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ABSTRACT

This evaluation of the 1989-90 Resource Laboratory Program for Computer Assisted Instruction (CAI) in Washington (District of Columbia) elementary and junior high schools found that the program improved participants' mathematics achievement, but did not have a significant effect on reading achievement. The program is funded under Chapter 1 of the Education Consolidation and Improvement Act of 1981. Students are assisted by a teacher and an aide with the following "tripod" of learning activities: (1) teacher-directed instruction; (2) a computer-assisted lesson; and (3) independent learning involving reading or mathematics activities. Three different computer systems, each with different capabilities, are used. Evaluation information was gathered from pre- and posttest scores on the Comprehensive Test of Basic Skills (CTBS), teacher and student questionnaires, and classroom interviews. The following findings are highlighted: (1) participants did not show significant gains in reading achievement, with the exception of those who used Apple computers that have interactive capabilities; (2) participants showed significant gains in mathematics achievement; (3) the scope of remediation was an important factor in promoting greater accuracy in mathematics skill development; (4) overall, participants' skill levels improved over the instructional period; (5) there may be some discrepancy between student learning objectives and the objectives tested by the CTBS; and (6) students and teachers reported satisfaction with the program. Statistical data are presented in 15 graphs. (FMW)

# CHAPTER 1 RESOURCE LABORATORY PROGRAM FOR COMPUTER ASSISTED INSTRUCTION (CAI) 1989-1990

## EVALUATION REPORT



Andrew E. Jenkins III
Superintendent of Schools
Chief State School Officer

December 1990

District of Columbia Public Schools

# CHAPTER 1 RESOURCE LABORATORY PROGRAM FOR COMPUTER ASSISTED INSTRUCTION (CAI) 1989-1990

## EVALUATION REPORT

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December 1990

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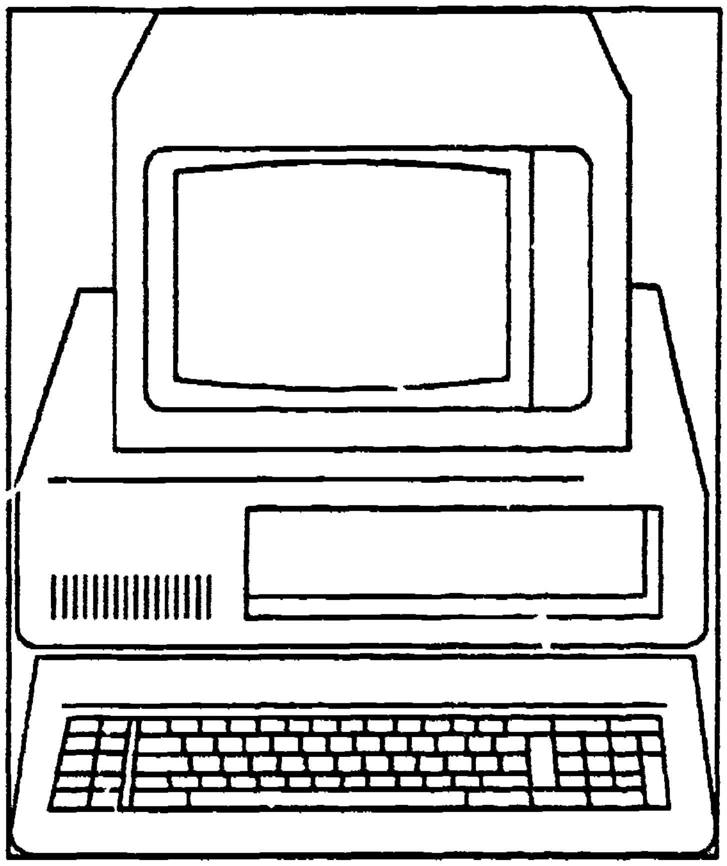

# CHAPTER 1 CAI
# EXECUTIVE SUMMARY

## RECOMMENDATIONS

1. The Chapter 1 computer-assisted instruction should gradually decrease its reliance on drill-and-practice software, and acquire more interactive tutorials.

2. More software should be provided to teachers at the secondary level so they can provide a broader spectrum of lessons to students.

3. The CAI procedures for instructional placement should be reinforced by good-quality teacher-made tests.

4. A comprehensive monitoring of student progress should be done bi-weekly using the "Objective-by-Objective Report" or any comparable performance profile.

5. Time on the computer does not automatically mean full engagement in the learning task. Student activities on the computer must be supervised more closely to limit any waste of time.

6. Teachers should take greater advantage of the computer capabilities to develop student writing skills. This approach could be adopted immediately for all the Chapter 1 schoolwide projects.

7. On the ESC/Tandy System, the active mode should be changed from a timed procedure to a "log-on/ log-off" procedure, thus allowing students to bring their own learning activity to closure.

8. The computer should be more widely and/or more systematically used to generate homework assignments for students.

9. The overall standard of performance and mastery should be consistent across the board, and probably needs to be raised at the Junior High school level.

10. Workshops in math are needed to help many Chapter 1 teachers strengthen their didactic skills in that subject.

11. As presently configured, the Chapter 1 lab is geared toward basic skills remediation. To create more direct opportunities for computer literacy for students, it would be desirable to coordinate the school-based lab with the Take-Home-Computer program.

12. It would be helpful to provide teachers with a data-entry program (a spreadsheet or a database) to expedite information recording.

## GENERAL SUMMARY OF THE EVALUATION FINDINGS

Computer-assisted instruction in Chapter 1 is provided under three different modalities , i.e., on three different computer systems: the Dolphin System which forms a set of learning tasks developed by Time Sharing Corporation (TSC); the Tandy System which integrates a set of learning tasks developed by Educational System Corporation (ESC); and the Apple System which makes use of software from various sources. The TSC/Dolphin System (D), which is the oldest, offers essentially drill-and-practice in the basic skills. The ESC System on Tandy (T), which has extensive graphic capabilities, enhances the primary basic skills exercises with pictures, and complements them with activities in figural problem solving and deductive reasoning. Both the Tandy System (T) and The Apple System (A) have interactive capabilities, in that they provide the opportunity for writing along with the drill-and-practice modality.

There are eight to twelve students attending the lab during any class period. They work with a Chapter 1 teacher who is assisted by an aide. The typical session in the CAI lab is organized into three segments; students are grouped into small clusters, and rotate through three learning activities: a) teacher-directed instruction, b) the computer-assisted lesson, c) independent learning, involving reading or math activities. This arrangement is known as the "tripod".

The following highlights of the assessment of the CAI program are summarized in keeping with the evaluation objectives.

### Primary Objectives

The primary objectives are both measured on the CTBS.

Objective 1: The total sample of CAI participants did not show significant reading gains from pretest to posttest. However, there are differences among the three systems: students on System A (Apple) are the only ones to achieve an impressive gain of 6.5 NCEs (Normal Curve Equivalent points) in reading.

Objective 2: Computer-assisted instruction in mathematics tends to be very beneficial, and clearly more so than in reading. For the total group of program participants, a net gain of 3.06 NCEs was registered.

### Secondary Objectives

The secondary objectives concern the quality of the learning experience provided through CAI.

Objective 1: Key CAI program factors influencing gains in CAI targeted skills

The scope of remediation (i.e., the total number of sessions the student completes in computer assisted remedial services) emerged as an important factor in promoting greater accuracy in mathematics skill development. Data showed that the more frequently a student worked on the computer, the greater was his/her level of accuracy in mathematics skill performance outcomes. More importantly, this level of mathematics accuracy was shown to be systematically related to national achievement trends in CTBS mathematics for the elementary school students.

The scope of remediation, however, was not equally extensive for all participating students. Among the sample of 163 elementary students who worked on the TSC/Dolphin Computer System, some 50% took a week or more to complete one instructional session; and less than 10% of these 163 students managed to complete two or more sessions per week. Given the finding that the scope of CAI remediation promotes academic gains, a concerted effort is required to make more productive the amount of time spent on computer assisted remedial services for many of the Chapter 1 students.

Analysis of student questionnaire responses revealed that more time spent on the computer was overwhelmingly favored by the students. Approximately 80% of all the students reported satisfaction with computer learning activities, and wished to work on the computer more often than they do currently. This finding indicates that a receptive student attitude prevails for a greater intensity of computer assisted remedial services.

Over 90% of the students, elementary and junior high schools alike, reported that school (as compared to home or elsewhere) provided the principal source of exposure to computers as a learning tool. Against the background of this finding, the need for a redoubling of efforts to provide greater computer learning exposure to more of the Chapter 1 students is even more evident.

Objective 2: Indices of overall significant gains in reading and mathematics skill level development over the instructional period September '89 through May '90

Overall significant mean grade level gains were shown for all elementary and JHS students who worked with the ESC System on Tandy computers. The group means, on CAI end-of-course grade equivalents, show gains of approximately 7 months and 3 months in reading and mathematics, respectively, for the elementary students. For the junior high school students, grade level means show similar gains of approximately 9 months and 7 months in reading and mathematics, respectively.

Indices reflecting a similar pattern of significant mean grade level growth is evident on both the AIMS and PLACEMENT measures in reading and mathematics for students who worked with the Apple Computer System. On the AIMS measure, indices of grade level growth were represented as 8.23 and 6.11 points for reading and mathematics, respectively; while on the PLACEMENT measure, the gains are represented as approximately 7 months and 9 months for reading and mathematics. (Linear comparisons should not be made between the actual mean growth indices for the AIMS and PLACEMENT measures because the measures are structured on distinctly different scales. PLACEMENT measure is aligned to the grade level scales while the AIMS measure is not).

The actual mean grade level gains shown in these findings are quite small in many cases. Yet, these modest increments of success should be understood against the background that the large majority of these students start out with cumulative deficit skills ranging from 2 to as many as 11. The larger challenge rests with achieving greater gains in the shortest possible time.

<u>Objective 3</u>: Indicators of the degree of correlation between students norm- and -criterion referenced achievement measures

Data analysis revealed systematic links, at some levels, between CAI criterion achievement outcomes and national achievement CTBS NCE trends for reading and mathematics.

Correlation coefficients indicate systematic relationship between <u>CAI end-of-course mathematics cumulative percent and CTBS mathematics NCEs</u>. Data for the TSC/Dolphin Computer users showed coefficients, significant at the ($p < .01$) level.

In the case of the ESC/Tandy System users, ratings for CAI end-of-course reading and mathematics tests correlate positively and significantly with the CTBS NCE scores for the elementary students. No significant trends were evident for the ESC/Tandy users at the junior high school level. Among the Apple Computer System users, correlation coefficients for norm and criterion achievement measures were significant for <u>reading only</u>.

At the junior high school level, the absence of links between student CAI criterion and CTBS norm-referenced performance scores in reading and math for the ESC/Tandy users and in mathematics for the Apple Computer users is indicative of one of two things: a) either students working on this particular level have not been properly placed in math, or b) there is a possible mis-alignment among CAI and CTBS objectives. Teachers in their survey responses indicated that evidence of some level of mis-alignment of objectives on these measures was observed. This may mean that there is a discrepancy between the objectives taught and the objectives tested.

Objective 4: Qualitative indicators of student attitudinal factors, reliability of computer systems, and general CAI program successes and/or limitations.

Overall, favorable indicators were shown for student interest in, and attitude toward the CAI program as a medium of enjoyable and beneficial learning. Of the 420 elementary and 168 junior high school students who completed questionnaires, some 88% of the elementary and 85% of the junior high students reported that their computer classes were generally interesting without undue frustration and that they always got a good feeling whenever they went to the computer laboratory.

Student satisfaction with academic progress in computer learning activities was also pervasive among all students. Some 83% of the elementary students, for instance, reported that they were satisfied with their progress in computer learning exercises, and that the difficulty level of the lessons was attainable.

Some 80% of the students reported satisfaction with computer learning exercises and wished to do computer exercises more often than they do currently. This finding indicates that increased CAI services is overwhelmingly favored by the students.

The CAI Program was shown to be the principal source of exposure to computers as a learning tool for the large majority of the students. Ninety-two percent of the elementary and 81% of the junior high school students reported that school was their principal source of computer learning involvement.

Factors related to attendance and level of CAI achievement show some degree of relationship at the junior high level. Analysis of reported absentee rate and GPAs showed that the majority of the students getting A's had very few absences for the year. The range of absences for these students was reported as 0 to 10 days.

Teacher satisfaction with the level of academic challenge inherent in the respective software packages used in individual schools was quite favorable. Generally, teachers felt that most of the programs were on grade level, with the added advantage of color and highly motivating subject matter. A few elementary school teachers wanted more challenge at the grades 5 and 6 levels.

The need was expressed by teachers for a more complete correlation between the CAI objectives inherent in the computer software for reading and mathematics and those for CBC to facilitate 1) easier monitoring of student progress and 2) more accuracy in student CAI placements which reflect levels comparable to those in the regular classrooms. This alignment between objectives taught and objectives tested is important also, in light of the evaluation finding that the 'objective by objective' student-performance-index was the teachers' most favored strategy for monitoring student progress.

Teacher satisfaction with student interest/attitude in computer assisted learning was also supported by the findings. For example, some 88% of the teachers reported that students were generally interested in their computer learning activities, and this was so even where the lessons presented some level of academic challenge.

Teacher satisfaction with the "instructional tripod" in the remediation process was evident from the data. Approximately 75% of the teachers felt that all three components (computer work, directed instruction, and independent self-directed student activity) of the instructional tripod were very helpful in student skill development.

Teacher overall ratings of the CAI program as an effective tool for correcting students' skill deficits were favorable. Forty-three percent rated the program as very helpful and 38% as helpful. That is a total satisfaction rating of 81%.

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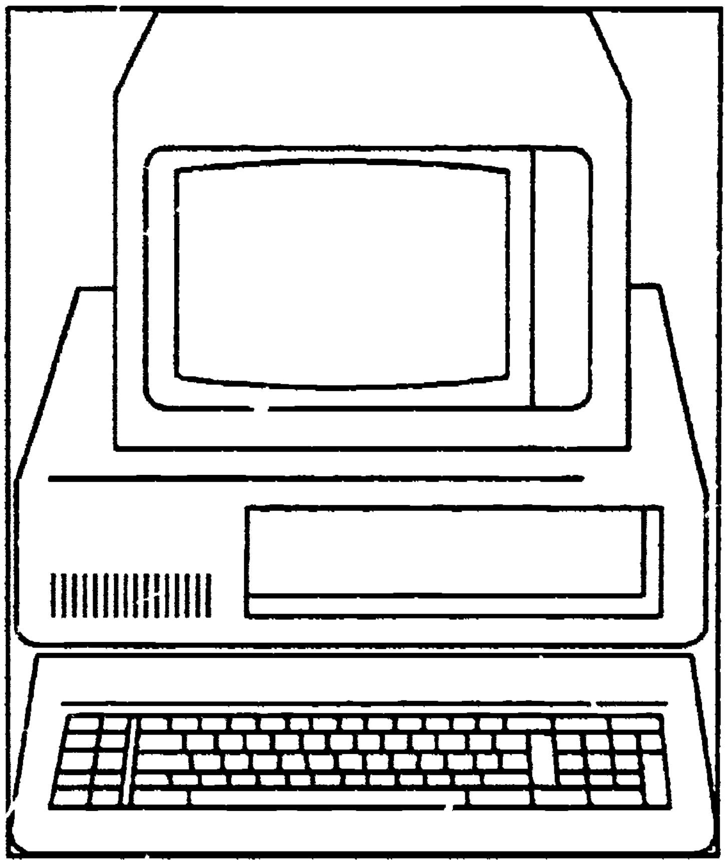

# CHAPTER 1 CAI
# GENERAL FRAMEWORK

## INTRODUCTION

### Purpose

The Chapter 1 Resource Laboratory Program for Computer Assisted Instruction (CAI) was implemented in the District of Columbia Public Schools (DCPS) in keeping with the Education Consolidation and Improvement Act (ECIA) mandate to provide remediation for low income students demonstrating critical educational needs. Students are assigned to the CAI program based on the annual school assessments. The large majority of these students are multiple retainees with cumulative deficit skills, particularly in reading and mathematics. The purpose of the present CAI program evaluation is to generate some quantitative as well as qualitative indicators of specific educational benefits provided to this population of Chapter 1 students through the computer assisted medium of instruction. In addition, the evaluation sought to determine (1) the extent to which CAI is providing remediation in reading and mathematics to Chapter 1 students with severe deficit skills (2) the level at which these remedial services appear to promote expected student achievement outcomes.

Further objectives include the following:

(1) to provide information on the level at which key CAI program elements (e.g., frequency of remediation and accuracy of skill performance) appear to influence gains in targeted outcomes;

(2) to analyze student performance data on CAI targeted objectives in order to quantify gains in skill levels attributable to the amount and scope of CAI remediation during the instructional period September '89 through May '90;

(3) to analyze students' national norm-referenced (CTBS) NCE data and CAI end-of-course test scores in reading and mathematics so as to determine the degree of correlation between students' norm- and -criterion referenced achievement trends;

(4) to assess qualitative information (gathered through classroom observation, interviews and questionnaires) in order to ascertain the way in which certain factors related to the reliability and appropriateness of computer hardware and software as well as teacher and student attitudes may be associated with student outcomes and general CAI program successes and/or limitations.

## BACKGROUND

### Need for the Program

The Computer Assisted Instruction is one component of the Chapter 1 Resource Laboratory Program designed as part of a major intervention for providing supplementary instruction to Chapter 1 students in Grades 2 through 6. The program was expanded subsequently, to include grades 7, 8 and 9 as a response to a felt need for the intervention at those grade levels. One underlying rationale behind the choice of the CAI medium of instruction is the inherent urgency of providing adequately for the academic needs of Chapter 1 students with severe achievement deficits. There is much empirical evidence supporting the claim that computer assisted instruction is effective as a supplement to conventional teacher-led instruction (Cohen, et al., 1982; Niemiec, et al., 1987).*

The pretest data gathered in the fall of 1989 for this evaluation, as well as the 1987-88 Chapter 1 report show patterns of multiple student retentions which indicate that the need for further remediation is still quite urgent. One trend shows a retention rate that increases more rapidly after grade 3. As a result the large majority of these students cluster at the 4 through 6 grade levels. Another trend indicates cumulative deficit skills in reading and mathematics ranging from 2 to as many as 11 among the elementary school students.

Thus, the challenge of having the Chapter 1 students catch up with the norm in the regular classrooms becomes even greater since these at-risk students start with academic needs that are a lot more severe. The CAI intervention provides an important cornerstone of program services for these Chapter 1 students.

### Basic Procedural Structure of CAI Laboratory Operation

The computer laboratories are equipped with eight to twelve computers. They are compatible in ratio to the average CAI class size of 8 to 10 students. Three computer systems (TSC/Dolphin,

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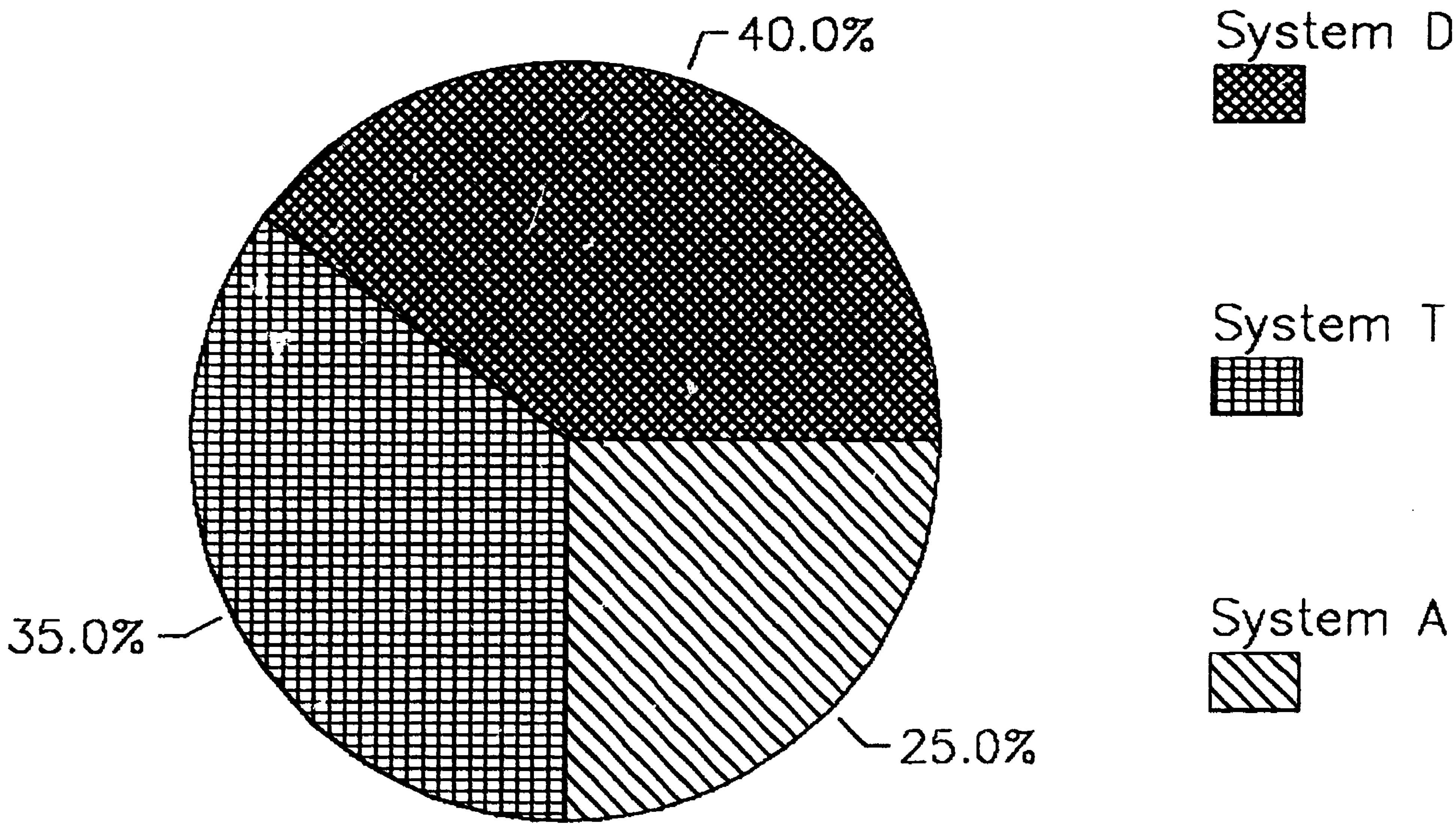
*Cohen, P. A., Kulik, J. A., Kulik, C. C. (1982). Educational outcomes of tutoring: A meta-analysis of findings. American Educational Research Journal, Summer, 237-48.

Niemiec, R.P., Samson, G., Weinstein, T., Walberg, J. W. (1987). The effects of computer-based instruction in elementary schools: A quantitative synthesis. AEDS Journal 112-14.

# % of CH1 Students by CAI Curriculum



ESC/Tandy, and Apple) are currently in place at school labs. We will designate these systems as System A, System D, and System T respectively. Each of these systems, though similar in the basic function of developing skill mastery in critical objectives, has its own unique style in accomplishing this end.

Each computer lab is managed by one classroom teacher, assisted by a teacher aide. Students attend computer lab classes based on a "pull-out" procedure. The delivery of CAI instruction is organized around the "tripod" method which requires the grouping of students on the basis of three components namely, supervised computer activity, directed instruction, and independent self-directed student activity. The groups are alternated to facilitate student exposure to all three components. Ongoing systematic in-house collaboration between CAI lab and classroom teachers on the progress of students is also a requirement of the program.

## METHODOLOGY

### Population

The target population involves Chapter 1 students in both elementary and junior high schools. These students are spread over 98 schools, citywide. A total of 743 elementary and JHS students from 15 schools -- 10 elementary and 5 junior high schools -- comprised the sample for the present evaluation.

### Major Research Questions

1. Did the students receiving computer-assisted instruction in SY 1989-1990 achieve some gains in reading and mathematics?

2. How effective did the amount and scope of remediation appear to be in promoting student proficiency in CAI targeted skills?

3. How did the qualitative indicators of certain student attitudinal factors and reliability of the computer systems/software appear to be related to general CAI program successes and/or limitations?

### Basic Design

The design was planned to generate both descriptive and interpretive information. Essentially, the basic plan involved a pretest-posttest procedure in which data were examined for significant gains in skill performance levels in reading and mathematics over the two-semester instructional period. Other procedures (mainly correlational) were used to test for linear relationships between students' CTBS NCEs and CAI criterion referenced measures.

## Instruments

The following instruments were used in the evaluation:

1. Comprehensive Tests of Basic Skills -- provided indices of CTBS 1989-90 NCE scores;

2. Criterion Instructional Tests -- provided indices of CAI end-of-course performance measures;

3. A twenty-item questionnaire -- solicited teacher perception of the levels of student interest and general appraisal of the effectiveness of the CAI Program as a medium for providing quality remedial instruction;

4. Two student questionnaires -- solicited information on students' level of interest/attitude in the computer assisted medium of instruction at the elementary and JHS levels.

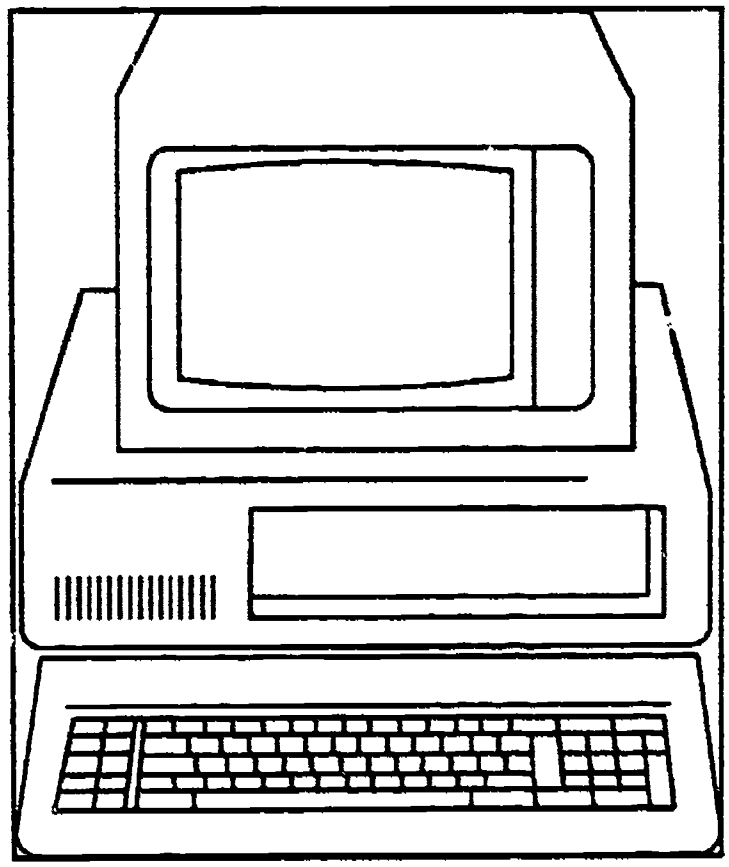
5. Structured classroom interviews -- provided qualitative information on factors related to the reliability and appropriateness of computer hardware and software and general CAI program successes and/or limitations.

## Data Collection Procedure

Schools were requested to submit computer-generated pretest and posttest Basic Skills and Placement Inventory reports for Chapter 1 elementary and JHS students. Reports in reading and mathematics for 15 schools were sampled for the analysis. Questionnaires were disseminated to schools at the end of May 1990. Structured interviews were conducted during school site visits over the 9-month instructional period September '89 through May '90.

## Data Analysis

To meet the evaluation objectives set out above, a number of statistical procedures were applied to appropriate data accordingly. Frequencies and crosstabulations were used to generate descriptive information about the variables examined in the evaluation. Pearson r correlation generated measures of linear relationships among selected factors. For the more interpretive types of information, two procedures were used, namely 1) a t test to analyze for significant skills gains over the pre-posttest period, and 2) a factor analysis to test for statistically valid factors related to students' reported interest in, and attitude toward the computer assisted medium of instruction.



# CHAPTER 1 CAI
# COMPARATIVE ANALYSIS

## COMPARATIVE ANALYSIS OF CTBS SCORES

The primary criterion adopted in DCPS to measure instructional effectiveness is student achievement on the Comprehensive Tests of Basic Skills (CTBS). Thus, the present study starts with a comparative analysis of the CTBS scores for students who received computer-assisted instruction. It is important at this point to keep in mind that computer-assisted instruction in Chapter 1 is offered under three different modalities, i.e., on three different computer systems: one of them has been in place for seven years; the other two have been introduced more recently. In that context, the issue under study concerns not just the global effectiveness of computer-assisted instruction, but also (and more importantly) the differential efficiency of the three systems. For that reason, the present analysis was guided by three major questions:

1. Did students receiving computer-assisted instruction in SY 1989-1990 achieve some gains in reading and mathematics?

2. How do these gains (or losses) compare to the overall performance of students in Chapter 1 for the year?

3. Are the gains (or losses) similar for all three systems supporting computer-assisted instruction?

Answers to these questions required the combination of three designs. The first question was approached through the norm-referenced model. The second question was amenable to a one-sample t-test, in which the overall gain/loss for all students in Chapter 1 served as the expected value. The third question was dealt with via an analysis-of-variance model.

This combination of designs was necessary because it is not feasible to adopt in this type of field study a one-shot experimental model. Indeed, it was virtually impossible to establish an equivalent control group: the majority of schools in DCPS receive Chapter 1 services in one form or another; the schools that are not eligible for Chapter 1 are so different socio-economically that they could not be considered equivalent. All this is to say that the question of the effectiveness of the CAI program could not be answered in a simplistic manner.

The selection of students to form the sample for this analysis was done on a school by school basis. The sample was stratified along two dimensions: type of computer system adopted (three possibilities), and administrative cluster (also three possibilities). The significance of the first dimension has already been underscored above. The second dimension was introduced in order to properly cover all the major geographic areas of the school district. This 3X3 matrix allowed for the selection of nine elementary schools and a total of 495 students.

## Reading Results

The results in reading are summarized in Table 1. Three points need to be highlighted from this table:

1. The total sample of CAI participants did not show a significant reading gain from pretest to posttest. The pretest score was 43.62, the posttest score was 43.84; so the change is equal to .22 NCE.

2. This difference, though very modest, is in the positive direction, and thus contrasts with the overall change for Chapter 1 which is a -1.32 NCE. That slight decline in performance for the Chapter 1 program reflects the general trend in the school district for the year 1989-1990.

3. There are some significant differences among the three systems. Students using System D, which is the oldest, have registered a decline of -2.82 NCE. Students on System T, with a variation of -.78 NCE, have remained virtually at the same level. But students on System A have achieved an impressive 6.51 NCE gain.

When one weighs these three sets of findings simultaneously, the overall conclusion which may be drawn is that computer-assisted instruction in reading, in its present configuration, may at best help students maintain the same level of performance. It has the potential for yielding greater and more significant gains, but closer attention would have to be paid to the instructional software, and the present configuration would probably need to be modified. That is indeed what is indicated by the differences obtained from the three computer systems. It is not possible in this preliminary report to explore the exact reasons for such differences. But the issue certainly calls for continued attention.

## Mathematics Results

The results in mathematics are summarized in Table 2. Once again, interpretation of these data will focus on three points:

1. For the total group of students receiving CAI instruction, there was a net gain of 3.06 NCEs. Their pretest scores averaged 48.99, their posttest score increased to r mean of 52.05. By most common standards, this is a respectable gain.

2. This positive change takes even greater significance when put next to the overall performance level of Chapter 1 students for the year 1989-1990. While the overall performance is marked by a decline of -1.4 (from 48.58 NCE to 47.33 NCE), for the CAI subsample, the trend is definitely upward.

Table 1A -- Average Gain/Loss on CTBS (NCE Scores)
Reading

| GROUP | 1990 | 1989 | Gain/Loss | N |
|---|---|---|---|---|
| Total CAI Sample | 43.84 | 43.62 | +0.22 | 495 |
| Subgroup D | 42.03 | 44.85 | -2.82 | 199 |
| Subgroup T | 45.20 | 45.98 | -0.78 | 174 |
| Subgroup A | 44.85 | 38.34 | +6.51 | 122 |
| Total Chapter 1 | 40.12 | 41.37 | -1.32 | |

Table 2A -- Average Gain/Loss on CTBS (NCE Scores)
Mathematics

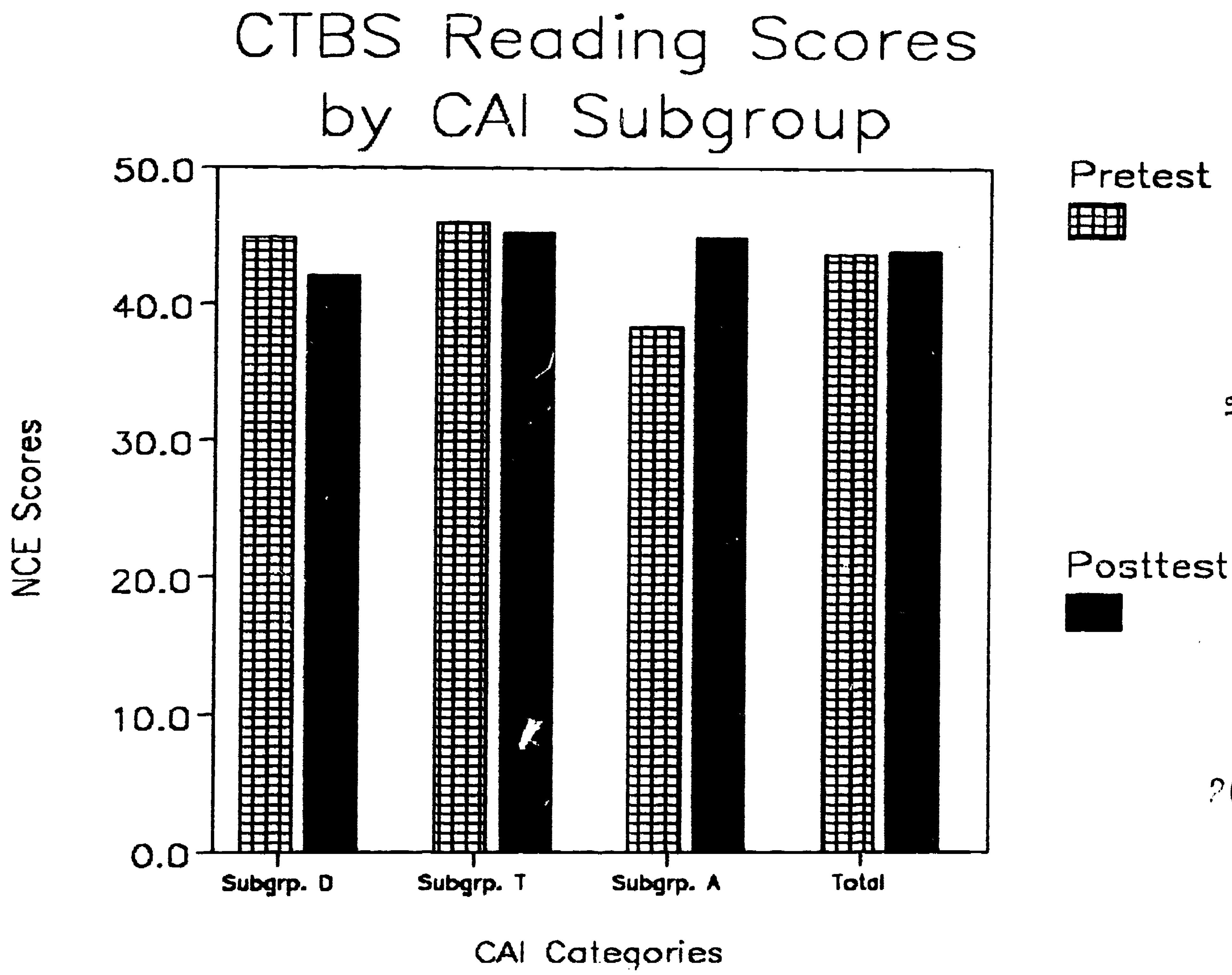
| GROUP | 1990 | 1989 | Gain/Loss | N |
|---|---|---|---|---|
| Total CAI Sample | 52.05 | 48.99 | +3.06 | 495 |
| Subgroup D | 53.99 | 43.41 | +5.58 | 199 |
| Subgroup T | 51.14 | 52.07 | -0.93 | 174 |
| Subgroup A | 50.21 | 45.34 | +4.87 | 122 |
| Total Chapter 1 | 47.33 | 48.58 | -1.40 | |

Table 1B -- Analysis of Covariance Summary of the Effect of CAI System on Reading Performance (1990). (Reading Pretest is the Covariate)

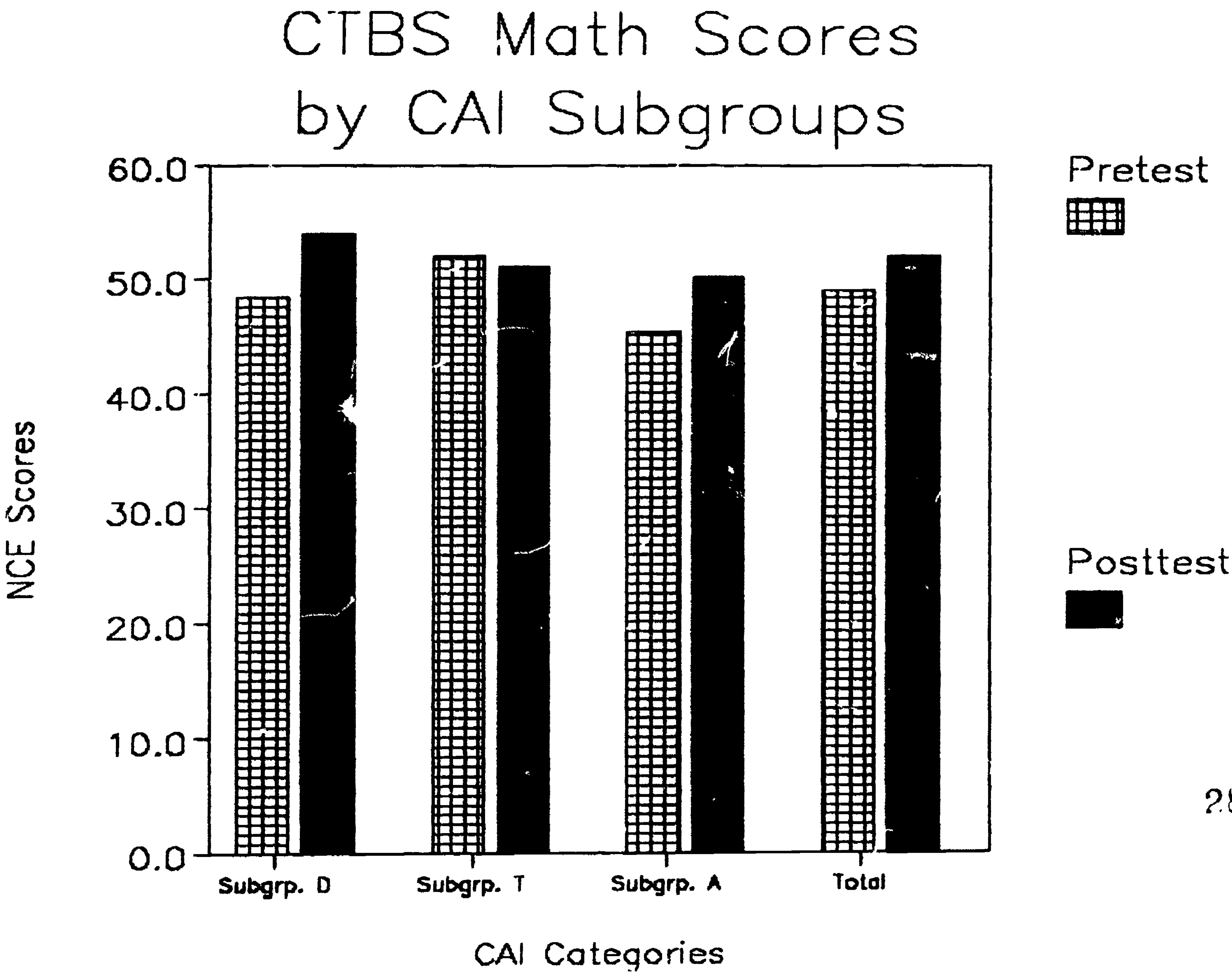
| SOURCE OF VAR. | DF | MEAN SQUARE | F VALUE | ALPHA |
|---|---|---|---|---|
| Covariate | 1 | 13697.15 | 61.32 | .000 |
| Main Effect: CAI System | 2 | 4780.56 | 21.40 | .000 |
| Explained | 3 | 7752.76 | 34.71 | .000 |
| Residual | 283 | 223.39 | | |
| Total | 286 | 302.37 | | |
| Multiple R = .519 | | | | |

Table 2B -- Analysis of Covariance Summary of the Effect of CAI System on Math Performance (1990). (Math Pretest is the Covariate)

| SOURCE OF VAR. | DF | MEAN SQUARE | F VALUE | ALPHA |
|---|---|---|---|---|
| Covariate | 1 | 9688.12 | 39.11 | .000 |
| Main Effect: CAI System | 2 | 1114.51 | 4.50 | .012 |
| Explained | 3 | 3972.38 | 16.04 | .000 |
| Residual | 280 | 247.69 | | |
| Total | 283 | 287.18 | | |
| Multiple R = .383 | | | | |



CTBS Reading Scores
by CAI Subgroup
50.0
40.0
30.0
20.0
10.0
0.0
NCE Scores
Subgrp. D
Subgrp. T
Subgrp. A
Total
CAI Categories
Pretest
Posttest


CTBS Math Scores
by CAI Subgroups
60.0
50.0
40.0
30.0
20.0
10.0
0.0
NCE Scores
Subgrp. D
Subgrp. T
Subgrp. A
Total
CAI Categories
Pretest
Posttest

3. Differences are also evident among the three computer systems. Two of the systems yield gains that approach or exceed five NCEs. On that score, the oldest system (System D) appears to be the most powerful, with a gain of 5.58 NCEs. On the other hand, System T seems to be 'out of sync' with the other two, since students under this modality lost almost 1 NCE.

The conclusion that can be derived from these findings is two-fold. a) Computer-assisted instruction in mathematics tends to be very beneficial, and clearly more so than in reading. This point is consistent with previous findings gathered both in DCPS and in other school districts. b) Not all computer systems are equivalent, nor is any system equally effective in all instructional areas. We have seen that System D which seems the least appropriate in reading, gives very promising results in mathematics. This evidence corroborates the point made earlier that any benefit from computer-assisted instruction cannot be accrued if one does not properly assess the instructional software.

This analysis only presented the global picture. Some additional steps were taken to further confirm these findings at the micro-level, by looking at the quality of the learning experience:

1. We conducted an inductive analysis of classroom observations in order to understand the learning process, and clarify student interactions with the computer.

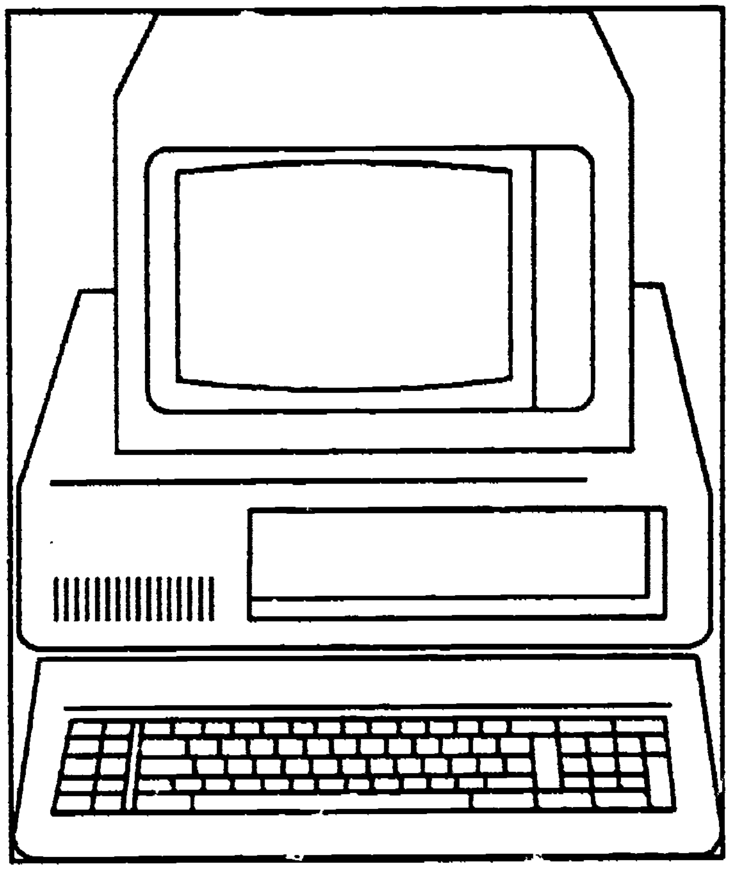
2. We looked at the change in performance demonstrated by students on the criterion-referenced measures provided through the CAI lessons themselves.

3. We calculated the degree of convergence between these internal (CAI) measures of achievement and the more normative indicator represented by the CTBS test.

4. We attempted to delineate the growth of student performance on the internal (CAI) measures, as a function of the number of sessions on the computer during the school year.

5. We examined the perceptions and expectations of the computer users (teachers and students) concerning the program of computer-assisted instruction as presently implemented.

The remainder of this report sketches out these issues.



# CHAPTER 1 CAI
# INDUCTIVE ANALYSIS

## Inductive Analysis of CAI Classroom Observations

As part of the evaluation of the Chapter 1 CAI program, the evaluation team conducted approximately fifty hours of classroom observations, followed by interviews of Chapter 1 teachers. The observations took place between January and May of 1990. For this qualitative approach, ten elementary schools and five Junior High schools were selected. These observations had a dual purpose a) to gain first-hand understanding of the interaction between the student and the computer , b) to account for the classroom dynamics, in a way that makes clear the plusses and minuses of computer-assisted instruction. The observation grid, without being rigidly structured, established the following parameters for data recording:

1. Student's instructional placement and/or task selection,
2. Student's management of time-on-task,
3. Alternative learning strategies,
4. Teacher-generated strategies for reinforcement.

Our methodological approach calls for a brief description of the lab as a learning environment. That will be followed by an inductive analysis of the observation records in line with the categories outlined above.

### I -- Environment and Participants

Of the fifteen labs visited, nine are located in very large, sun lit rooms; four are located in small, but well-lit rooms; two are located in small rooms with no windows. Most of these labs provide a quiet environment for learning, except for one which is situated next to the music room in a junior high school. At that particular location, the frequent noise coming from the rehearsal room represents a serious source of distraction.

Each lab is equipped with eight to twelve workstations, plus an additional unit for the teacher. At some of the elementary schools, a number of independent listening stations are also available for students' self-directed learning; at a few others, the visual and aural modes of instruction are integrated: students not only see the instructions on their computer monitor, but listen to the questions on a headphone. At three of the junior high schools, the Chapter 1 teacher reported the existence of another computer lab. It could not be established for certain whether all Chapter 1 students also attend that other lab. But it seems that the schedule of students to the Chapter 1 lab has to be built around that of the other lab.

The Chapter 1 CAI lab is under the management of a Chapter 1 teacher. At the elementary level, the teacher is assisted by an aide. At the secondary level, an aide was not always present;

however, in at least one case, the person responsible for the STAR program collaborated with the Chapter 1 teacher. The role or involvement of the aide seems to vary significantly from school to school. At about half of the sites, we observed the aide working with one to four children, engaging them in a question-and-answer process aimed at developing reading comprehension. At the other sites, the role of the aide seemed limited to simply monitoring the students.

There are eight to twelve Chapter 1 students attending the lab. On any given day, one to four students may be absent. The attendance rate is better in the elementary schools than in junior high. In teachers'opinion, the attendance rate for the Chapter 1 lab is on par with the rate for the school in general.

## II - Records Analysis

The analysis has been structured around four main themes.

### A -- Student's instructional placement and/or task selection.

#### a) Level of difficulty of lesson

Instructional placement is more easily done in math than in reading. Some teachers feel that the CAI curriculum, especially on the ESC/Tandy system, may be more difficult than the CBC curriculum. Indeed, they report that some students doing relatively well in their classroom cannot manage the CAI exercises. Some seventh graders taking the Basic Skills Inventory (BSI) placed as low as the first or second grade level. The teacher in that particular situation gives her students a test. If any discrepancy is found between the results on the teacher-made test and the BSI, the student is placed on an intermediate level of instruction. Chapter 1 may want to extend this practice. In general, teachers working at the secondary level expressed the need for a broader spectrum of lessons.

#### b) Relevance of lessons to CTBS and higher-order thinking skills

In the early grades, the CAI lessons do not always seem appropriate for fostering comprehension skills. We observed a student working on a primary reading lesson presented via the Pass-Plus program. The task was to choose between two words to fill up a blank in a short sentence. Twenty sentences were presented. The exercise could be qualified more appropriately as word placement than reading comprehension. This kind of task may not transfer well to the CTBS performance. At the secondary level, the lessons presented in the lab as Remedial and Corrective Reading may be too remote from what the Chapter 1 students have to do in their regular classroom. While the concepts reviewed may be fundamental, the pedagogical presentation may not be appropriate.

c) Frequency of instruction in subject area (Scheduling).

In terms of frequency of instruction, we have observed two types of arrangements.

Under the first arrangement, Chapter 1 students go to the lab every day, but they are not assigned lessons in both reading and math every day. Students may be given assistance in reading for three days, while the remaining two days are devoted to math. That is one of the explanations for the relatively limited number of instructional lessons completed in each subject for the year. At the junior high level, some students received computer-assisted instruction in each of the basic skills only two days a week, as the fifth day is reserved for typing lessons.

Under the second arrangement, students do receive instruction in both subjects every day, as the lessons in reading and math automatically alternate. However, the time on each subject is very short and may not exceed ten minutes. Moreover, the insertion and sequencing of specific exercises within each lesson do not always facilitate continuity. Even the teacher is at times uncertain about the appropriateness of lesson sequence on the CAI.

In either case, the amount of instructional time may be insufficient to impact performance on the standardized test.

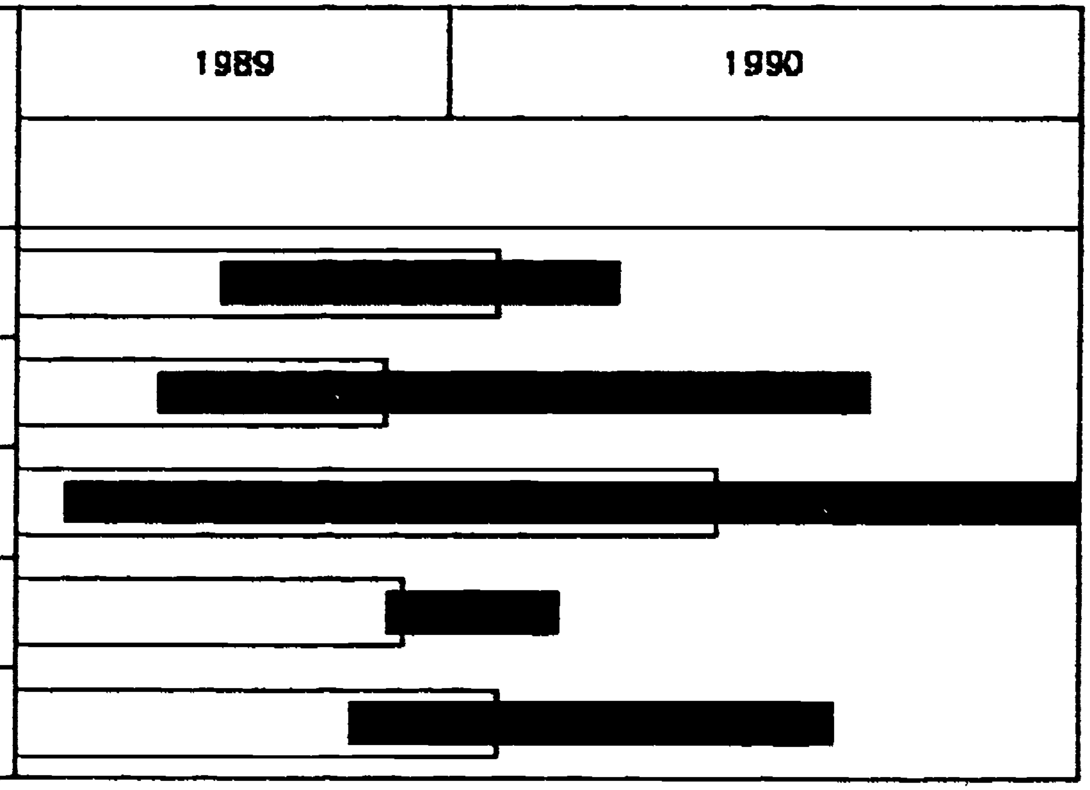
B- Student's management of time-on-task

a) Maximum use of time-on-task

Students need to be monitored while working on the computer. While most of the students we observed concentrated on their lesson, many did not. Some students took an inordinate amount of time to answer any question presented to them on the computer display. As a result, they could never complete a lesson. The problem may be at times due to some features of the equipment itself. For instance, on the Dolphin System, the print is very small; on the Tandy System, the print is bigger but rather "fuzzy": in either case, it is taxing on the eyes. However, the waste of time is often due to distraction (student daydreaming) or difficulty with the assignment. That problem makes evident the need for a teacher aide in the lab, even at the secondary level. Interaction with the teacher aide appears even critical to some students who are poor readers and who do not readily or fully understand instructions presented in the visual mode (computer screen).

# Inductive Analysis of CAI Classroom Observations

| Instructional Domain | Indicator 1 | Indicator 2 | Indicator 3 |
|---|---|---|---|
| PLACEMENT | Level | Relevance | Scope |
| TIME-ON-TASK | Efficiency | Closure | -------- |
| DIDACTICS | Feedback | Structure | Homework |
| REINFORCEMENT | Reward | Standard | ------- |
| TEACHER NEEDS | Software | Training | Management |




| Needed Revision | Potential Benefit | | Description |
|---|---|---|---|
| | | | Graphic Identifier |

b) Abrupt stop of lesson/session on ECS/Tandy

On the flip side of the time-on-task issue is the problem of lesson closure. On the Tandy system, the lesson always ends unexpectedly, with the message "That's it for today!". That abrupt ending is an obvious cause of frustration for students fully engaged in the task. The inability to bring the learning task to closure does not help cognitive assimilation. (That is known in psychology as the Zeigarnik effect). The software developers should consider including in the program a "two-minute warning".

C -- Alternative Learning Strategies

a) Feedback / Task shifting

When a student fails a particular item three times, the computer program simply moves the student to an easier set of exercises. This seems to be the only available strategy for dealing with student errors. The obvious advantage of this strategy is that it continuously provides every student with a positive learning experience. However, the less obvious disadvantage resides in the fact that a student's error may not receive immediate attention, or may never get corrected. After a student has been re-routed repeatedly to easier lessons, he/she gets the feeling of "running in circles", and the CAI lesson is no longer profitable because it does not fully sustain academic development.

b) Problem structuring / Processing

On all three computer systems in place in the Chapter 1 lab, the available software for basic skills tends to be organized in a format for drill-and-practice rather than for interactive tutorial. That format determines the structure of the exercises and the cognitive processes required to solve them. Concretely this means, for instance, that too many of the exercises in math focus only on the computational aspect. Although the computer presents some word problems, these exercises do not require any translation of concepts into numbers, or any decision about necessary operations. On that score, some improvement in the software seems desirable. Specifically, students should be presented with different alternatives for working out a math problem. For instance, a "Help menu" should be available to students with suggestions for transposing a problem into a picture. That would enhance understanding.

c) Opportunities for homework

The literature on effective schools has established the significance of the relationship between quality homework and academic performance. Potentially, homework assignments could be computer-generated every day. Answers to the homework exercises would then be presented on the computer screen the next morning, and students could correct their own papers. In such an arrangement, the increased amount of homework would not become an increased burden on teachers. The kind of learning opportunity just described are not fully taken advantage of at the present time.

D -- Strategies for performance reinforcement

a) Teacher-managed or inspired strategies

The computer provides reinforcement to students for good performance, in the form of a smiling face or a word of encouragement. We observed that, at some schools, the CAI teacher has developed her own techniques for reinforcement. For instance, each student is given a yellow cup, and when he/she achieves 100% on a lesson, the student is allowed to raise that cup in celebration. This kind of strategy, by making academic success a "social event", adds to student motivation.

b) Overall standard of performance/mastery

The computer strictly defines the standard of mastery, and applies that standard in determining whether a student moves to the next lesson or not. However, the standard does not seem consistent across all three computer systems. On the TSC/Dolphin System, it is reportedly set at 80%. At some secondary schools, the standard of accuracy in performance seems to be set at 65%. That criterion was spelled out in full letters in a classroom:

> "Given computer-assisted instruction, the student will demonstrate mastery of the prescribed skills with 65% accuracy."

Chapter 1 administrators and teachers need to ponder whether that criterion is high enough to promote competence.

III -- Teacher needs and wishes

a) Software needs/equipment needs

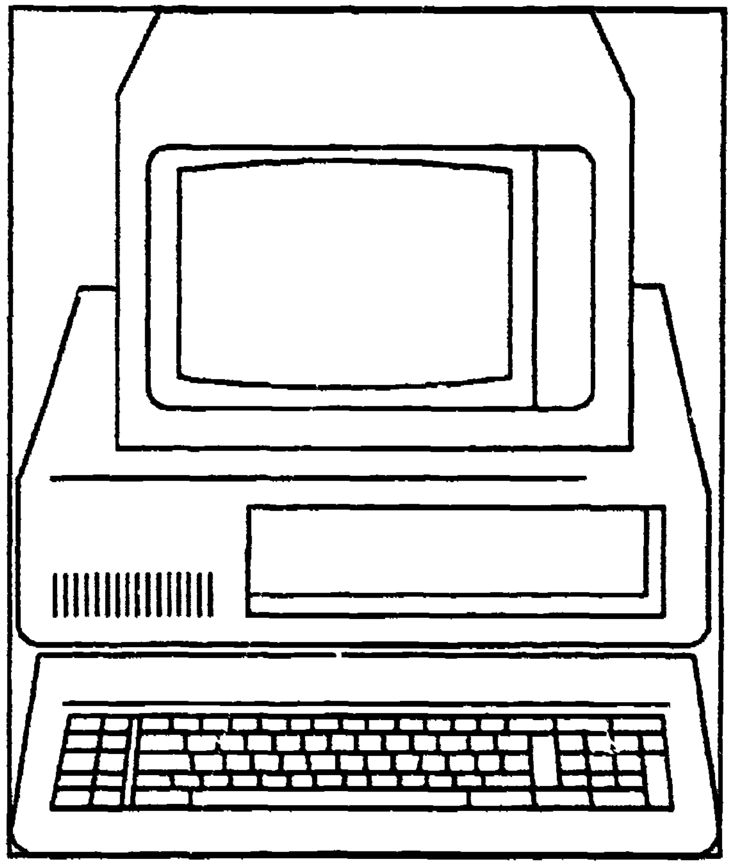
Most teachers are satisfied with the equipment available to them in the CAI lab, as well as with the maintenance of this equipment (except in one case). However, many have expressed a need for additional software which includes a broader range of lessons. Four teachers would like to have a VCR to make the lesson more animated. One teacher we observed uses an overhead projector to present the reading lesson to a small group; that allows key segments from each reading passage to be highlighted, and thus facilitates comprehension. This is a practice that could be shared with other teachers.

b) Training needs

Almost half of the teachers interviewed asked for more training in mathematics. Some of the teachers said they were trained as reading specialists, therefore they were never entirely comfortable teaching math; that task was almost "imposed" upon them without much preparation. The concern is particularly serious at the junior high school level. One teacher requested and obtained the assistance of the STAR teacher to instruct math. But the problem is sufficiently important to be addressed by the Chapter 1 administrative unit in a series of workshops.

c) Multiple use of the computer

Many teachers complained about the "work paper" load required by Chapter 1. It seems that the same information often has to be entered on three or four different forms. One way to reduce this work paper burden would be to computerize some of these forms. There is already a micro-computer installed in the lab for management of instruction. The acquisition of any data entry program (a spreadsheet or a database package) could drastically expedite information recording at a very low cost.



# CHAPTER 1 CAI CONATIVE ASPECTS

## DISCUSSION OF THE RESULTS WITHIN THE CONTEXT OF THE FOUR SECONDARY OBJECTIVES

### 1. Key CAI Program Factors Influencing Gains in CAI Targeted Skills

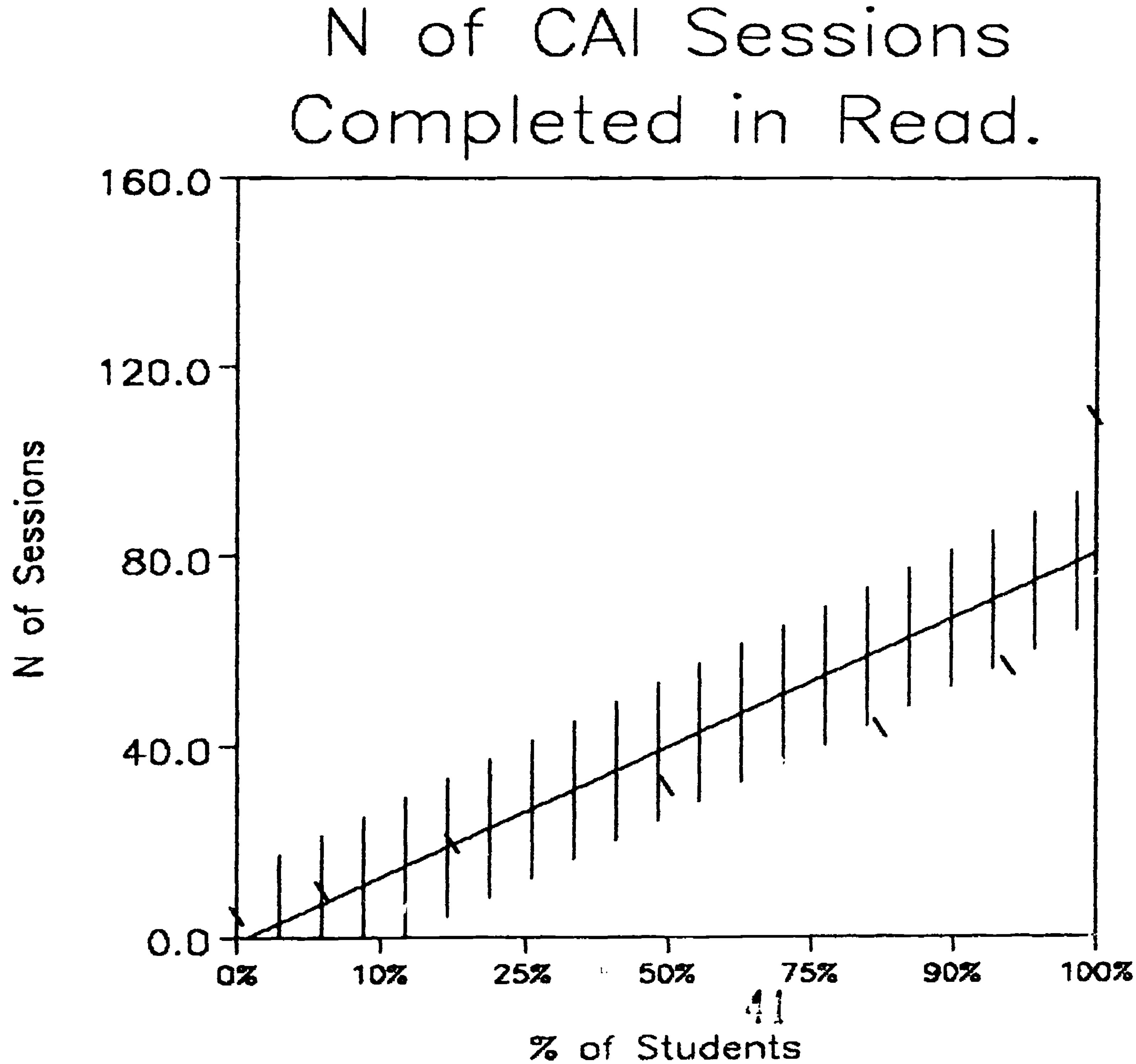
Objective (1) provides information on (a) the frequency distribution of remedial services and (b) the systematic relationship between the scope of remediation and the accuracy of students' skill performance in reading and mathematics.

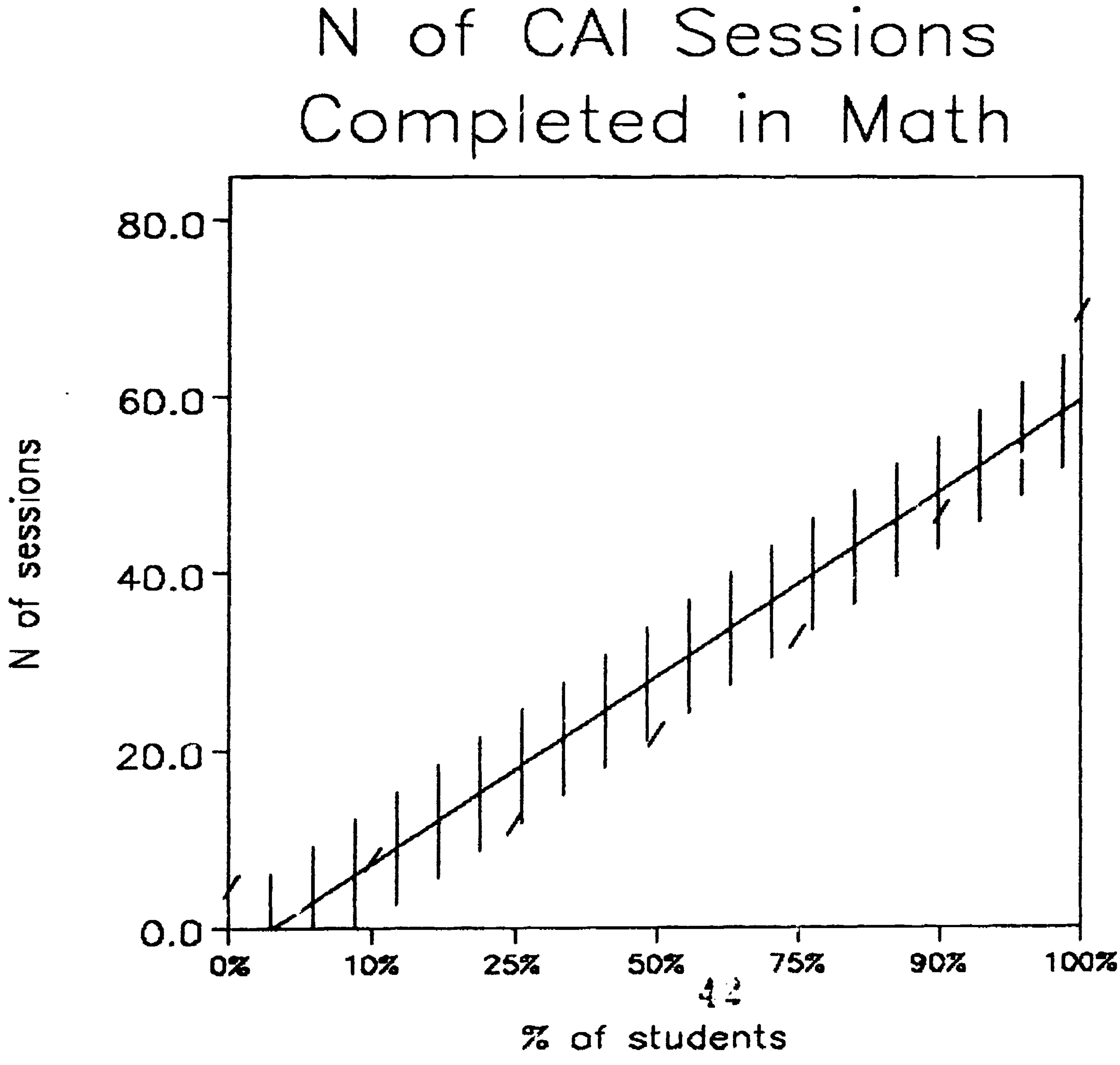
Scope of remediation is represented as the total number of sessions the student completes in remedial services by way of computer assisted instruction. The total number of sessions is equivalent to "the number of times a student has completed, not necessarily mastered a skill". Consequently, the greater the number of sessions a student completes, the more extensive the scope of remediation he/she has received. The frequency distribution laid out in Table 3 indicates the intensity of CAI remediation in reading and mathematics for the 163 elementary students who worked on the TSC/Dolphin Computer System.

**TABLE 3 -- Frequency Distribution of CAI Remedial Services Among Chapter 1 Elementary School Students**

| | Reading | Mathematics |
|---|---|---|
| % of Students | # of Sessions | # of Sessions |
| 10% | 14 or less | 10 or less |
| 11 to 25% | 15 to 25 | 11 to 15 |
| 29 to 50% | 26 to 35 | 17 to 26 |
| 51 to 75% | 36 to 48 | 27 to 37 |
| 76 to 90% | 49 to 62 | 38 to 52 |
| 91 to 100% | 63 or more* | 54 or more* |
| Maximum # of Sessions | 154 for Reading; | 84 for Mathematics |
| Mean # of Sessions | 37.5 | 28.3 |

From the results, the scope of remediation emerged as important in influencing the accuracy of skill performance (or the cumulative percent). Data in Table 4 show that, in mathematics, the scope of remediation and the accuracy of skill performance are positively correlated for elementary school students at statistically significant levels. ($p < .01$). In general terms,


N of CAI Sessions
Completed in Read.
160.0
120.0
80.0
40.0
0.0
N of Sessions
0%
10%
25%
50%
75%
90%
100%
% of Students


N of CAI Sessions
Completed in Math
N of sessions
80.0
60.0
40.0
20.0
0.0
0%
10%
25%
50%
75%
90%
100%
% of students

this means that the greater the number of sessions a student completed on the computer, the greater was his/her level of accuracy in skill development.

Another very important finding is that the accuracy of skill performance in mathematics significantly correlates with the 1990 norm-referenced CTBS mathematics NCEs ($r = .298$, $p < .01$). (See Table 4). In effect, this shows that the higher a student's level of skill accuracy was on the CAI criterion objectives, the higher was the student's scores on the national norm-referenced NCE measure in mathematics.

Looking, once again, at the data reported in Table 3, it is evident that for a number of students, time-on-task may not have been at its maximum, given the number of sessions on the computer. In reading for instance, 50% of the elementary users on the Dolphin Computer System had 35 or fewer sessions for the instructional period. This represents a rate of only about one session a week or less for at least half of the students. The picture is even less favorable for mathematics, which shows that 50% of the students had 26 or less sessions; and less than 10% of these students managed to complete two or more sessions per week. Given the finding that the scope of CAI remediation is systematically related to achievement gains, a concerted effort is required to make more productive the amount of time spent on the computer for a lot more of the Chapter 1 students.

TABLE 4 -- Correlation Coefficients Showing Relationships Among Scope of Remedial Services, CAI Level of Skill Accuracy and CTBS Mathematics NCEs for the Elementary TSC/Dolphin Computer Users

| | Scope of Services | CTBS Math NCEs |
|---|---|---|
| Level of Accuracy (Cumulative %) | .298** (N=161) | .207* (N=125) |
| Levels of Significance | *p < .01<br>**p < .001 | |

2. Overall Gains in CAI Reading and Mathematics for Instructional Period -- September '89 Through May '90

Objective (2) provides evidence of overall significant gains in reading and mathematics skill level development.

Table 5 shows that, (for the sample of students with matching pre- posttest reading scores) in reading, grade level means grew from 2.02 to 2.68. This represents a significant reading level gain of approximately 7 months. Also, a mean growth index of about 3 months in mathematics is shown for the 94 elementary school ESC/Tandy Computer users. Although the actual mean gains are quite small, they should be viewed within the framework of the students' severe academic needs to start with. As stated earlier, data for the present population showed cumulative deficit skills ranging from 2 to as many as 11.

**TABLE 5 -- T-Test of Pre-Posttest Gains in CAI Reading Levels for Elementary ESC/Tandy Users**

| # of Cases | | Grade Level Mean | Grade level Mean Growth | T-Value | Sig. |
|---|---|---|---|---|---|
| 88 | Pretest | 2.02 | | | |
| | Posttest | 2.68 | .66 | 6.35 | .001 |

**TABLE 6 -- T-Test of Pre-Posttest Gains in CAI Mathematics Levels for Elementary ESC/Tandy Users**

| # of Cases | | Grade Level Mean | Grade level Mean Growth | T-Value | Sig. |
|---|---|---|---|---|---|
| 94 | Pretest | 1.83 | | | |
| | Posttest | 2.15 | .32 | 4.43 | .001 |

The pattern of mean growth for the JHS students who worked on the ESC/Tandy Computer system is similar to that for the elementary students except that in the case of the JHS students the margin of growth is slightly larger for both reading and mathematics. The JHS reading and mathematics levels grew by 8.6 months and 6.8 months respectively. (See Tables 7 and 8).

**TABLE 7 -- T-Test of Pre-Posttest Gains in CAI Reading Levels for JHS ESC/Tandy Users**

| # of Cases | | Grade Level Mean | Grade level Mean Growth | T-Value | Sig. |
|---|---|---|---|---|---|
| 195 | Pretest | 3.63 | | | |
| | Posttest | 4.49 | .86 | 7.85 | .001 |

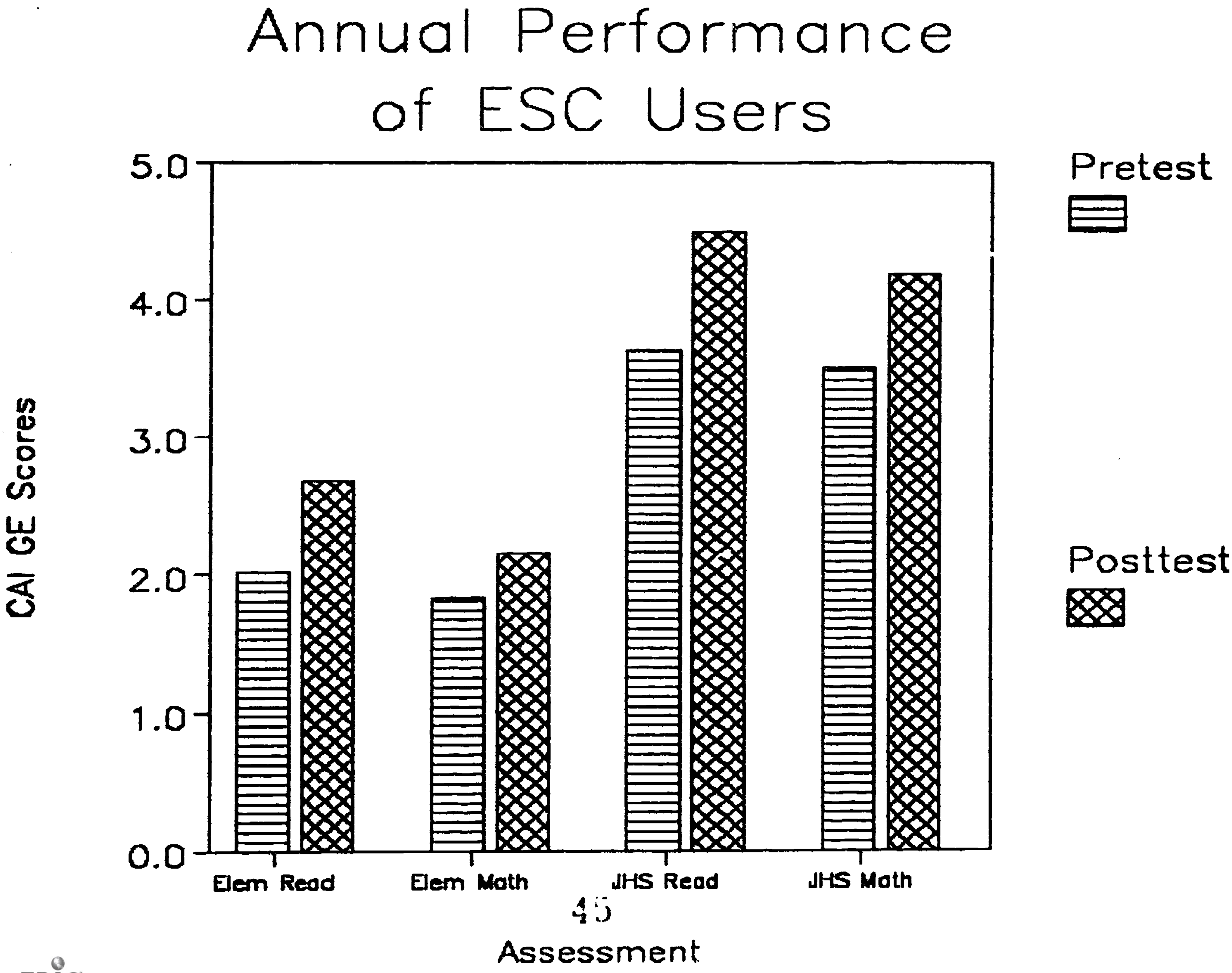

Annual Performance
of ESC Users
5.0
4.0
3.0
2.0
1.0
0.0
CAI GE Scores
Pretest
Posttest
Elem Read
Elem Math
JHS Read
JHS Math
Assessment

TABLE 8 -- T-Test of Pre-Posttest Gains in CAI Mathematics
JHS Tandy Users

| # of Cases | | Grade Level Mean | Grade level Mean Growth | T-Value | Sig. |
|---|---|---|---|---|---|
| 228 | Pretest | 3.50 | | | |
| | Posttest | 4.18 | .68 | 7.41 | .001 |

A similar pattern of statistically significant mean grade level growth is evident on both the AIMS and PLACEMENT measures in reading and mathematics for the Apple computer users. On the AIMS test type, pre- posttest reading scores grade level means grew from 7.51 to 15.74. This represents a significant growth of 8.23 points. The mathematics posttest score showed a significant gain of 6.11 points. Similarly, on the PLACEMENT test type, reading and mathematics posttest mean scores showed significant gains of 6.5 months and 9.2 months, respectively. (See Tables 9, 10, 11 and 12).

Note: No attempt should be made to draw linear comparisons between the actual mean scores of AIMS and PLACEMENT test type because the two measures are structured on distinctly different scales.

TABLE 9 -- T-Test of Pre-Posttest Gains in CAI Reading Levels
for Elementary Apple Users (AIMS Test-type Measure)

| # of Cases | | Grade Level Mean | Grade level Mean Growth | T-Value | Sig. |
|---|---|---|---|---|---|
| 65 | Pretest | 7.51 | | | |
| | Posttest | 15.74 | 8.23 | 12.09 | .001 |

TABLE 10 -- T-Test of Pre-Posttest Gains in CAI Mathematics
for Elementary Apple Users (AIMS Test-type Measure)

| # of Cases | | Grade Level Mean | Grade level Mean Growth | T-Value | Sig. |
|---|---|---|---|---|---|
| 55 | Pretest | 8.13 | | | |
| | Posttest | 14.24 | 6.11 | 11.66 | .001 |

**TABLE 11 -- T-Test of Pre-Posttest Gains in CAI Reading Levels for Elementary Apple Users (Placement Test-type Measure)**

| # of Cases | | Grade Level Mean | Grade level Mean Growth | T-Value | Sig. |
|---|---|---|---|---|---|
| 64 | Pretest | 3.60 | | | |
| | Posttest | 4.25 | .65 | 7.55 | .001 |

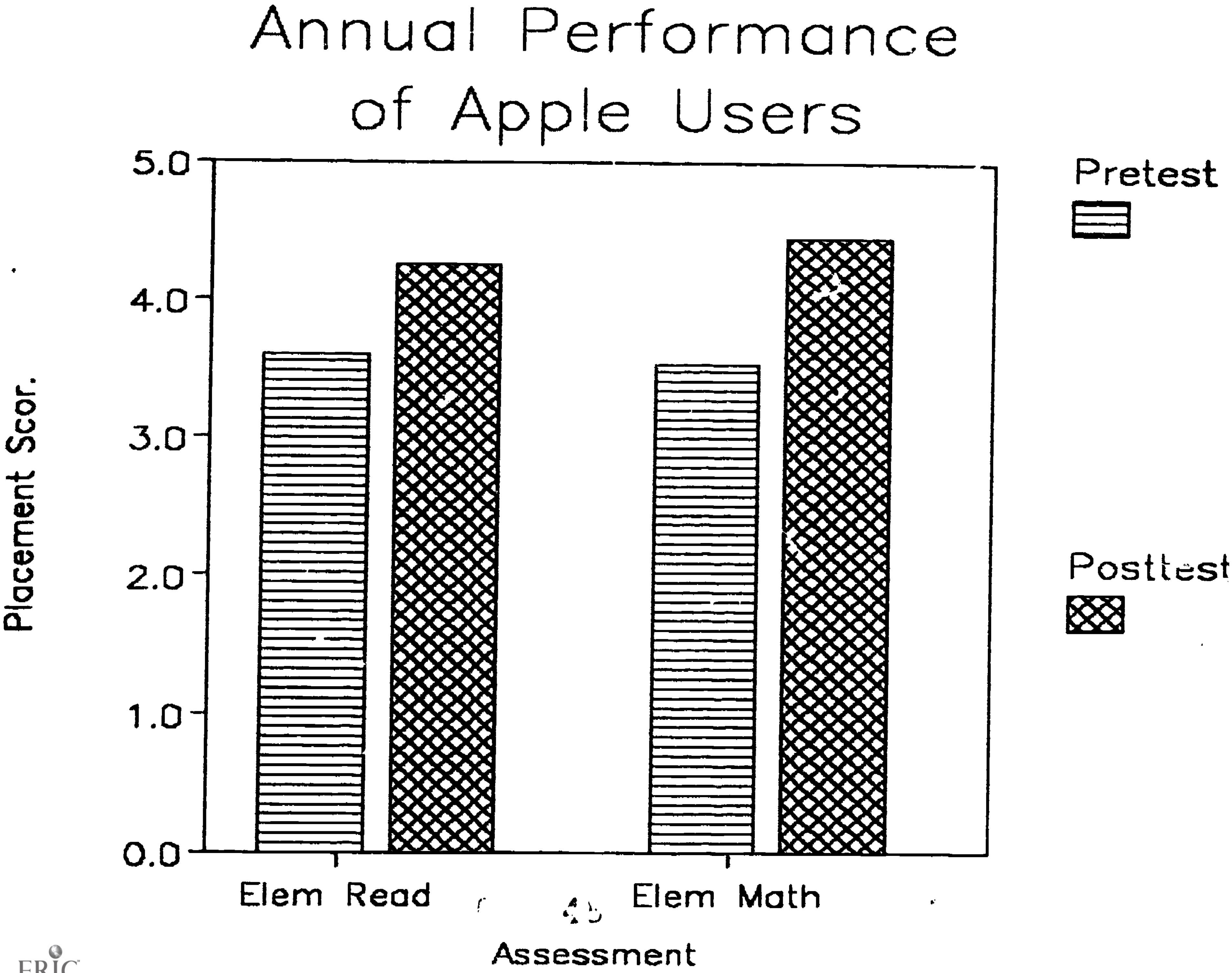
**TABLE 12 --T-Test of Pre-Posttest Gains in CAI Mathematics Levels for Elementary Apple Users (Placement Test-type Measure)**

| # of Cases | | Grade Level Mean | Grade level Mean Growth | T-Value | Sig. |
|---|---|---|---|---|---|
| 69 | Pretest | 3.53 | | | |
| | Posttest | 4.45 | .92 | 5.64 | .001 |

3. <u>Relationships Between National Norm-Referenced CTBS NCEs and CAI Criterion Achievement Measures</u>

Objective (3) provides indicators of the degree of correlation between students' norm- and -criterion referenced achievement measures.

The correlation matrix in Table 13 gives coefficients indicating levels of significant links between the elementary students' CAI end-of-course reading and mathematics scores and CTBS 1990 reading and mathematics NCEs. No systematic relationship was shown for the JHS ESC/Tandy users on any of the measures. Data for the 125 TSC/Dolphin Computer System users (for which NCE scores were matched) showed that students' cumulative percent score significantly correlates with their NCE's for mathematics ($r = .234$, $p < .01$). This, in effect means that the greater the level of accuracy students achieved in their CAI mathematics skill performance outcomes, the higher were their CTBS mathematics NCEs. In the case of the ESC/Tandy System users, the coefficients for the 84 elementary students with matching end-of-course mathematics test scores and CTBS NCEs, also showed significant linearity between both measures. In reading, CAI and CTBS scores for 55 students were also significantly correlated. Similar significant correlation coefficients were shown for the Apple System users in reading only on both the AIMS and PLACEMENT measures.


Annual Performance
of Apple Users
Placement Scor.
5.0
4.0
3.0
2.0
1.0
0.0
Pretest
Posttest
Elem Read
Elem Math
Assessment

The absence of statistically significant positive relationships on these two achievement measures in mathematics for the Apple Computer users and the JHS ESC/Tandy users may be explained in terms of a possible mis-alignment between objectives taught and objectives tested. One observation made by teachers in their survey responses indicates that there is evidence of some level of mis-alignment among those objectives taught and those tested.

Table 13 -- Pearson Correlation Coefficients Between CTBS Scores and CAI Criterion-Referenced Measures of Achievement.

| SYSTEM TYPE | | CTBS TEST | |
|---|---|---|---|
| | Criterion Measure | Reading | Mathematics |
| TSC/Dolphin | | | |
| | Reading | --- | |
| | Math | | .207** (N=125) |
| ESC/Tandy | | | |
| | Reading | .226* (N=84) | |
| | Math | | .203* (N=55) |
| Apple | | | |
| | Reading (AIMS) | .582*** (N=55) | |
| | Reading (Placement) | .649*** (N=42) | |
| | Math (AIMS) | | .054 (N=49) |
| | Math (Placement) | | .032 (N=44) |

Level of significance: *p < .05; **p < .01; ***p < .001

Data analyzed for this objective show clearly that there is a systematic relationship between the CAI achievement outcomes and national achievement NCEs at least at the elementary level. It should be pointed out that the modest successes evident in these findings are positive increments toward the long range goal of helping Chapter 1 students catch up with the norm in the regular classrooms. Right now that goal, though attainable, is still many increments away from realization.

## 4. Factors Associated with Teacher and Student Attitudes, Reliability of Computer systems, and General CAI Program successes and/or Limitations

Objective (4) assesses qualitative information generated through classroom observation, teacher interviews and teacher and student questionnaires. It provides indicators of student attitudinal factors, teacher perception of the reliability of the computer systems as an efficient tool for providing quality remedial services for these Chapter 1 students. It also gives some descriptive assessment of general CAI program successes and/or limitations and the ways in which these factors may enhance or retard progress.

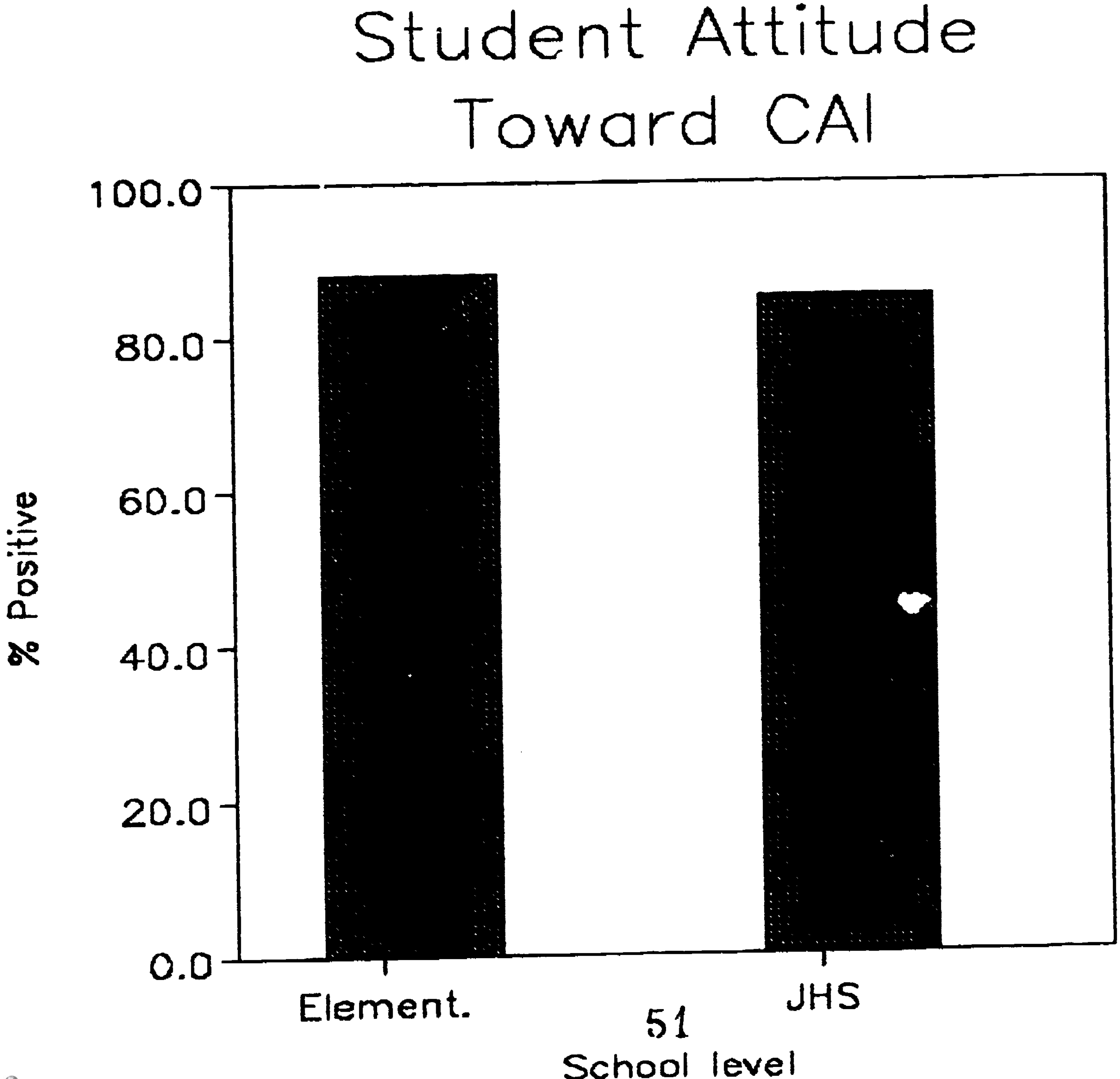
Overall, favorable indicators were shown for student interest in and attitude toward the CAI program as a medium of enjoyable and beneficial learning. Of the 420 elementary and 168 JHS students who completed questionnaires, some 88% elementary and 85% JHS students reported that their computer classes were generally interesting without undue frustration and that they always got a good feeling whenever they went to the computer laboratory.

Student satisfaction with academic progress in computer learning activities was also pervasive among all students. Some 83% of the elementary students, for instance, reported that they were satisfied with their progress in computer learning exercises, and that the difficulty level of the lessons was attainable.

Some 80% of the students reported satisfaction with computer learning exercises, and wished to do computer exercises more often than they do currently. This finding indicates that more time on the computer is overwhelmingly favored by the students, which ties in appropriately with the earlier finding, that a large number of the students need to have more time on the computer. This need becomes even more evident when it is considered within the context of another finding showing that the schools' laboratories constitute the principal source of exposure to computers as a learning tool for over 90% of the students--elementary and JHS alike. Ninety-two percent of the elementary and 81 % of the junior high school students reported that school was their principal source of computer learning exposure.

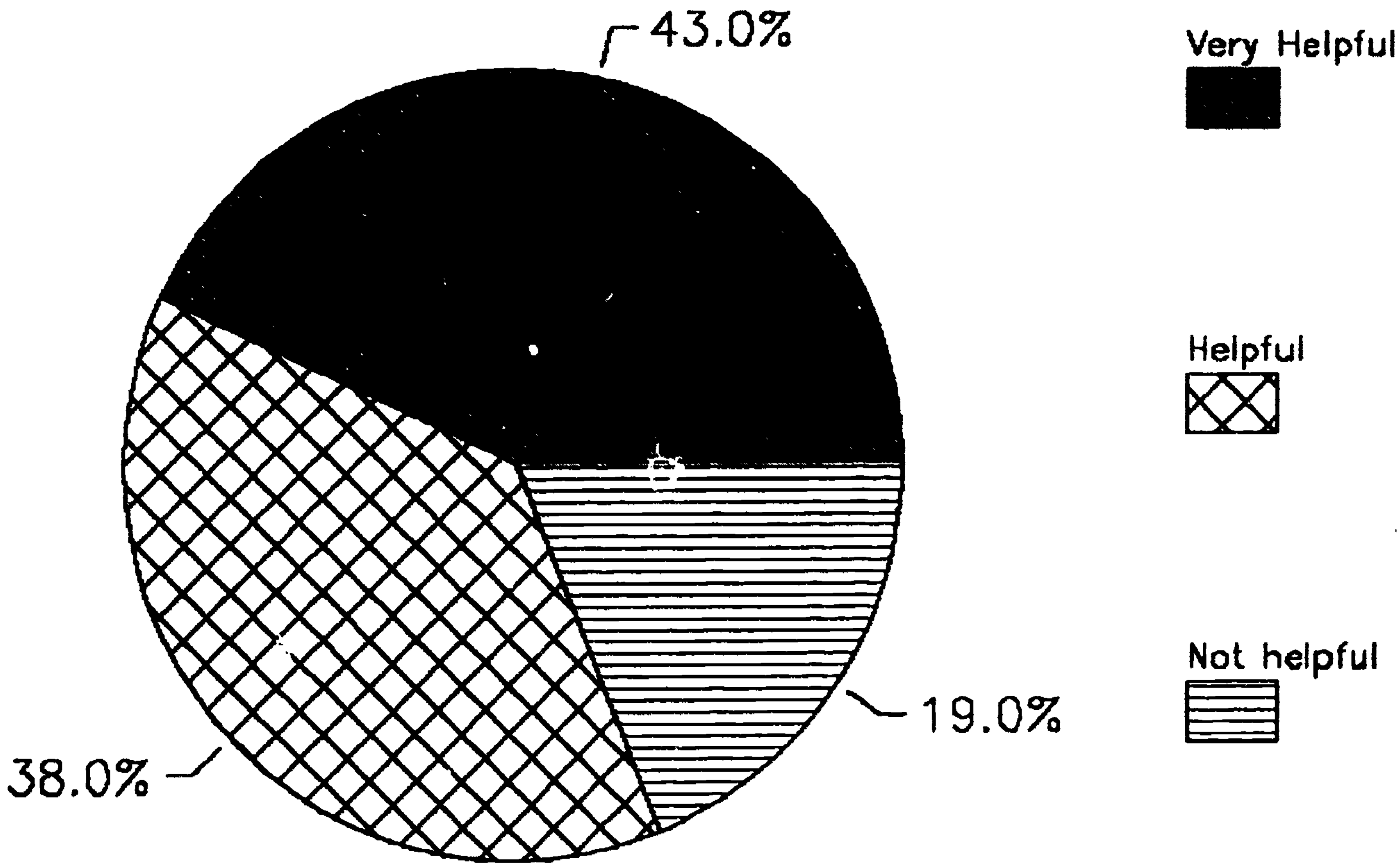
Factors related to attendance and level of CAI achievement show some level of relationship at the JHS level. Analysis of reported absentee rate and GPAs showed that the majority of the students getting A's had very few absences for the year. The range of absences for these students was reported as 0 to 10 days.

Teacher satisfaction with the level of academic challenge inherent in the respective software packages used in individual schools was quite favorable. Generally, teachers felt that most of the programs are on grade level with the added advantage of color and highly motivating subject matter. A few elementary

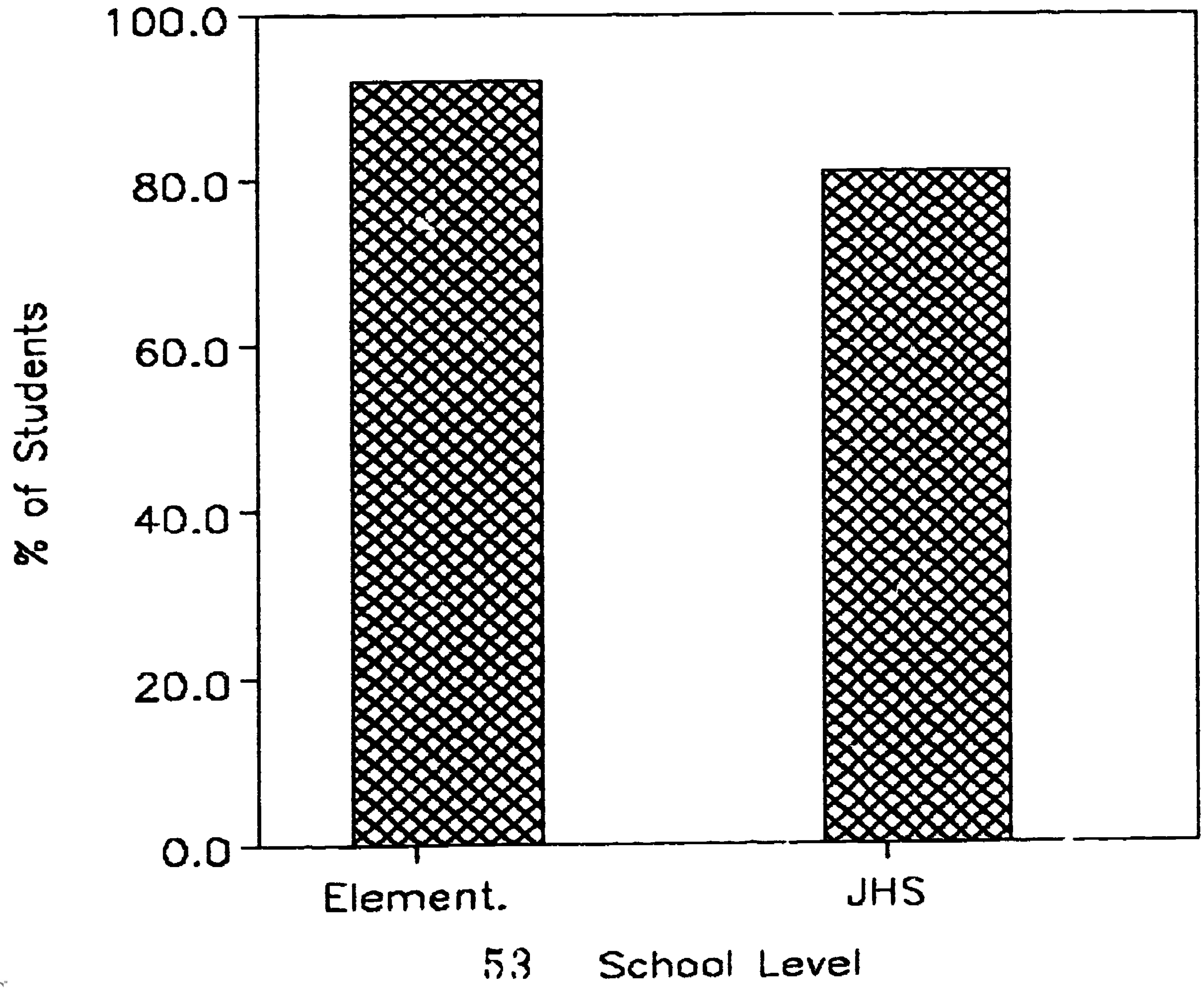


Student Attitude
Toward CAI
100.0
80.0
60.0
40.0
20.0
0.0
% Positive
Element.
JHS
School level

# Teacher Judgment of Chapter 1 CAI



# School as Source of Computer Learning



school teachers wanted more challenge at the grades 5 and 6 levels.

The need was expressed for a more complete correlation between the CAI objectives inherent in the computer software for reading and mathematics and those for CBC to facilitate 1) easier monitoring of student progress and 2) more accuracy in computer placements at levels comparable to those in the regular classrooms. This alignment is important also, in light of the evaluation finding which shows that the majority of teachers found that the 'objective by objective' student-performance-index was the most useful way of monitoring student progress.

Teacher satisfaction with student interest/attitude in computer assisted learning was also supported by the findings. For example, some 88% of the teachers reported that students were generally interested in their computer learning activities, and this is so even where the lessons presented some academic challenge.

Approximately, 75% of the teachers felt that all three components (computer work, directed instruction, and independent self-directed activity) of the Tripod instructional procedure were very helpful in the remediation process. Teacher overall ratings of the CAI program as an effective tool for correcting students skill deficits were favorable. Forty-three percent rated the program as very helpful and 38% as helpful.

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Despite the challenge posed by the severity of students' needs, the prognosis for alleviating the academic problems of many of these Chapter 1 students through the CAI program intervention appears promising. The findings indicate marginal successes in academic gains in reading and mathematics and an overwhelming positive student attitude toward the computer assisted medium of instruction and learning.

The critical task now is for the CAI Program to sustain these successes and to develop fresh strategies to propel further skill mastery gains that are more aligned to grade level norms in the regular classrooms.

Most urgent, it would seem, is the need to increase significantly, the amount of CAI remedial services offered to a large number of Chapter 1 students. The extent to which the CAI Laboratory Program meets the mandated long-range goal of correcting academic deficits in Chapter 1 students seems largely dependent on the extent to which these students are provided with adequate remedial services.