiry-based, hyper-media learning and cooperative learning techniques. An original feature of the project is the inclusion of cooperative education, creating a collaborative learning environment both within the classroom and at home. Based on the project goals, as specified in the project proposal, three outcome evaluation questions were formed to focus the evaluation study. They were:

1. To what extent does the project enhance mathematics and language arts achievement for the participating students as measured by an increase in standardized test scores?

2. To what extent does the project enhance positive student and parent attitudes toward learning, the integrated learning system, and education in general?

3. To what extent does the project enhance positive teacher and administrator attitudes toward the integrated learning system and cooperative learning?

The project's first and second year evaluations were primarily descriptive (Beyer, 1991, 1992). As a result of delayed funding and difficulties in ordering and receiving the necessary hardware and software, the project was not initiated until the second half of its first year and, during this time, was not fully operational. An implementation focus for the first year evaluation was designed to help ensure that prerequisite conditions for proper program implementation were met. During year two, the two participating school districts experienced many difficulties with the Jostens Learning Corporations' computer-based learning system. Because of these unexpected problems, which involved both the computer software and hardware, the project reached only a minimal level of operation; the evaluation of the project's second year had an implementation focus as well. During year three, the unexpected and frustrating difficulties with the computer-based learning system were less prevalent and the project was more fully implemented in the two middle schools. However, because this is a summary report of a three-year project, and critical implementation issues remained a key concern, the process evaluation question included in the first and second year reports is also included in this third year report. Thus, a fourth evaluation question was added:

4. To what extent was the project implemented as planned?

A discussion of the findings related to this evaluation question will be presented first to set the stage for interpreting the outcome evaluation findings.

## Evaluation Design and Procedures

This section describes the evaluation design, student sample, instrumentation, and data collection and analysis undertaken by RBS in connection with its third year evaluation of the CAI/Cooperative Learning Project implemented in two middle schools, one in the Pittston Area School District and one in the Hatboro-Horsham School District.

### Design

The approach used to address the evaluation questions was to include quantitative data collection of curriculum-embedded tests and standardized achievement tests. In addition, implementation and attitude measures were to be obtained through survey data collected at the end of the school year and through observations and informal interviews made during periodic visits to each of the sites. A pretest-posttest control group design was to be used to enhance the validity of the findings, although there were differences in the nature of the control or comparison group at each school. For the Hatboro-Horsham School District, the control group was to be constituted from students within the same school who had no contact with computer-assisted instruction. For the Pittston Area School District, the control group was to consist of students within the school who had minimal contact with computer-assisted instruction.

A number of changes were made in the evaluation design originally proposed. Major changes and their rationales are listed below. In terms of the proposed evaluation plan for collecting outcome data:

- The TELLS was not an outcome measure, as planned, as the state (Pennsylvania) discontinued this testing program. However, other standardized test data and curriculum-embedded test data were collected and analyzed as planned.

- Standardized test data from the Hatboro-Horsham School District were not collected and analyzed for year two as this district experienced extensive implementation difficulties (see Beyer, 1992).

- Parent attitude data from the Pittston Area School District were not included in the third year report as the district did not administer the parent surveys.

- During year three, the Pittston Area School District developed reading and mathematics laboratories for implementing the project and scheduled all students to participate, thus eliminating the control group from RBS' evaluation design. This was in response to teacher and teacher union concerns about students missing regularly scheduled classroom instructional time while working on the computer.

- For the year three evaluation, in order to obtain richer and more meaningful data on teacher and administrator attitudes, interviews and observations were emphasized rather than attitude surveys (responses to open-ended survey questions were limited).

In terms of the proposed evaluation plan for collecting process data:

- The cooperative learning component was not fully addressed by the districts. Although during year three the Hatboro-Horsham School District did attempt to implement this component, adequate data were not available for analysis.

- Time-on-task data were not collected and analyzed as informal observations indicated consistently high student engagement rates and very little variability.

Further discussion of some of these issues can be found in the text. Also, because project implementation at each site was very different during year three as compared to years one and two, the focus of this evaluation report is on the project's third and final year.

Student Sample

Different strategies were used at each site to select program and control groups. In the Hatboro-Horsham middle school each grade is divided into two heterogeneous teams, a red team and a black team. For year one, the program group was selected from only the red team and consisted of the 25 lowest-achieving students from each of the sixth, seventh, and eighth grades. All of these students had standardized achievement scores below grade level in mathematics and/or reading. The control group consisted of 25 comparable students from each of the black team's three grades (these students did not have computers in their classes). For years two and three, the seventh and eighth grade program and control groups remained intact, to the extent possible; the new sixth grade groups were assigned using the year one strategy.

For year one, the Pittston middle school was divided into two groups based on standardized achievement test scores, an at-risk or program group (i.e., scoring below the grade level median) and a not at-risk group. All students in the at-risk group were then randomly assigned to one of two groups, a "low use" group which was to receive 15 minutes of computer time per week, or a "high use" group which was to receive 60 minutes of computer time per week (in 15 minute segments). There were approximately 50 students in each group at each grade level. To balance the low and high use groups, students assigned to one group for mathematics were to be assigned to the other group for reading. It should be noted that although the not at-risk group also spent time on the Jostens computer learning system, their data are not included in this report as the focus of the project was to be on low-achieving students. For year two, the seventh and eighth grade groups remained intact, to the extent possible, and the incoming sixth grade groups were formed using the year one strategy. For year three, the district administration established two computer laboratories for the project, one for reading and one for mathematics, in response to teacher concerns that integrating computers into the classroom was disruptive and difficult to monitor; the administration was also responding to concerns of the local teachers' union. As a result of the change in design, the control group was eliminated and all students participated in the Jostens computer laboratories on a six-day, rotating schedule. Also, in each school, program students (five at a time) were to be on a rotating schedule to bring a computer home for a six week period.

Instrumentation

A number of evaluation instruments were developed by RBS, and approved by the districts, for use in the three-year study. They included the following:

- Administrator Attitude Survey
- Teacher Attitude Survey
- Student Attitude Survey
- Parent Attitude Survey
- Computer Home Use Survey.

The administrator and teacher attitude forms contain questions which address concerns regarding the new computer learning system, the advantages and disadvantages of the system, the adequacy of training and follow-up technical assistance, the implementation of the system, the adequacy of the computer curriculum, and the effectiveness of the computer learning system. The student attitude form addresses attitude toward using the computer in school, and the advantages and disadvantages of the computer learning system; and the parent attitude form and the home use form ask about parent involvement in the program, their child's attitude toward participation, and the advantages and disadvantages of the computer learning system. The home use survey is developed for parents of those students, who on a rotating basis take a computer home to increase their time on the system and their parents' involvement in collaborative learning.

Achievement data were Jostens student achievement reports and standardized test data (Stanford Achievement Test (SAT) basic skills data for the Pittston Area School District, IOWA Test of Basic Skills (ITBS) data for the Hatboro-Horsham School District). As an additional outcome measure both districts asked to readminister the Jostens Basic Skills Inventory, designed to place students in the reading and mathematics curricula, to all project students at the end of the school year.

Data Collection and Analysis

Process data were collected from both school districts participating in the project. These data were collected primarily through frequent informal interviews, telephone conversations, and on-site observations. Monthly visits were made to each school during which time the computer coordinator was informally interviewed along with at least one reading and one mathematics teacher at each grade level. The interviews focused on implementation progress and issues of concern. Four questions formed the basis of the informal, conversational interviews:

- How has the program been running recently; have there been any changes?

- Describe some parts of the program that are going well?
- Describe some parts of the program that need to be improved?
- Do you think the program is making a difference?

At the Hatboro-Horsham middle school, which experienced extensive difficulties with the computer-based learning system during years one and two, these visits were scheduled, whenever possible, to coincide with the monthly Jostens inservice sessions. The Pittston Area School District developed an observation and interview schedule prior to each of the evaluator's visits. During both classroom and laboratory visits, students were observed working on computers. Also, RBS' time-on-task measure was not used to collect data, as observations of students working on the computer, along with teacher feedback, indicated that students were highly engaged while working through their computer assignments and there was little variability in engagement rates.

The two school districts also submitted third year outcome data for the project which consisted of completed attitude surveys and student achievement data. Attitude surveys were to be administered at the end of the school year, nd year one (for the Pittston Area School District) or year two data (for the Hatboro-Horsham School District) were to serve as a pretest. In cases where pretest data were not available (e.g., for the new sixth grade students), surveys were administered two times, at the be..nning and end of the school year.

Analyses were planned for both attitude and achievement data. Responses to items on the student, and parent surveys were analyzed separately for each evaluation instrument. Also, only the student survey data were compared to earlier findings; because parents did not include their names on the surveys, it was not possible to match their data over time. The SAT and ITBS data were used to examine student achievement in reading and mathematics. It should be noted that the 1993 ITBS data were provided to RBS during the last week in August, 1993 and the 1992 ITBS data were provided at the end of October, 1993, rather than in mid-June, as originally promised. As a result of renorming the test in 1992 (the previous norms were from 1988), the publisher had to develop a new program and restructure the scoring services which was reported to have taken more time than originally anticipated. The SAT was also renormed in 1993.

In order to assess overall achievement gains, students' 1993 standardized test scores (posttest) were compared to students' scores when entering the program (pretest). Thus, for the Pittston Area School District, the 1992-1993 sixth grade participated one year, and the 1992-1993 seventh and eighth grades participated two years (the site was only in partial operation during year one). For the Hatboro-Horsham School District, analyses were based on only a one-year participation for all 1992-1993 students, as outcome data were not collected during previous years due to extensive implementation problems. These analyses were carried out in terms of normal curve equivalents (NCEs) in order to look at students' achievement growth; an NCE change of zero indicates that students' achievement growth rate equals the rate of the representative national sample. In terms of the curriculum-embedded basic skills data, in addition to initial placement and final placement, the number of lessons students completed during the year was also made available. The lesson data were analyzed to address project implementation and to set the stage for the discussion of outcomes. Both districts felt that the computer generated reports of student time were not valid as the software grossly underestimated the amount of time students spent on the computer learning system.

## Findings

The findings presented in this section of the report relate to the evaluation questions for year three. They are discussed below in two separate sub-sections, program implementation and program outcomes. As indicated earlier, because of significant changes in implementation during year three, the focus of this evaluation report is on the project's third and final year.

### Program Implementation

Specific feedback on implementation of the project was obtained from informal interviews with teachers and computer coordinators, on-site observations, and telephone contacts. These data are discussed below under the implementation evaluation question. Additional interview data is presented in the Program Outcomes section of the report.

#### To what extent was the project implemented as planned?

In the fall of the 1992-1993 school year, each of the two sites ordered and received additional hardware and software to continue their implementation of the project during its third year; student groups were updated/redefined; parents of newly-participating students were provided with information on the project; and schedules were developed for student computer use and data collection. Following these initial preparations, the two school districts attempted to implement the project, as described below.

The Hatboro-Horsham School District. During the first two years of the project, the Hatboro-Horsham School District experienced extensive problems related to the functioning of both the computer hardware and software (Beyer, 1991; Beyer, 1992). In spite of these problems, the district continued to work toward the project goals. Teachers were trained in the use of the ILS, and they met on an on-going basis with the project coordinator, and monthly with the Jostens trainer, to discuss implementation issues.

Although some of these problems continued during the project's third year, the Jostens Learning System was operating more smoothly than it had previously. The major problem continued to be that, while working on the computer learning system, students were frequently presented with lessons which they had previously completed, which meant their progress was not being stored in the system. These errors were reflected in student achievement reports; when data on lessons completed are not stored, all other reporting data (e.g., average scores, times, dates) are obviously inaccurate. Additional problems included a faulty repeater, printing difficulties with IBM network software, lessons freezing, printers producing pages of nonsense, and lessons being omitted from instructional units.

To address problems with the operation of the Jostens Learning System, the computer coordinator monitored the file server and documented student progress on a daily basis. The documentation was then provided to Jostens representatives, who hypothesized several solutions, e.g., installing the latest update of the software (2.95); updating the CD player to be compatible with the file server. At one point, the documentation and data files were sent to a Jostens consultant in San Diego, California. After district persistence, Jostens agreed to provide an open line for support, at no additional cost to the district, until the technical problems were resolved. In addition, teachers reported that the monthly staff meetings with the Jostens representative were helpful. This was due, in part, to the efforts of the computer coordinator, who set meeting agenda around the staffs' expressed needs.

With the district's constant attention throughout the school year, the major problem of lessons repeating was reduced, but not eliminated. as was the level of frustration among teachers and students. Ironically, at the end of the school year, the computer coordinator from the Pittston Area School District solved the lesson repetition problem! In cases where IBM software is used, a "fairness switch" in the file server must be turned off. This discovery, which Jostens did not communicate, is obviously critical for all IBM installations.

Early in the 1992-1993 school year, the Assistant Superintendent for Curriculum from the Hatboro-Horsham School District requested a meeting with Jostens staff to discuss the status of the Jostens project in the district. Attendees at the meeting, which was held in late October, included: the Assistant Superintendent, the middle school principal, and the project coordinator from the Hatboro-Horsham School District; the project coordinator from the Pittston Area School District; the RBS project evaluator; and six Jostens staff, including regional representatives and the corporation's Director of Testing and Evaluation. As a result of the meeting, Jostens recommended expanding the outcome evaluation of the project, and a number of alternatives were proposed, e.g., creating a criterion reference test, developing a writing assignment. Although these were quality suggestions, the district and RBS agreed that, because implementation issues were still paramount, the proper functioning of the computer learning system should continue to be the main focus, rather than an outcome evaluation. They also agreed that the goals of the project should not change during the project's third and final year. It should be noted that the recommendations offered were both time consuming and costly.

During the 1992-1993 school year, the Hatboro-Horsham School District also attempted to implement the home learning and cooperative learning components of the program. In terms of the home learning component, there were two rotations of five computers for sixth and seventh grade students and one rotation of five computers for eighth grade students. Three reasons were offered for why more students were not involved. First, the district decided that the home placement would be more meaningful if students could spend at least four months with the computers. Second, the computer coordinator experienced difficulty obtaining parental interest and support for their child having a computer at home. And, third, it was difficult coordinating home-school procedures (e.g., updating diskettes, transferring lesson results) and thus students were frustrated by lesson repetitions at home. In spite of these difficulties, the district continued to communicate with parents and to involve them in the project; most of these students were able to complete lessons and move through the curriculum.

In the middle of the school year, after the system was up and running, the middle school principal met with the RBS evaluator, the computer coordinator, and the the district staff developer to plan for the implementation of cooperative learning in the classroom. This component of the project had been set back due to the malfunctioning of the system. It was decided that the staff developer would provide support to one teacher from each grade level (sixth, seventh, and eighth) in integrating cooperative learning with the Jostens Learning System. Cooperative learning was broadly defined as having a student who was using the computer on a particular day be "updated" on the portion of the class lesson he or she missed by a student who was not using the computer that day. During interviews and observations these teachers indicated that they were beginning to experiment with the integration of cooperative learning with student's use of computers. One other area with which teachers began experimenting was the use of Alternate Learning Pathways (ALPS), a component of Jostens updated curriculum. Through the use of ALPS, teachers could design lessons to match their current instructional topics.

The Pittston Area School District. The project's third year also ran more smoothly for the Pittston Area School District. By November, some technical difficulties experienced early in the year were resolved (e.g., malfunctioning base band unit, systems engineer taking several weeks longer than expected to upgrade the Jostens curriculum). Following the Hatboro-Horsham meeting with Jostens representatives, Pittston administrators scheduled a parallel meeting, which was, unfortunately, scheduled and canceled on three occasions due to inclement weather. In addition to technical problems, some district changes also affected the operation of the project. Specifically, there were three new project teachers who were not familiar with the Jostens Learning System, the computer coordinator had multiple competing responsibilities that limited the amount of time he could devote to the project, and the use of the Jostens system was dramatically changed, as described below.

At the beginning of this last year of the project, the Pittston Area School District made some major changes in how students were to be scheduled to use the Jostens Learning System. As previously indicated, the original evaluation design included an experimental or "high use" group receiving one hour of computer time per week and a control or "low use" group receiving 15 minutes of computer time per week. The difficulties which the district experienced with this design were three-fold. First, it was difficult for teachers to monitor and manage students' computer time (i.e., the limited number of computers per class made it difficult to schedule students for 60 minutes of computer time a week; teachers reported that students in the 15-minute condition frequently did not have their time recorded on the system). Second, the experience of reading teachers participating in the project was that having students use computers during class time was disruptive, e.g., students working on computers missed important instruction which meant teachers had to reteach portions of their lessons (some mathematics teachers voiced this objection as well, although to a lesser degree). And third, the local teacher's union was concerned about students missing regularly scheduled instructional time while working on the computer.

To address these scheduling problems, the district created two Jostens laboratories, one for reading and one for mathematics. In November, the reading teachers began bringing their classes to the laboratory, once every six days, for an entire day, during which each class spent an entire class period of approximately 45 minutes working on the Jostens reading curriculum. Because the laboratory only had thirteen computers, and each class had more than 13 students, the overflow of students fro' the laboratory was assigned to work on computers in other reading teacher's classrooms (this meant that reading teachers could not use the computers in their own classrooms, as they were being used by these other teacher's students).

The mathematics laboratory was not operational until mid-year, when the necessary wiring was completed for the thirty newly-purchased computers. Prior to that time, teachers rotated students on the computers in their classroom, in most cases aiming to provide all project students with the same amount of computer time each week (the weekly times estimated by teachers ranged from 20 to 60 minutes). The mathematics laboratory then operated on the same six-day schedule as the reading laboratory, but without the student overflow problem.

During informal interviews, all teachers agreed that the change to a laboratory setting was an improvement in the operation of the Jostens Learning System, and many commented that the laboratory setup forced them to be more aware of the Jostens curriculum and more involved in their students' computer work. For example, one teacher commented that, "Last year, I seldom saw what kids were actually doing on the computer." Another said, "I like the lab and monitoring kids. Some kids aren't mature enough to use the system on their own and need a little assistance." In addition, observations confirmed that teachers were comfortable in their new role of managing and monitoring an entire class working on computers. One teacher commented, "It's very structured this year and I like the control. I wasn't really happy last year." Another teacher said, "I like the lab a lot and kids like it. It's 110 percent better."

The Pittston Area School District also experienced some difficulty implementing the home learning portion of the project. The major problem was that the software discs for the home units did not function properly, and Jostens representatives were very slow in responding to district requests for technical assistance. In addition, as in the Hatboro-Horsham School District, it was difficult to obtain parental interest in having their child have a computer at home. After the technical problems were resolved, one rotation of twelve computers was used at home, from March 1993 to the end of the school year. In addition, cooperative learning was not part of this district's third year implementation because, as originally defined (i.e., pairing students working on and off the computer), it was incompatible with a laboratory setting.

Program Outcomes

Specific information on outcomes resulting from the two school districts' implementation of the computer project was gained from attitude surveys, end-of-year interviews, Jostens student achievement reports, and standardized achievement tests. The sections below describe and discuss analyses of this survey, interview, and achievement data.

Survey data. Attitude surveys were administered to students at the end of the school year. These data are briefly described below and are compared to students' initial survey results (all students were administered a student survey upon entering the program). A summary of all quantifiable student survey data (i.e., mean ratings) is presented in Appendix A. The results of the parent surveys are also summarized below (as noted earlier, these surveys were only administered in the Hatboro-Horsham School District).

The student survey was completed by 47 sixth, seventh, and eighth grade students from the Hatboro-Horsham School District. Overall, student end-of-year responses to the survey's 30 "yes-no" items were positive, although less positive than students' initial responses (i.e., 23 of the 30 items showed a decrease, ranging from 1 percent to 32 percent). Students indicated that the computer is easy to use, that they like computer work better than written assignments, that they can do most of the computer lessons without help from anyone else, that the computer helps you to correct your mistakes, and that your teacher knows when you make mistakes on your computer assignments (79 percent or more of the students responded positively to these items). Most students (87 percent) also recognized that it is important to do well on computer assignments. Fifty-four percent of the students felt that the computer helped them to learn math better, 43 percent felt that it helped them to read better, and 60 percent indicated that their parents think they are learning from the computer. The biggest changes from students' initial reports were: an increase of 12 percent in students who feel that their teacher knows when they make mistakes on their computer assignments; and a decrease of 18 percent or higher in students who feel that computers make it fun to learn and working on the computer is fun, computers make school subjects more interesting, who like going to the computer and using the computer at school, who would like to go to the computer more often, and who get bored working on the computer by themselves. Interestingly, this latter finding is in direct opposition to observations and teacher reports of generally high student interest and engagement rates.

It should be noted that, in spite of the decreases, the majority of students responded positively to most of the survey items. Also, the end-of-year survey appears to reflect a more negative student attitude in general, e.g., positive responses to the question, "Do you like school?" decreased from 83 to 51 percent over the pretest-posttest interval. The less positive end-of-year responses could be accounted for, in part, by the fact that the survey was administered right before summer recess. And, during interviews, teachers indicated that some students were "turned off" by the tedious technical problems (i.e., repeating lessons).

In the Pittston Area School District, end-of-year survey results from 198 students were matched with students' initial results. Overall, the end-of-year responses were very positive, although in this district they were also less positive than students' initial responses (i.e., 23 of the 30 items showed a decrease, ranging from 1 percent to 44 percent). Students reported that they like going to the computer, they like computer work better than written assignments, that it is important to do well on computer assignments, that your teacher knows whether you make mistakes on your computer assignments, that they can do most of the computer lessons without help from anyone else and that they do not have to hurry, and that the computer helps you correct your mistakes (80 percent or more of the students responded positively to these items). Fifty-seven percent of the students reported that the computer helped them to learn math better, 41 percent felt that it helped them to read better, and 59 percent reported that their parents think they are learning from the computer. The most positive change was an increase of nine percent in the same item as the Hatboro-Horsham district, i.e., students who felt that their teachers knows when they make mistakes on their computer assignments. The most negative change was, 44 percent of the respondents changed their mind and felt that the computer was not easy to use. Also, there was a decrease of 20 percent or higher in students who felt that computers make it fun to learn, who find the computer lessons interesting, and who reported that they get bored working on the computer by themselves. Similar to Hatboro-Horsham, this latter finding is contrary to observations and teacher reports. However, in spite of these decreases, the majority of the students in this district also responded positively to 23 of the 30 items.

At the end of the school year, the Hatboro-Horsham School District sent the parent survey to all parents of students in the computer learning project. After repeated requests to complete and return the forms, more than half of the parents (56 percent) complied, representing twelve or thirteen students from each grade level.

In terms of parental knowledge of and involvement in the computer learning system, 62 percent indicated that they were somewhat informed about the computer learning system at their child's school, 5 percent reported that they were well-informed, and 14 percent reported that they were not informed about the computer learning system. Most parents indicated that they were encouraged to visit school (mean rating of 3.4 on a 5-point scale) and that they were specifically invited to visit their child's classroom (63 percent). However, only 32 percent did visit, and only 11 percent took advantage of an opportunity to observe their child working on the computer. Most parents reported that teachers did not discuss their child's program on the computer (78 percent), and did not keep them informed of their child's progress on the computer (mean rating of 2.5 on a 5-point scale). Interestingly, prior to their child's participation in the project, parents were sent a letter describing the project and requesting permission for their child to participate. During interviews, some teachers reported sending print-outs of student work home.

In terms of parents' observation of changes in their child's attitude as a result of participation in the computer learning system, less than half of the parents reported that his or her child talks about work on the computer (14 percent), is more enthusiastic about school (25 percent), or likes school better because of computer work (19 percent). However, many parents reported that their child feels good about the academic progress being made on the computer (3.0 mean rating on a 5-point scale). Also important, many parents reported that their child's mathematics skills have improved because of the computer program (3.0 mean rating on a 5-point scale), and, to a slightly lesser extent, that reading skills and writing skills have improved as well (2.8 rating for each item on a 5-point scale).

Interview data. During end-of-year interviews, teachers were asked to reflect on the implementation of the project and to identify its major strengths and weaknesses. In the Hatboro-Horsham School District, the six participating teachers were interviewed, along with the computer coordinator and school principal.

Of the eight Hatboro-Horsham staff interviewed, seven indicated positive attitudes toward the computer learning system and their involvement in the project. With one exception, all staff interviewed identified the major benefit of the Jostens system to be reinforcement of needed skills, particularly those below grade level skills which teachers do not have time to address in class. Other benefits which several staff mentioned were: computer work is an alternative means of presenting information to students who have been difficult to reach with traditional methods; and computer work is motivating to some students who experience little success in class. Th ee staff indicated that they are looking forward to next year, when they will have more freedom in how the computer learning system is being used; two staff noted that they personally benefited from the project as their computer literacy was increased and having to integrate technology caused them to rethink their traditional teaching strategies.

Although most teachers felt it was too soon to comment on the impact of the project, three teachers did offer positive comments. First, an eighth grade mathematics teacher indicated that this year she was recommending more students for ninth grade algebra, as opposed to basic mathematics, than in previous years. She felt that Jostens was a contributing factor. Second, another teacher reported that, "A few students may have learned more from Jostens than they did in the classroom....It's a benefit for me with classroom management and for students because they don't have the needed social skills." A third teacher, commenting on her own personal growth, said: "I feel much more comfortable after three years. I can print reports and move kids around if I have to. I hate to give them (computers) up but I know others (teachers) will want them."

The one teacher who did not have a positive experience with the project, felt that, although the computer learning system has a lot of potential, she experienced too many implementation problems for it to be successful. For example, she tried to take advantage of Jostens' capability to design alternative learning pathways (ALPs), only to find that the system did not function properly (i.e., lessons were included in the ALP which she did not select, and all selected lessons were not included). This eighth grade teacher also felt that many of her students did not like using computers because of the stigma of being identified as part of the project. However, she did conclude that, "It was worth a try for three years. Although implementation didn't go well, we moved [in the right direction]."

The major disadvantage cited by all other staff interviewed was the large number of technical problem experienced, particularly during year two (e.g., repeating lessons, freezing lessons, skipping lessons, inaccurate times). Two staff felt that integrating computers into their classroom instruction was difficult and that, while on the computer, students were missing classroom instruction on prerequisite skills for the next grade level. Several also had specific suggestions for Jostens around the improvement of individual lessons and lesson formats.

In the Pittston Area School District, the twelve participating teachers were interviewed, along with the computer coordinator and district administrator working with the project. When asked to identify the most positive aspects of the computer learning system, all staff interviewed commented favorably on the new laboratory setting. They found the laboratory to be less disruptive, students did not miss classroom instruction while on the computer, and teachers liked being more involved in and aware of students computer work. For example, after students take unit tests on the computer, they are moved ahead in the Jostens curriculum regardless of their test score. In a computer laboratory setting it is much easier for a teacher to know when students are taking unit tests. One teacher added, "I can see what students are doing, and they can't use 'I was working on the computer' as an excuse."

Similar to the Hatboro-Horsham staff, the most commonly cited benefits of the computer learning project by Pittston Area School District staff were: the reinforcement of needed skills, increased interest and motivation of lower performing students (in fact, teachers indicated that many students were disappointed on days when the computer system was down and regularly scheduled computer time had to be canceled. Five staff also commented on the evolution of the project over the three-year period and the significant increase of student and staff computer skills. One teacher noted, "I was 'anti' three years ago. Now they're [the computers] fabulous. It made me a believer. I can actually see kids learning subtraction on the screen." Also similar to Hatboro-Horsham, staff felt it was too early to determine the impact of the project.

Approximately half of those interviewed commented on the Jostens reporting system. With the new laboratory setting, teachers were being provided with Jostens student achievement reports immediately following their day in the laboratory, and they found the reports to be timely and helpful both to themselves and to students as well. Three teachers also commented favorably on Jostens newly developed exception reports. These reports, made available with the latest curriculum update, helped teachers to identify the lowest performing and highest performing students in their classes (i.e., those scoring above 85 percent and below 60 percent). Two teachers and the administrators interviewed felt that a strength of the project was its integration into the regular school curriculum. For example, students were given grades for their work with Jostens, and these grades were included on students quarterly performance reports.

Of the staff interviewed, half reported the major disadvantages of the computer learning system to be technical and the other half identified implementation issues. The technical issues cited included: inconsistencies in some of the software (e.g., cannot see a previous screen, inconsistent or confusing instructions), portions of the curriculum are too elementary, the fact that time was grossly underestimated. As one teacher said, "Everyone's really following the schedule and trying to get the minutes in, but the times are way off." Implementation issues included: the reading laboratory should have enough computers to accommodate an entire class, the project needs more time from the computer coordinator to respond to teacher needs and facilitate interaction. Several teachers said their classes were mixed, i.e., "some kids love it, and some kids hate it."

During interviews the administrators showed strong support for the project and a commitment to not only continue but also to expand the use of Jostens during the next school year. The primary focus of the expansion will be on the use of ALPs and the integration of ALPs into outcome-based education.

Achievement data. The first type of achievement data analyzed was the Jostens student achievement reports. The rationale for looking at these data is that, if the computer learning system is to have an impact on student achievement in general, it must first be demonstrated that students made substantial progress in the system, in terms of lessons completed. And, as noted earlier, both districts requested that the Basic Skills Inventory (BSI), the curriculum-embedded test designed for student placement in reading and mathematics, be readministered to project students at the end of the school year and that the data be provided to RBS for analysis. Caution should be used in interpreting these later analyses as the BSI was developed as a gross measure to place students in the Jostens curriculum, not as a measure of achievement or student progress.

Performance records were maintained by the system for each student's interaction with the curriculum and the level, unit, and lesson in which the student was engaged. The districts were asked to provide RBS with students' beginning placements and number of lessons completed, in addition to end-of-year placements. Although, in the Jostens curriculum, the numbers of lessons per unit and units per grade level are not consistent from grade to grade, the number of lessons completed was felt to be one of the best available measures of student progress in the system (as noted earlier, the computer software did not accurately record the amount of time students were logged on the system).

For the Hatboro-Horsham School District, the mean number of lessons completed by project students, for reading and mathematics, is presented in Table 1, along with standard deviations. As the table indicates, sixth grade students completed the greatest number of lessons over the course of the year (213), followed by eighth grade students (147). Seventh grade students completed relatively few lessons (56). Sixth and eighth grade students completed more reading than mathematics lessons, while seventh grade students completed few lessons in both reading and mathematics. In addition, the standard deviations indicate a large amount of variability within each group.

In interpreting these data it should be noted that the **Jostens Student Achievement Report Manual** recommends that students complete 12 to 15 lessons over an instructional interval of 4 weeks. It goes on to indicate that students completing fewer than 10 lessons during a 4-week period will be progressing too slowly to make meaningful progress. If this guideline were followed: the system was being implemented at about the recommended level, by sixth grade students; at about the recommended level, by eighth grade students (for reading only); and at a level much lower than that recommended by Jostens for achieving academic growth, by seventh grade students.

As an aid to interpreting the lessons completed data, the total number of units and lessons sequenced in the various levels of the Jostens reading and mathematics curricula were obtained from a Jostens consultant (see

Table 1

Mean Number of Reading and Mathematics Lessons Completed
Hatboro-Horsham School District

| Grade | N | Lessons Completed: Reading # | SD | Mathematics # | SD | Total |
|---|---|---|---|---|---|---|
| 6 | 27 | 129 | 48 | 84 | 15 | 213 |
| 7 | 24 | 27 | 15 | 29 | 11 | 56 |
| 8 | 20 | 100 | 32 | 47 | 28 | 147 |

Table 2 below). Although Jostens program levels are not equivalent to school grade levels, if students move at the recommended pace it is reasonable to expect that they will complete a minimum of all lessons at one level of difficulty during a school year. Applying these data to those displayed in Table 1, it appears that the sixth grade students completed about a level and a third of the reading curriculum, and a little less than a level of the mathematics curriculum. Seventh grade students completed about a third of a level of each curriculum. And eighth grade students completed a little more than one level of the reading curriculum, and about half of a level of the mathematics curriculum.

Additional analyses were carried out on the mean BSI placement levels and the mean increase in program level based on the BSI pre- and posttesting. Included in Table 3 are the number of students in each grade (N), the mean BSI placement level, the mean BSI placement level based on end-of-year testing, and the mean pre-post increase. As the table shows, most students participating in the project were initially placed on the third or fourth grade level, with the placements for sixth grade students being closest to their actual grade levels. In terms of the pre-post increases, mean gainsfor seventh and eighth grade mathematics were approximately one and one half years; the mean gains for sixth grade mathematics and sixth, seventh, and eighth grade reading were between one half and one year. The inconsistencies for the seventh grade, between the BSI and lessons completed analyses should be noted. In interpreting these gains it should also be noted that placement points for the reading curriculum, Levels 2 through 6, are the first lesson of each level (Level 1 has 3 placement points); placement points for the mathematics curriculum are at the first lesson or mid-point of each level.

Table 2

Total Number of Units and Lessons in the Jostens Curricula*

| Curriculum Area/ Level | Number of Units | Number of Lessons |
|---|---|---|
| Mathematics | | |
| Level 1 | 11 | 100 |
| Level 2 | 13 | 111 |
| Level 3 | 11 | 91 |
| Level 4 | 11 | 77 |
| Level 5 | 12 | 80 |
| Level 6 | 12 | 71 |
| Reading | | |
| Level 1 | 8 | 91 |
| Level 2 | 10 | 109 |
| Level 3 | 10 | 99 |
| Level 4 | 10 | 93 |
| Level 5 | 12 | 106 |
| Level 6 | 11 | 101 |

*The numbers in the table were obtained via telephone from a Jostens consultant, August-September, 1993.

Thus, the Jostens BSI was developed as a placement tool, not a measure of progress, and therefore is most likely not a sensitive indicator for measuring student achievement.

Table 3

Student Basic Skills Inventory (BSI) Scores by Grade
Hatboro-Horsham School District

| Grade/Subject | N | Mean Placement Initial | Mean Placement End-of-Year | Increase/ Decrease |
|---|---|---|---|---|
| 6th Grade | | | | |
| Reading | 25 | 4.4 | 5.0 | .6 |
| Mathematics | 25 | 3.6 | 4.3 | .7 |
| 7th Grade | | | | |
| Reading | 24 | 3.3 | 4.1 | .8 |
| Mathematics | 24 | 2.5 | 3.9 | 1.4 |
| 8th Grade | | | | |
| Reading | 18 | 4.4 | 5.0 | .6 |
| Mathematics | 18 | 4.2 | 5.7 | 1.5 |

Tables 4 and 5 present similar analyses of the Jostens student report data for the Pittston Area School District. As indicated in Table 4, the sixth grade implemented the program at a higher level than the seventh grade for mathematics, and at a slightly lower level than the seventh grade for reading (unfortunately, data for grade 8 were not provided to RBS). However, using both Jostens' guideline for the number of lessons to be completed each week and also the total number of lessons in each curricula level (see Table 2) to interpret the data, both grade levels were progressing through the curricula at a rate lower than that recommended by Jostens for achieving academic growth.

Table 4

Mean Number of Reading and Mathematics Lessons Completed
Pittston Area School District

| Grade | N | Lessons Completed: Reading # | Reading SD | Mathematics # | Mathematics SD | Total |
|---|---|---|---|---|---|---|
| 6 | 44 | 41 | 11 | 79 | 29 | 118 |
| 7 | 56 | 55 | 17 | 29 | 19 | 84 |
| 8* | -- | -- | | -- | | -- |

*Data not provided to RBS.

Table 5

Student Basic Skills Inventory (BSI) Scores by Grade
Pittston Area School District

| Grade/Subject | N | Mean Placement: Initial | Mean Placement: End-of-Year | Increase/ Decrease |
|---|---|---|---|---|
| 6th Grade | | | | |
| Reading | 70 | 4.5 | 4.1 | -.4 |
| Mathematics | 70 | 3.9 | 3.9 | 0 |
| 7th Grade | | | | |
| Reading | 74 | * | 4.0 | -- |
| Mathematics | 74 | * | 4.0 | -- |
| 8th Grade | | | | |
| Reading | 67 | 3.8 | 4.7 | .9 |
| Mathematics | 67 | 3.9 | 4.6 | .7 |

*Data not provided to RBS.

Analyses of the mean BSI placement levels and the mean increase in program level based on the BSI pre and posttesting are presented in Table 5. Similar to the Hatboro-Horsham district, most project students were initially placed on the third or fourth grade level (unfortunately, initial placement data for the seventh grade were not provided to RBS). In terms of pre-post increases, the sixth grade had a small decrease in reading, and no change in mean mathematics placement level, and the mean gains for eighth grade reading and mathematics were close to one grade level (.9 and .7, respectively).

In addition to student progress on the Jostens curriculum, another focus of the evaluation is on the extent to which progress on the computer system is transferable to standardized achievement tests. Tables 6 and 7 present analyses of ITBS mathematics and reading scores for the Hatboro-Horsham School District. The scores are presented as normal curve equivalents (NCEs) by grade and group, for tests administered in the spring of 1992 (pretest) and 1993 (posttest). Students' scores in both the experimental and control groups are matched for the two years.

NCEs are normalized standard scores, with 50 indicating the national average or grade level. An NCE gain of zero from one year to the next would signify that students maintained the same relative standing with respect to the norm group, which is what would be expected to occur without any special program or intervention. However, the general rule of thumb is that only NCE changes of three or more are considered to be educationally significant. As the comparisons in Tables 6 and 7 indicate, overall, students in the Jostens program had more significant increases than the control students. Four out of six comparisons were significant for the experimental group (i.e., seventh and eighth grade reading and mathematics), whereas only two out of six comparisons were significant for the control students (i.e., eighth grade reading and

Table 6

Mathematics Achievement Test Scores (ITBS) for
Experimental and Control Groups
Hatboro-Horsham School District

| Grade/ Group | N | ITBS (Mean NCE) 1992 | 1993 | NCE Gain | t |
|---|---|---|---|---|---|
| 6th Grade | | | | | |
| Experimental | 25 | 40 | 41 | +1 | ns |
| Control | 22 | 47 | 48 | +1 | ns |
| 7th Grade | | | | | |
| Experimental | 24 | 33 | 40 | +7 | -3.09* |
| Control | 22 | 43 | 46 | +3 | ns |
| 8th Grade | | | | | |
| Experimental | 19 | 43 | 49 | +6 | -2.07* |
| Control | 18 | 43 | 49 | +6 | -3.02* |

* $p < .05$

Table 7

Reading Achievement Test Scores (ITBS) for
Experimental and Control Groups
Hatboro-Horsham School District

| Grade/ Group | N | ITBS (Mean NCE) 1992 | 1993 | NCE Gain | t |
|---|---|---|---|---|---|
| 6th Grade | | | | | |
| Experimental | 25 | 42 | 43 | +1 | ns |
| Control | 22 | 50 | 49 | -1 | ns |
| 7th Grade | | | | | |
| Experimental | 24 | 39 | 46 | +7 | -3.18* |
| Control | 22 | 44 | 48 | +4 | ns |
| 8th Grade | | | | | |
| Experimental | 19 | 46 | 52 | +7 | -2.96* |
| Control | 18 | 44 | 50 | +6 | -3.50* |

* $p < .05$

mathematics). Also, all six comparisons showed a positive increase for the experimental group, and five out of six were positive for the control group. Considering this was only a one year implementation of the computer learning system, these data seemed promising. Further analyses were then conducted to compare experimental and control groups at each grade level, using Analysis of Covariance to statistically control for any initial group differences on the pretest. The results of these analyses showed no significant differences between posttest means at any of the three grade levels, for reading or mathematics (summaries of these analyses are presented in Appendix B).

Tables 8 and 9 present results of analyses of the standardized test data (SAT) for the Pittston Area School District. Three years of data are included for this district, as compared to two years for Hatboro-Horsham, because this district implemented the project during the 1991-1992 school year (1991-1992 data were included in the previous evaluation report, Beyer, 1992). Also included in the tables are mean NCE scores for all non-project students (whose scores could be matched) in the three grade levels. These data from non-project students are included for the purpose of identifying district trends in test scores, not for comparing the actual scores of the two groups.

As Tables 8 and 9 show, the experimental or project group did not make anv significant gains (comparisons could not be made for grade 6, as data for this group in the 1991-1992 fifth grade were not available). Upon examining the grade comparisons for these students, seventh grade mathematics and reading scores showed a statistically significant decrement from the expected level of achievement, as did eighth grade mathematics scores. The other two comparisons were non-significant changes of 0 and -2 NCEs. Interestingly, the pattern for the not at-risk group was similar, with seventh grade mathematics and reading scores and eighth grade mathematics scores also showing a

Table 8

Mathematics Achievement Test Scores (SAT) for
Experimental and Not at Risk Groups
Pittston Area School District

| Grade/ Group | N | SAT (Mean NCE) 1991 | 1992 | 1993 | NCE Gain 91-2/92-3 | t |
|---|---|---|---|---|---|---|
| <u>6th Grade</u> | | | | | | |
| Experimental | 58 | -- | -- | 47 | --/-- | --/-- |
| Not At Risk** | 158 | -- | -- | 61 | --/-- | --/-- |
| <u>7th Grade</u> | | | | | | |
| Experimental | 58 | -- | 58 | 50 | --/- 8 | --/ 7.03* |
| Not At Risk** | 120 | -- | 71 | 61 | --/-10 | --/10.81* |
| <u>8th Grade</u> | | | | | | |
| Experimental | 84 | 54 | 46 | 44 | -8/-2 | 8.80*/ 1.94 |
| Not At Risk** | 82 | 75 | 65 | 65 | -10/0 | 12.31*/ -.55 |

* p < .05
** This group includes all non-project students and is included in the table to identify district trends.

Table 9

Reading Achievement Test Scores (SAT) for
Experimental and Not at Risk Groups
Pittston Area School District

| Grade/ Group | N | SAT (Mean NCE) 1991 | 1992 | 1993 | NCE Gain 91-2/92-3 | t |
|---|---|---|---|---|---|---|
| <u>6th Grade</u> | | | | | | |
| Experimental | 58 | -- | -- | 47 | --/-- | --/-- |
| Not at Risk** | 158 | -- | -- | 57 | --/-- | --/-- |
| <u>7th Grade</u> | | | | | | |
| Experimental | 58 | -- | 51 | 45 | --/-6 | --/ 3.53* |
| Not at Risk** | 120 | -- | 61 | 57 | --/-4 | --/ 3.79* |
| <u>8th Grade</u> | | | | | | |
| Experimental | 84 | 47 | 47 | 47 | 0/0 | -.14 / .13 |
| Not at Risk** | 82 | 68 | 62 | 66 | -6/+4 | 4.72*/-3.05* |

* p < .05
** This group includes all non-project students and is included in the table to identify district trends.

statistically significant decrement from the expected level of achievement. The one additional finding for this non-project group was for the eighth grade, with a statistically significant decrease in reading achievement scores, from 1991-1992 and a statistically significant increase in reading achievement scores, from 1992-1993.

In summary, there is no evidence in the Pittston Area School District of accelerated achievement levels on the SAT resulting from the computer learning system program. However, a number of factors must be considered in interpreting these data: first, the SAT test administered at the end of the 1993 school year was based on a new set of revised norms which were different from those used in previous years; second, the trends evident in the standardized test scores of project students are almost identical those of the school's higher-achieving, non-project students; third, a control group was not available for statistical comparison; and also significant is the fact that the quality of the implementation was not at a high level throughout the life of the project.

## Conclusions and Implications

Presented below are general conclusions which relate to the project's four evaluation questions, followed by some implications of the evaluation's findings and conclusions.

### Conclusions

To what extent was the project implemented as planned? During years one and two of the CAI/Cooperative Learning Project, the two participating school districts experienced many difficulties with the Jostens Learning Corporation's computer-based learning system. These problems involved both the computer software and hardware, and implementation issues (i.e., how to best integrate the project and its components into the regular school curriculum). During year three, the computer learning system was more fully operational at both sites; many problems were resolved, while others were less disruptive. To some extent, the Hatboro-Horsham site continued to experience hardware/software/networking problems, and the Pittston site addressed implementation difficulties which necessitated changes in the project design (unfortunately the changes resulted in the loss of a comparable control group, which is needed to minimize threats to internal and external validity). However, to their credit, both school districts continued to focus on project goals over the three-year period and to deal with and overcome many technical and practical barriers. As a result of their efforts, the Hatboro-Horsham district was thus able to reach a fairly high level of implementation and to introduce the various components of the project, as appropriate; the Pittston district's level of implementation of its revised design was more moderate.

To what extent does the project enhance mathematics and language arts achievement for the participating students as measured by an increase in standardized test scores? In terms of student achievement, the first data examined were student progress on the Jostens curriculum. Specifically, the variables of interest were number of lessons completed, and pre and posttest scores for the Jostens Basic Skills Inventory (BSI). For the Hatboro-Horsham School District, the lessons completed data showed high implementation levels for sixth and eighth grades. Although the BSI results showed sixth grade to have the lowest gains, it is difficult to interpret these findings as this curriculum-embedded test is not technically valid for measuring student progress. This pattern of results for the analysis of completed Jostens lessons and BSI data was similar for the Pittston Area School District, although the total number of lessons completed for the middle school grades in this district was generally lower.

Analysis of standardized test scores in the Hatboro-Horsham middle school (ITBS) provided evidence that all Jostens students had NCE gains in both reading and mathematics, and for seventh and eighth grade these gains in reading and mathematics were statistically significant. In comparison, only eighth grade gains were significant for the control group. These results are quite impressive considering the technical difficulties experienced by this district during years one and two. However, grade-level comparisons between experimental and control groups failed to reach significance using Analysis of Covariance. It should be noted that, time spent on Jostens, which in most cases focused on reinforcing basic skills, did not negatively impact student's performance. Analyses of Stanford Achievement Test (SAT) scores for the Pittston middle school did not provide evidence of score improvement. However, the district's elimination of the control group makes it difficult to draw conclusions about project impact. And the fact that the district trend has been for SAT scores to decline, questions the assumption that, without any new programs or special treatments, SAT scores would remain stable relative to the norm group over the pre to posttest interval.

<u>To what extent does the project enhance positive student and parent attitudes toward learning, the integrated learning system, and education in general?</u> Overall, students had positive attitudes toward the computer-assisted instructional program, although unlike teachers and administrators, student enthusiasm decreased over time. This could be interpreted as attitudes becoming more realistic with experience. That is, staff anxiety decreases as they grow to develop an appreciation for computer-assisted instruction and a more positive attitude, and students' initial excitement about the new technology wanes as they become accustomed to the "newness" of

the innovation and understand it is a serious component of their school curriculum.

Information on parent attitude was obtained from parents in the Hatboro-Horsham School District at the end of the school year (it was not feasible to administer the survey on two occasions). Although overall, parents reported being informed about the project, they also indicated being minimally involved in their child's computer work i.e., through discussions with their child, through information from teachers, or through observations. Ironically, the Pittston Area School District, which did not administer the parent survey, was incorporating students' performance on into quarterly progress reports and teacher/parent conferences.

Hatboro-Horsham parents who responded to the survey felt that the impact of the computer learning system on their child was more in terms of improving specific skills (e.g., mathematics skills) rather than improving their child's attitude toward school. Also important, most of these parents reported that their child feels good about academic progress being made on the computer.

To what extent does the project enhance positive teacher and administrator attitudes toward the integrated learning system and cooperative learning? During end-of-year interviews, teachers and administrators had very positive attitudes toward the Jostens computer learning system. Hatboro-Horsham staff had worked through two years of extensive technical problems and were finally seeing the benefits of the system and its capabilities during year three. Pittston staff were pleased that their implementation concerns were addressed and felt that the laboratory setup was a major improvement in how the project was being implemented. They no longer had to deal with classroom management issues or satisfy experimental time constraints. In addition, it is clear that, in both districts, initial staff anxiety about the program and the operation of the new technology decreased with experience, over time. In general, teachers came to realize that lower-achieving students can benefit from working on computers, at their own rate, and in non-threatening situations.

## Implications

The general implications of the findings and conclusions are summarized as follows:

- For a project to succeed, what is originally proposed must be not only well conceived, but also realistic. The implementation of an innovation which includes technology is a major challenge. An effective strategy to include additional components (e.g., collaborative learning at home and in the classroom) might be to phase them in, in a step-wise fashion, during successive years, which is what actually occurred in one of the two implementing districts (the Hatboro-Horsham School District).

- It is also critical, in planning, to define each project component and how it is to be implemented and monitored. For example, cooperative learning, although a "hot" educational topic, has a strong research base (e.g., Slavin, 1989) which must be taken into account when proposing a "cooperative learning project." That is, we know that successful methods are those that include instruction, structure, individual accountability, group goals and rewards, and long-term teacher support.

- Planning for a project such as this one, that involves federal funds, must take into account the realities of the funding cycle. For example, in this project the timeline was as follows: requests to purchase new equipment were developed in the Spring of each year, approval was communicated in late August, yet, the federal government did not release funds until October 1, at which time a purchase order had to be written by the district and processed. As a result, newly purchased equipment did not get up and running until the second half of each school year, and implementation was obviously delayed.

- Effective assistance, from inside or outside the school, is strongly associated with good project outcomes (Huberman & Miles, 1984). When technology is included, this support should include initial training by the vendor (for both the project coordinator and teachers), ongoing meetings to discuss technical and implementation issues (i.e., on the job training), on-going communication with colleagues who are also implementing the project, and the availability and accessibility of a project coordinator who works closely with the staff and is sensitive to their needs.

- Interestingly, each of the sites involved in the project had a different response to the innovative use of computers. One site attempted to implement on a school-wide basis, and the project coordinator had multiple competing responsibilities. This site ended up creating computer laboratories, and thus resisted the kind of instructional innovation originally proposed by the project. The second site, which appeared to have more positive outcomes as a result of its implementation, overcame much initial staff resistance to change and integrated the computers within the classroom. This site had fewer students involved and had a full-time project coordinator. However, some suggest that, what is important is "letting computers in the door." That is, as teachers become more familiar with computer technology, needed changes in curriculum and instruction will begin to occur and schools will become more compatible with society (e.g., Collins, 1991).

This evaluation report recognizes the extraordinary efforts on the part of the two school districts in attempting to implement the CAI/Cooperative Learning Project. Although computer-assisted instructional programs such as these commonly experience setbacks and delays, the amount of difficulty experienced by these two districts was exceptional. It is hoped that the report will be useful to the districts as their integration of educational technology continues to grow and evolve. Clearly, technological resources such as computers are essential for preparing students for the 21st century.

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APPENDIX A

Mean Student and Parent Survey Responses for Rated Items

## Student Survey
## Hatboro-Horsham Middle School (N=47)

| | Item | Percent Responding (Post) Yes | No | Pre-Post Difference |
|---|---|---|---|---|
| 1. | Do you like school? | 51 | 49 | -32 |
| 2. | Is the computer easy to use? | 98 | 2 | +4 |
| 3. | Is working on the computer fun? | 48 | 52 | -20 |
| 4. | Do computers make it fun to learn? | 53 | 47 | -26 |
| 5. | Do you learn a lot on the computer? | 52 | 48 | -18 |
| 6. | Do computers make school subjects more interesting? | 34 | 66 | -19 |
| 7. | Do you get bored working on the computer by yourself? | 76 | 24 | +21 |
| 8. | Do you need much help when working on the computer? | 7 | 93 | +3 |
| 9. | Does your computer give you help when you need it? | 67 | 33 | -12 |
| 10. | Does the computer help you correct your mistakes? | 79 | 21 | -4 |
| 11. | Do you have to hurry when you work on the computer? | 9 | 91 | -4 |
| 12. | Do you like computer work better than written assignments? | 83 | 17 | 0 |
| 13. | Is it important to do well on your computer assignments? | 87 | 13 | -4 |
| 14. | Does working on the computer help you do better in school? | 44 | 56 | -8 |
| 15. | Does your teacher know whether you make mistakes on your computer assignments? | 79 | 21 | +12 |
| 16. | Do you get good grades when you work hard in school? | 89 | 11 | -7 |
| 17. | Do you like going to the computer? | 48 | 52 | -20 |

| | | | |
|---|---|---|---|
| 18. Would you like to go to the computer more often? | 30 | 70 | -33 |
| 19. Have you worked on a computer in school before this year? | 89 | 11 | -2 |
| 20. Do you have a computer at home? | 43 | 57 | +8 |
| 21. Do you like using the computer at school? | 59 | 41 | -19 |
| 22. Has the computer helped you to learn math better? | 54 | 46 | -7 |
| 23. Has the computer helped you to read better? | 43 | 57 | -6 |
| 24. Has the computer helped you to write better? | 23 | 77 | +1 |
| 25. Has the computer helped you to understand science better? | 9 | 91 | -13 |
| 26. Can you do most of the computer lessons without help from anyone else? | 89 | 11 | -11 |
| 27. Are the computer lessons interesting? | 52 | 48 | -7 |
| 28. Do your computer lessons help you do work in the classroom better? | 38 | 62 | -15 |
| 29. Is your time with the computer the best part of your day? | 13 | 87 | -11 |
| 30. Do your parents think you are learning from the computer? | 60 | 40 | -10 |

Student Survey
Pittston Area Middle School (N=198)

| | Item | Percent Responding (Post) Yes | No | Pre-Post Difference |
|---|---|---|---|---|
| 1. | Do you like school? | 81 | 19 | +12 |
| 2. | Is the computer easy to use? | 52 | 48 | -44 |
| 3. | Is working on the computer fun? | 67 | 33 | -17 |
| 4. | Do computers make it fun to learn? | 64 | 36 | -20 |
| 5. | Do you learn a lot on the computer? | 57 | 43 | -15 |
| 6. | Do computers make school subjects more interesting? | 57 | 43 | -14 |
| 7. | Do you get bored working on the computer by yourself? | 61 | 39 | +26 |
| 8. | Do you need much help when working on the computer? | 8 | 92 | +4 |
| 9. | Does your computer give you help when you need it? | 70 | 30 | -10 |
| 10. | Does the computer help you correct your mistakes? | 81 | 19 | -8 |
| 11. | Do you have to hurry when you work on the computer? | 20 | 80 | -1 |
| 12. | Do you like computer work better than written assignments? | 88 | 12 | -3 |
| 13. | Is it important to do well on your computer assignments? | 90 | 10 | -3 |
| 14. | Does working on the computer help you do better in school? | 56 | 44 | -13 |
| 15. | Does your teacher know whether you make mistakes on your computer assignments? | 82 | 18 | +9 |
| 16. | Do you get good grades when you work hard in school? | 90 | 10 | -6 |
| 17. | Do you like going to the computer? | 80 | 20 | -6 |

| | | | | |
|---|---|---|---|---|
| 18. | Would you like to go to the computer more often? | 73 | 27 | -9 |
| 19. | Have you worked on a computer in school before this year? | 94 | 6 | -1 |
| 20. | Do you have a computer at home? | 36 | 64 | +5 |
| 21. | Do you like using the computer at school? | 76 | 24 | -11 |
| 22. | Has the computer helped you to learn math better? | 57 | 43 | -11 |
| 23. | Has the computer helped you to read better? | 41 | 59 | 0 |
| 24. | Has the computer helped you to write better? | 15 | 85 | -3 |
| 25. | Has the computer helped you to understand science better? | 13 | 87 | -5 |
| 26. | Can you do most of the computer lessons without help from anyone else? | 95 | 5 | +1 |
| 27. | Are the computer lessons interesting? | 55 | 45 | -24 |
| 28. | Do your computer lessons help you do work in the classroom better? | 46 | 54 | -18 |
| 29. | Is your time with the computer the best part of your day? | 35 | 65 | -8 |
| 30. | Do your parents think you are learning from the computer? | 59 | 41 | -17 |

# APPENDIX B

Summary Tables of Analysis of Covariance for Hatboro-Horsham Standardized Test Data

Analysis of Covariance: Comparison of Experimental and Control Groups on Reading Achievement Test Scores (ITBS) (Hatboro-Horsham School District)

| Grade/ Group | N | 1993 ITBS (Mean NCE) Obtained | Adjusted | F |
|---|---|---|---|---|
| **Grade 6** | | | | |
| Experimental | 25 | 43 | 44 | .63 (ns) |
| Control | 22 | 49 | 47 | |
| **Grade 7** | | | | |
| Experimental | 24 | 46 | 48 | .08 (ns) |
| Control | 22 | 48 | 47 | |
| **Grade 8** | | | | |
| Experimental | 19 | 52 | 51 | .10 (ns) |
| Control | 18 | 50 | 50 | |

Analysis of Covariance: Comparison of Experimental and Control Groups on Mathematics Achievement Test Scores (ITBS) (Hatboro-Horsham School District)

| Grade/ Group | N | 1993 ITBS (Mean NCE) Obtained | Adjusted | F |
|---|---|---|---|---|
| **Grade 6** | | | | |
| Experimental | 25 | 41 | 42 | 2.46 (ns) |
| Control | 22 | 48 | 47 | |
| **Grade 7** | | | | |
| Experimental | 24 | 40 | 43 | .10 (ns) |
| Control | 22 | 46 | 43 | |
| **Grade 8** | | | | |
| Experimental | 19 | 49 | 49 | .05 (ns) |
| Control | 18 | 49 | 48 | |