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Evaluating the effects of computer assisted instruction on student achievement in mathematics

Linda G. Bingham
University of Dayton

EVALUATING THE EFFECTS OF COMPUTER ASSISTED INSTRUCTION ON STUDENT ACHIEVEMENT IN MATHEMATICS

MASTER'S PROJECT

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by

Linda G. Bingman

School of Education
UNIVERSITY OF DAYTON
Dayton, Ohio

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Official Advisor

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CHAPTER I

INTRODUCTION

Purpose for the Study

In the district where the writer teaches, every classroom from third to sixth grade is required to have the students use a computer-generated instructional program every day for approximately 15 minutes. The program is an individualized instructional mathematics program. The Computer Curriculum Corporation (CCC) software program that is used contains over 1,000 objectives and 30,000 exercises. It spans kindergarten through middle school levels. The writer felt because students were required to use the computers daily, it would be valuable to assess the results of each student's achievement using computer assisted instruction (CAI).

The program offers an Initial Placement Motion (IPM). During the student's first ten sessions, the system automatically adapts the level of instruction based on the student's performance. Progression through the program is based on the student's proficiency at each level. In this way the CAI personalized mathematics for students, remediating lower achieving students and it accelerated higher achieving students. (Anand and Ross, 1987)

The writer used this management options available on the computer to determine if students were accelerating at the pace promised by the CAI software manufacturer. If a student encounters difficulty in an area, a special tutorial support is triggered to help a student through the troublesome area. Individualized worksheets are available for the teacher to print out for practice. The teacher has access at any time to a gains report to determine the individual student's progress. This gains report includes the IPM of the student, sessions attempted, gain since IPM, and a course average. This allows continual monitoring of student's progress. Tracking students progress on the computer may quickly enable a teacher to recognize problem areas and allow a teacher to implement the necessary intervention.

In a previous study done by the writer, each student was charted weekly for gains which was one reason for doing more research with CAI. If a student was not progressing as expected, several methods of intervention were available. Intervention may include extra worksheets, classroom review of an area, or more time allotted on the computer. Different intervention methods were implemented. It appeared the most effective intervention to directly impact gains made by the students was additional time spent on the computer. More study may need to be done in this area.

Another reason for conducting the study was the writer wanted to evaluate the effectiveness of this program with students in order to achieve the maximum gains per student to fulfill the expectations of the district. The writer's school district piloted this program for CCC. CCC and the district's administration expected eighty percent of students to achieve a gain of one year and three months in one school year (excluding special education students' data). Special education students used the CCC program and were expected to benefit from this program, but were not included in the results. The students received traditional classroom mathematics instruction along with this supplemental computer course.

Since the writer wanted another independent standardized testing tool to compare the results of the CCC program, an independent test was used to determine the validity of the CCC results, which was one purpose of the study. The IPM and course average record results in grade level.

Another reason for conducting this study was to compare the results of this program to other CAI so this program could be used to help teachers evaluate the effectiveness of the computer enhanced learning. Computers are now becoming cost effective to use in the classroom, as opposed to hiring tutors for students. (Fletcher, Howley and Piele, 1990) As this becomes apparent to school districts, they will be using computers more and more in their programs. Teachers will need to feel comfortable using CAI and need to see the benefits generated by these programs. The writer hopes to show teachers the results that they can reasonably expect to achieve using this software program.

Problem Statement

The purpose of this study was to evaluate the effectiveness of supplemental computer assisted instruction (CAI), on the mathematics achievement, of third grade students.

Hypothesis

There will be no significant difference between the students mathematical achievement pretest and posttest scores after experiencing computer assisted instruction (CAI) in mathematics.

Assumptions

To carry out this study the writer must make the following assumptions. First, the students will perform to the best of their ability on both the pre and posttests. Second, the

students will consistently perform to the best of their ability on daily computer sessions. Also, it is assumed the students can effectively operate the computer program.

The writer assumes the pre and posttests measure what they are designed to measure. The writer was assuming the pretest did not serve as a learning experience for the posttest, and therefore alter results. The students may have performed better or worse because they were older, more or less fatigued, more or less interested, or more or less motivated when taking the posttest. (Issac and Michael, 1995)

Limitations

One of the limitations of the study was the inability to survey a large population of students. There was a sample size of eighteen students. Findings might have been more representative if a larger number of students in varying school systems could be surveyed.

Another limitation of the study, was that in using the T_1 X T_2 study design there was no control group. Gains achieved by students could be influenced by other factors, such as maturity, classroom instruction, parental intervention, motivation, or the effects of the pretest. (Isaac and Michael, 1995)

Another limitation of the study was the Brigance Diagnostic Inventory of Basic Skills may not have tested the same types of mathematics areas as the CCC program. The difference in methods of testing may also be a factor in the results. Some students may not perform as well as using paper and pencil methods of testing.

Definition of Terms

Achievement is the amount of gain or difference in pre and post test scores as measured by the computer or standardized test.

Brigance Diagnostic Inventory of Basic Skills is a criterion based assessment of academic skills useful in diagnosing strengths and weaknesses and potential approaches to intervention in assessed areas.

Computer Assisted Instruction (CAI) is a computer program based on personalized tutoring, immediate feedback-correctives, and frequent reinforcement. (Mavarech, 1985)

Computer Curriculum Corporation (CCC) is the company that offered educational computer systems software used in this study.

Initial Placement Motion (IPM) an individualized process of the CCC software program, where the system automatically adapts the level of instruction presented based on the student's actual performance.

Intervention a process of determining and implementing alternative approaches to problematic academic tasks presented to the child in the classroom.

Supplemental Material is the use of a personalized computer software program.

Technology is the use of computer hardware and software. (Dyrli and Kinnaman, 1995)

CHAPTER II

REVIEW OF THE RELATED LITERATURE

The review of literature will be discussed in this chapter. It is divided into two sections. They are reasons for using technology and studies that support computer assisted instruction.

Reasons for Using Technology

There are several reasons for using technology in the classroom. One reason is in this generation of technological advances it only seems practical to implement the highest quality of instructional methods available to teachers. Computer assisted instruction (CAI) is a highly motivating method to use. However, teachers must be made aware of the benefits of using CAI in the classroom to use this technology effectively. (Miller and Olson, 1994)

Teachers tend to be leery about innovations introduced into the teaching profession. In a study by Allison (1995) at Marion Elementary, in Central Kansas, $100,000 worth of computer technology was purchased over a four year period. It was found that teachers were not effectively integrating the computers and software. The reason cited was lack of training in the use of computers and lack of knowledge of available software.

Another example of a school system integrating computers and software was Indian Creek. Indian Creek Elementary School in Indianapolis was aware of the need for teacher inservices in technology. From the inception of this science and technology magnet school, a large portion of the resource dollars was directed to teacher training. Teachers were treated as professionals whose ideas on the use of technology in the classroom counted at staff meetings. When teachers were part of the decision making process on the use of technology, they used this technology in the classroom and came up with innovative ways to incorporate it into all curricular areas. (Gould, 1991)

When using technology, teacher input is extremely important. Dr. Henry Jay Becker of the University of California summarized, "The ways in which teachers use software is more important than the software itself." (Dyrli and Kinnaman, 1995) Research shows that word processing is the dominant usage of computers in the classroom. However, the quality of the student's skills and uses that they make of the computer is still dependent on what the teacher has students do with the technology. Once teachers experience technology they generally are motivated to use it and adapt it to their individual uses.

A reason to use technology is because of the flexibility that it offers. The computer is meant to be used as a teaching tool by the teacher. The teacher does not need to alter his/her methods of teaching, only adapt the computer to fit their instruction. Software developers are becoming aware of the role of the teacher and the existing curriculum. This has led to changes in the development of educational software. Teachers now have more options of using the computers than the traditional drill and practice. The Computer Curriculum Corporation (CCC) software program used in this study is one example of a performance-based instruction using an individualized process. It produces instruction continuously customized for each student according to the CCC curriculum profile.

Another reason to use technology is its cost-effectiveness. Using technology in the classroom is becoming more cost effective than it has ever been before. (Fletcher, Hawley and Piele, 1990) The ratio of students to computers that was about 125:1 ten years ago has dropped to about 15:1 today. (Allison, 1995) "Ten years ago the limited access to computers and the limited knowledge about computers led educators to teach about computers. Today, knowing about computers is not enough. We must find ways to effectively use the technology as a tool in the learning environment," stated Allison. (1995) As computers become widely available and accessible to teachers and students, the possibility of technology exists for everyday classroom applications. (Ross, Anand and Morrison 1988) Teachers need to be made aware of how to apply these technologies to their curricular areas to use them as effectively as possibly.

One reason teachers may use computers is because computers are non-judgmental in corrections and never lose patience. (Miles and Weaver, 1986) Also students can continue to review material until it is mastered, unlike regular classroom instruction where a teacher must move on due to time constraints. Higher achieving students progress at their own pace, minimizing boredom in the regular classroom. The CCC program allows students to progress at their own pace by placing them at a level determined by their proficiency on the computer. Teachers can use the management options to review and reinforce skills the students are learning in their program. In addition, the more comfortable the teacher feels using these options, the more likely they will be to use them.

There are many reasons for using technology in the classroom. One of these reasons is to individualize student's learning. The writer feels in her own classroom, there exists a wide range in the material assimilated by students entering into third grade. Some students may be below grade level, some on grade level, and some students may be above grade level. The teacher cannot always instruct at a level to accommodate each individual's placement. One way for a teacher to remediate a student's weak area, or enrich a strong area, is to use CAI. A teacher can closely monitor a student's progress. This can be done

using the CCC software by running individual worksheets, or reports. The more understanding a teacher has about how a program works, the more effectively it can be used.

Studies That Support Computer Assisted Instruction

In reviewing the literature the writer found several studies evaluating the use of CAI. With the increased usage of technology in the classroom will come more research into the effectiveness of these new programs. Studies have been done using students as young as preschool to college age students. Various areas have been studied from mathematics to music. Students have been studied in different countries, of varying socioeconomic backgrounds and abilities. The methods employed in these studies vary greatly, but the basis is the same, to determine the effectiveness of computer assisted instruction. Does this technology deliver what it promises? One of the purposes of the writer's study was to try and answer this question.

In one study preschool children received CAI and Logo software to teach pre-math/spatial skills. Eighty percent of instruction was through the computer with twenty percent teacher instruction. Pretests and posttests were used to assess gains in skills: pre-math knowledge, comprehension monitoring, spatial ability, and ability to transfer. Independent variables included cognitive style and type of software. Two classrooms or forty preschoolers participated in the sixteen-week long study. One week of initial training was done using software before completing lessons. Children used the computers three times a week. No significant differences were found among the groups. All groups did become more proficient and answered more questions correctly. All children learned to use CAI and Logo software successfully. (Howard, Watson, Brinkley and Ingels-Young, 1994)

The next study was of great interest to the writer because the grade level and subject were the same as the writer's study. This study dealt not only with student's mathematical achievement using CAI, but also the student's attitudes toward mathematics. The subjects were 204 third grade students in four Israeli schools. All the students were from lower socioeconomic status families. The mathematics achievement was assessed by a standardized test (AAT). The attitudes were assessed by the Intellectual Achievement Responsibility (IAR) questionnaire. A two factor multivariate analysis was performed on measures of achievement, anxiety, and locus of control. Students using CAI indicated a significant gain in achievement scores. Also CAI students had less mathematics anxiety than non-CAI students. (Mavarech, 1985) It is interesting that not only is CAI of interest

in our country but elsewhere. Also, the results being seen in other countries (Mavarech, 1985) are similar to results here.

Another study done in mathematics was with seven students in second through seventh grade students. These students were in three different elementary schools in Tel Aviv Israel. The students had varied backgrounds regarding socioeconomic status, type of school, and achievement in mathematics. Four observers, experienced in mathematics, observed these students. Data collection included observations; interviews with students, teachers, parents, and siblings; questionnaires for teachers; computer-generated reports; paper-and-pencil tests; and tutoring. This study evaluated the effectiveness of CAI with lower and higher ability mathematics students. The conclusions reached were that higher achieving students were more able than the low achievers to adjust to the special environment of computer work and to derive great benefits from it. (Hativa, 1988) Learning styles seemed to play an integral part in the student's ability to effectively use the CAI.

A study done with fifth and sixth graders was conducted at Hurst Hills Elementary School in Hurst, Texas. Hurst Hills participated in a nationwide study done by Dr. Henry Jay Becker of Johns Hopkins University. Hurst Hills was chosen because of its implementation of a high-tech curriculum. Hurst Hills was participating in Apple Computers model school's program. All fifth and sixth grade students were pretested with the California Achievement Test (CAT). Students were randomly assigned to a CAI group or a control group. Hurst Hills projected that the CAI group would make greater gains than the traditional group, but was surprised by the results. Goode (1988) stated,"Both the fifth- and sixth-grade computer groups gained an additional year of achievement over their classmates in the traditional group. Pre- and post-test results also indicated that computer students at both extremes of the ability-level spectrum showed greater gains." This seems to conflict with the results of Hativa (1988) who concluded lower achieving students did not gain as much as higher achieving students. The writer felt because Hurst Hills was a high-tech school, maybe more emphasis was placed on the CAI group with higher expectations. Also, the types of software used by Hurst Hills may have been more conducive to the learning styles of lower ability students than the ones used in Havtiva's study. More research may need to be done to determine if these could be determining factors.

Another study done with fifth and sixth grade students was done in Memphis, Tennessee. These students were also using CAI with mathematics doing a unit on division of fractions. Fifth and sixth graders were grouped together in mathematics classes. Students were randomly chosen to be in a control group, a concrete group, an abstract

group, or a personalized CAI group. In this personalized CAI group a questionnaire was filled out with personal information regarding subject's background and interests. Personalized contexts were developed replacing abstract referents with personally familiar items using questionnaires. Each student had a disk with their personalized dated entered into it. Three areas were tested, context, transfer and formula recognition. The personalized CAI group outscored the other groups in every area. One of the reasons cited for the success of personalization was increasing interest in the task. Another reason cited was the meaningfulness of the material. (Anand and Ross, 1987) Personalizing mathematics could not be done as easily without the use of CAI. The implications of this study suggest personalizing could also be beneficial in the teaching of reading comprehension. The CCC software program does not personalize by inserting student's interests and background information into the program, but it does personalize by adapting each program to the student's individual learning pace.

As with the previous two studies mentioned (Anand and Ross, 1987; Goode, 1988) Thomas Miles and John Weaver (1986), also studied the effectiveness of CAI in mathematics. They were interested in student's achievement and attitudes using CAI as was Mavarech (1985). The results of this study showed there was a significant difference in attitudes in both sixth grade and eighth grade students who were studied over non-CAI students. This appears to support Mavarech's study. There was a significant gain in eighth grade student's achievement scores, but not in the sixth grade scores. Since this study was done by two different researchers, conditions may have varied enough to account for this difference. The eighth grade student's results appear to be more consistent with the other research reviewed.

In a different type of study done using third grade students CAI was used as an aid in learning music reading skills. This study also used the pretest and posttest method. The music reading skills included staff identification, pitch identification, and duration identification. Two different elementary schools were used in this study, one urban and one rural. Since a standardized test was not available to test these areas, the researcher had to design her own test. There was also a control group utilized in this test. Data was analyzed using a series of 2 x 2 analysis of variences, as well as a t-test. Although both groups achieved gains, the results showed significant gains of the CAI groups over the control group. (Roach, 1990) This study shows that CAI not only can be used effectively in the traditional classroom areas, but also in other areas.

The last study reviewed was somewhat different due to the age and nature of the study. In this study sixty undergraduate students were studied for the effects of comprehension-directed and memory-directed computer-based learning-strategy training on the achievement

of learning objectives. Included in this one week study were two treatment groups and one control group. A one way ANOVA indicated the main efects were significant at the $p<.001$ level. The comprehension-directed training was the most effective. All treatment groups mean scores were significantly higher than the control group. (Cardinale and Smith, 1994)

It appears there does seem to be a positive effect of CAI in student achievement and attitude not only in mathematics but also in other areas. All the studies were evaluating different software programs, yet most of the results were similar. With the rapid pace of software publication and the influx of technology in the classrooms more study will need be done to determine if these programs are up to the promised standards. Teachers will need to be familiar with these programs and the use of technology. The more knowledgeable and involved in technology teachers become, the more accepting and effective they can be.

CHAPTER III

PROCEDURE

The procedures used in the completion of this project are discussed in this chapter. It is divided into five sections. They are: subjects, setting, data collection, design, and treatment.

Subjects

One class of eighteen third grade students was involved in this study. There were ten boys and eight girls. Seventeen students were Caucasian and one student was Black. The students IQ's ranged from 81 to 137. The mean IQ was 102.8. This falls into the range of average intelligence. Six of the students had repeated a grade. Ten of the students had been in a special reading program in either first or second grade. This was the first year these students had used the Computer Curriculum Corporation (CCC) software program with the exception of one student who was repeating the third grade.

Setting

School. The project was conducted in a public school consisting of third grade through sixth grade students. There were approximately five classes at each grade level in this particular building. There were approximately 500 students in the building. In the school system all classrooms from third through sixth grade were equipped with two Macintosh LC II computers using computer assisted instruction in mathematics.

There were six elementary buildings, one junior high, and one high school in this school system. One elementary consisted of kindergarten through second grade. This study was conducted in the only building containing third through sixth grade. All other elementary buildings included kindergarten through sixth grades.

Community. Two parent towns merged to begin this community in 1950. There are approximately 31,300 people living in an 11.34 square mile area. This is a suburban community offering eight major neighborhoods with a wide range of homes. These homes range from historical, traditional, and contemporary, to ultra-modern. There are forty-three Protestant churches and one Catholic church in this community. Included in this community are a government center, one library, four fire stations and four cemeteries.

The location is near four major interchanges. The two major employers are a military base and a university located within the community. Besides the community's population, the military base has 4,050 residents and the university has 17,500 students.

Data Collection

Construction of the Data Collecting Instrument. The Brigance Diagnostic Inventory of Basic Skills from "Curriculum Associates" was used as a pre and posttest to determine grade level placement. Also used was the Initial Placement Motion (IPM), and a final grade placement level from computer data. The CCC management options were used to monitor student's progress. Once a week a gain's report was run. The Brigance pretest and posttest were used to evaluate the effectiveness of CAI by calculating the gain. The Brigance Diagnostic Inventory of Basic Skills test was chosen because of ease of administration to a large group. The Brigance also measured results by grade level.

Administration of the Data Collecting Instrument. During the first week of school the Brigance Diagnostic Inventory of Basic Skills test was given in a group setting. There were twenty-eight problems on this test involving addition, subtraction, multiplication, and division. This test determined the initial grade level of the students. No set time limit occurred. This enabled all students to complete the test and check over mistakes. Students were allowed to use paper and pencil to work out problems if needed. Students did not receive the test results.

Students were introduced to the computer hardware and software a few days after the Brigance was given. After a two week initial testing period on the computer, each student was assessed and placed at their appropriate grade level by the computer. At this time, each student began an individual program based on his/her own abilities as determined by the computer program. Some students were placed below their grade level, some on grade level, and some were placed above grade level. Each student was allowed to work and progress at their own pace.

At the end of the study the posttest, identical to the pretest, was given under the same conditions as the pretest. A current grade level was then determined for each student. A gain was calculated for each student's achievement.

Design

The experimental design for this experiment was one-group pretest-posttest. (Campbell and Stanley as cited in Isaac and Michael, 1995)

$$T_1 \ X \ T_2$$

The T_1 represents the Brigance pretest. The T_2 represent s the Brigance posttest. The X represents the independent variable of the computer assisted instruction (CAI).

Treatment

In this study of eighteen third grade students, each student was pretested at the beginning of the school year using the Brigance Diagnostic Inventory of Basic Skills Math Grade Level Test A-1 by Curriculum Associates. The Brigance was chosen because it was an independent testing tool. Also, the Brigance records results in grade level and was easy to administer to a large group.

The Computer Curriculum Corporation (CCC) mathematics software program was used. The CCC system was an individualized performance-based instruction that promised rapid academic gains. It included kindergarten through middle school levels.

Before the beginning of the program, the teacher enters each student's name, computer number, and an initial enrollment level. The level for third grade was 3.0, which equates to the beginning of the third grade. All students were entered into the program at level 3.0. To initiate each session the student enters their name and assigned computer number to access their program.

During the first ten sessions the student takes in the course, the system automatically adapts the level of instruction presented. This is based on the student's actual performance. At the end of ten sessions, the student is then working at their own functional level, regardless of initial enrollment. This level may be at, above, or below the initial enrollment level of 3.0.

There were two computers available in the classroom. Each student used the computer program at least once a day, for approximately fifteen minutes, throughout the duration of the study. At the end of the three month study each student was given the same posttest (the Brigance).

The independent variable is the computer assisted instruction in mathematics that the students were exposed to during the study. A pretest and posttest were given to determine the students grade level placement and the amount of gain achieved during the study.

CHAPTER IV

RESULTS

The result of the hypothesis of this project is presented and discussed in this chapter. A table is used to show the outcome of the hypothesis. The table consists of the number of students in each group (n), mean scores ($\bar{x}$), and standard deviations (s). A discussion of the results follows the table.

Presentation of the Results

The third grade students using CAI had a higher mean posttest score than on the pretest, and the standard deviation was lower on the posttest scores. Both groups consisted of the same eighteen students. The test consisted of twenty-eight problems. The mean score for the pretest was 10.37 and for the posttest it was 12.67 (See Table 1).

A t-test for dependent samples was used to determine if the finding between the mean scores of the two tests was a significant one. The t-value was determined to be 3.92. Since the value of t is greater than the critical value, the null hypothesis is rejected. The writer concludes that there does appear to be a significant difference in the mathematics achievement of third graders who received CAI to supplement their regular classroom instruction.

TABLE 1

THIRD GRADE ACHIEVEMENT EXPRESSED AS
MEAN SCORES, STANDARD DEVIATIONS,
AND T VALUE FOR CAI PRE AND POST TEST GROUPS

Test	n	x	s
Pre	18	10.37	2.64
Post	18	12.67	1.33

degrees of freedom = 17
$t = 3.92$; $p < .05$

Discussion of the Results

There appears to be a significant difference in mathematical achievement of third grade students who are taught using CAI as a supplemental teaching aid. The t-value of this study was determined to be 3.92 which was greater than the critical value. (Issac and Michael, 1995) The t-test for dependent samples used indicated there was a significant difference.

These results seem to support all of the findings of the studies researched for this project with the exception of one sixth grade study on mathematical achievement by Miles and Weaver. (1986) In this study, sixth grade students used CAI in mathematics as a supplement to determine if a significant gain was achieved. In this particular study there was not a significant gain achieved.

McConnell (1983) as cited by Miles and Weaver's did a study showing the effects of CAI with third through sixth grade students. McConnell's findings showed third grade students gained the most using CAI and sixth grade students made the least gains. This research done by McConnell (1983) concurs with the discrepancy between the writer's findings with third grade students achieving a significant gains, and Miles and Weaver's findings with sixth grade students not achieving a significant gain. Also the type of material covered by the students at the different grade levels and the student's willingness to use the software may account for the difference.

Types of software programs used may have been one factor in the difference in gains. Hurst Hills (Goode, 1988) used only Educational Systems Corporation software. Another study (Howard, Watson, Brinkley and Ingels-Young, 1994) used a variety of CAI software consisting of Sticky Bear ABC's, Sticky Bear Numbers, Math Rabbit, and Logo software. The writer used the Computer Curriculum Corporation (CCC) Mathematics program. Also, the ages of the children may have been a factor in the results (Miles and Weaver, 1986).

Another reason the results between different studies may have varied in their gains, may have been the ways in which the instructors used the programs. (Dyrli and Kinnaman, 1995) Indian Creek Elementary School (Gould, 1991) incorporated their technology into all curricular areas. Their teachers were inserviced extensively and were part of the decision making process. Hurst Hills (Goode, 1988) also had a high tech curriculum. The students would be more familiar with the use of the computer. The writer used CAI in Mathematics and had used this program for two years. In several studies students weren't as familiar with the computers because they used CAI in Mathematics only, and their

instructors may have been somewhat unfamiliar with the programs. (Anand and Ross, 1987; Hativa, 1988; Mavarech, 1985; Miles and Weaver, 1986)

The Computer Curriculum Corporation (CCC) indicates in their publications that the amount of time students spend using the program directly relates to the amount of gains achieved. The different studies varied in length of implementation that may have accounted for varying results. Miles and Weaver's (1986) study lasted only twelve days, in which the sixth grade students showed no significant gain. The results of the eighth grade students showed significance at the .05 level. The writer's study of third grade students agrees with Miles and Weaver's eighth grade results with significance at the .05 level. The Hurst Hills study (Goode, 1988) was a six month study. They used fifth and sixth grade students and had a significant gain at both grade levels. This comparision of studies of time using the computer appears to coincide with CCC's claim that the amount of time using CAI is a direct factor in the amount of gains achieved. This appears to justify students using CAI with increasing amounts of time spend accessing or using the computer programs.

The CCC also indicates students should gain one year three months in one school year using CAI. Theoretically a student would gain 1.0 or one year growth in one school year. In this study during the three month test period the mean growth was .47 or about four and one half months. If the students continue to progress at this rate, in a nine month school year the mean score would theoretically be 1.41 or one year and approximately four months gain. This would surpass the goal of one year three months set by CCC by approximately one month. It would appear from this information that this class will attain the goal set by CCC and the writer's school district of one year three months gain. Of course other factors such as maturation, classroom instruction, or parental intervention (Isaac and Michael, 1995) could have affected end of the year results. Using a control group or a larger sample population to conduct this type of research would be more conclusive.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

In this project the writer wanted to determine the effectiveness of computer assisted instruction (CAI) used in her district. The district had used this program for three years and teachers were required to have the students use the program. This requirement for students to use the computer prompted the writer to do this study.

The purpose of this study was to evaluate the effectiveness of CAI used as a supplement on the mathematics achievement of third grade students.

There will be no significant difference between the students mathematical achievement pretest and posttest scores after experiencing CAI in mathematics.

In this three month study eighteen third grade students were pretested using the Brigance Diagnostic Inventory of Basic Math Skills to determine the students initial mathematics level. The students were then introduced to the computer hardware and software program. After a two week initial testing period on the computer, each student was assessed and placed at their appropriate grade level by the computer. All students in one classroom were taught mathematics each day by the same instructor. Every day the students would use the supplemental CAI software program for approximately fifteen minutes.

At the end of the study the Brigance Diagnostic Inventory of Basic Math Skills was again given in a group setting as was the pretest. No time limit was set on either test. The posttest determined the student's final mathematics level. The difference in the pretest and posttest scores were calculated.

The student's mean gain score of student achievement was 1.83. A t-test was used to determine if the difference was significant. On the basis of the t-value, the null hypothesis was rejected. This indicated that there was a significant difference in the mathematics achievement of third grade students using CAI as a supplement.

Conclusions

As a result of this project, there appears to be evidence that CAI is effective in improving the mathematical achievement of third grade students. It seems CAI can be a

useful tool in supplementing mathematics programs. More research needs to be done in this area to be conclusive.

Recommendations

The writer feels more research needs to be done on the effectiveness of CAI. With the increase in computers in the classroom and the multitude of software programs available, studies will need to be done continually to evaluate the effectiveness of different programs. One mathematics software program could be compared to another mathematics software program. This type of study may encourage software programs to increase effectiveness and become more cognizant of the school's needs and curricular areas. This could potentially help students to do better on required proficiency tests.

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