PRESCRIPTIVE VERSUS NON-PRESCRIPTIVE SOFTWARE: WHICH PROGRAM MORE POSITIVELY AFFECTS ACHIEVEMENT?

D. ALLISON CURD

To the Graduate Council:

I am submitting herewith a field study written by D. Allison Curd entitled "Prescriptive Versus Non-Prescriptive Software: Which Program More Positively Affects Achievement?" I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Education Specialist, with a major in Education.

Donald W Luck

Dr. Donald Luck, Major Professor

We have read this field study
and recommend its acceptance:

Rebecca Slayton Mullahe

Daniel B. Hall

Accepted for the Council:

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Prescriptive Versus Non-Prescriptive Software: Which Program More Positively Affects Achievement?

An Abstract

Presented to the

Graduate and Research Council of

Austin Peay State University

In Partial Fulfillment

of the Requirements for the Degree

Education Specialist

by

D. Allison Curd

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ABSTRACT

A study was conducted to determine if Integrated Learning System software is more effective than multimedia software which is not prescriptive for the subject of mathematics. The Computer Curriculum Corporation software was used with the experimental group of six fourth graders, which is an ILS system, and Hartley Skills Collection was used with the control group, which was a group of seven fourth graders in the same class. The students in each group worked for twenty minutes every other day on their respective software. The 1996 TCAP (Tennessee Comprehensive Assessment Program) served as a pretest and the 1997 TCAP served as a posttest. A qualitative evaluation was also ongoing during the study. The quantitative study revealed no significant difference between the treatment and the control group, but the qualitative study noted some differences in the two software systems.

Further study was suggested with a larger group in order to gain statistical significance. Suggestions were also made to improve teacher training, and to make resource people available for assistance during the school day.

ACKNOWLEDGEMENTS

I would like to express my gratitude to Dr. Donald Luck, my major professor, for the patient guidance, and innumerable resources he has made available to me. I would also like to thank Mrs. Sara Caudill and Dr. Wesley Freeman for their encouragement and assistance in this study, as well as their personal encouragement to me in my efforts toward higher education. In addition, I would like to thank Dr. Camille Holt and Dr. Rebecca McMahan for providing constructive comments in order to improve the study. Finally, I would like to thank my parents, Mr. and Mrs. Lewis Curd, for their encouragement and support throughout my life.

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CHAPTER 1

Introduction

As the tax base continues to shrink in many areas, schools are being asked to closely examine the cost-effectiveness of their programs. Innovative and technologically advanced programs are being offered on the market, but they are often offered at a premium. According to Trotter, computers and related support materials are being purchased by schools at a rate of about one billion dollars per year (1990). Many Tennessee schools have received computers and funds to purchase software through the Twenty-First Century Schools Program. Although teachers have training sessions to prepare them for the technology, they are often at a loss when choosing software. The available research is often vendor-financed; and therefore, the results may be skewed. Teachers also often rely on peer recommendation for information, which may also be inaccurate, and certainly not comprehensive. Finally, the technology changes so frequently that it is difficult to keep abreast of current findings.

Research conducted which compares different types of software within the same classroom over an extended time frame is scant (Standish, 1992). The research that does exist is often flawed by lack of researcher control, differing instructors for control and experimental groups, and vendor-financing, which could color the results (Beckner, 1990). Prescriptive software is expensive, and the time necessary for the computer to "diagnose" a student is extensive. If the money and time yield a favorable outcome, then the effort may be worthwhile. But if non-prescriptive software is just as effective, then the money may be better spent on a larger variety of software, or an additional unit for the

classroom. The question arises, "Is computer assisted instruction more effective if the software being utilized is prescriptive?"

Statement of the Problem

The problem to be investigated in this study was to determine the effectiveness of prescriptive software as compared to non-prescriptive software.

Limitations of the Study

This study was limited to a single classroom of fourth graders at Sullivan Elementary School in Dickson County. The treatment group was limited to six students. Only one prescriptive software program was examined, which was Computer Curriculum Corporation. The students were heterogeneously grouped by the principal of Sullivan Elementary using battery scores from the Tennessee Comprehensive Assessment Program. They were not randomly selected, but stratified according to the total battery math, reading, and overall total battery scores. The students were also stratified according to grades, reading level, gender, race, special programs and other special needs. The placement of students was completed through the state-approved Horizon software program. The literature review was limited to the electronic databases and holdings of Woodward Library at Austin Peay State University.

Methodology

This study involved the use of prescriptive software, which is an Integrated Learning System (ILS) designed to help students attain a

particular target level. The software diagnosed students for thirty sessions, and then prescribed the appropriate placement based on the students' performances. The students were assigned to the prescriptive software group, which was the treatment group, or the non-prescriptive software group, which was the control group. The students were assigned to groups based on their 1996 TCAP total mathematics NCE scores. For the experimental group, two students were chosen to represent the top third of the class, two students were chosen from the middle third, and two students were chosen from the bottom third to represent the an academically equivalent group when compared to the control group. Students in both groups received thirty minutes of computer time every other day, and they all worked with the mathematic computation programs.

Students in the control group were diagnosed by the teacher, and the students received the treatment which the teacher felt was most appropriate. This continued through the academic year. Each person in the treatment group was placed individually by the computer into the appropriate program according to his or her performance. The students in the control group received placement based on which software was applicable to the objectives currently being taught. Test results were analyzed using ANOVA. The results from the spring of 1996 TCAP (Tennessee Comprehensive Achievement Program) served as a pretest, and the results from the 1997 TCAP served as a posttest. The achievement of the control group was compared to the achievement of the treatment group using TCAP scaled scores, and the gain of each group was compared using the NCE of the TCAP test. The students' gains were also compared to their past performance gains, and this was accomplished by using existing scores from the school permanent records. A letter of consent was

given to each class member, and parental permission was obtained before these records were reviewed for experimental purposes.

These tests were analyzed using t tests as well. The children in the treatment group were selectively chosen due to the small sample size. This selection was based on the 1996 TCAP NCE scores for total mathematics. Two students were selected to represent the top third of the class, two students were chosen to represent the middle third, and two students were chosen to represent the lowest third of the class. The subjects were assigned numbers in order to reserve their anonymity. The six students in the treatment group were a heterogeneous group based on 1996 TCAP results.

A qualitative study was also ongoing during the treatment, which lasted from the beginning of the study through April. The students in the treatment group were observed while using the computers, and the researcher notated students' reactions, feelings, and responses. Students kept journals documenting their feelings toward the computers. Any anecdotal information which was significant to the study was included. The notes and documents were then evaluated in order to find any common themes, problems, or successes, and discussion was generated from this data.

Definition of Terms

ANOVA- Analysis of variance

TCAP- Tennessee Comprehensive Assessment Program

COMPUTER CURRICULUM CORPORTATION - a brand of prescriptive software selected for the experimental group's use for this study.

PRESCRIPTIVE SOFTWARE- An integrated learning system (ILS), designed to help students attain a particular target level. The software evaluates students for thirty sessions, and then places them in the appropriate level. The program will then give the teacher a timetable in which the student will be predicted to reach the target. It also individualizes worksheets, and provides feedback to the student instantly. This is a type of multimedia software.

NON-PRESCRIPTIVE SOFTWARE- Any software which is prescribed by the teacher.

CHAPTER 2

Review of Related Literature

Research which has been recently conducted indicates that computers are at least not detrimental to student achievement, and in most cases improve student performance. For example, in a study conducted by Weiner in 1994, eight low-achieving sixth graders were chosen for a treatment group in an experiment involving multimedia software. They were chosen based on low scores on the 1993 Stanford Achievement Test. The experimenter set several behavioral objectives based on their weaknesses, and these objectives were to be met by working on the computer. Teacher-made objective based pretests and posttests were administered with each new skill. The results from the post-Stanford Achievement Test show all students in the treatment group improved their scores, and some gained as much as three hundred percent.

A study was done in the Chicago Public School System involving seventy-five seventh grade minority students. Fifteen students were randomly selected to work on computers and serve as the treatment group. The rest of the population was the control group. The Iowa Basic Skills Test was utilized as a pretest and posttest measure. After a year of computer use, the ITBS data was analyzed using a t-test. The control group had a mean score of 5.2 on the pretest, and 5.8 on the total battery of the posttest. The experimental group's mean score on the pretest was 5.3, and the posttest total battery was 6.5, which is significantly higher (Arroyo, 1992).

Programs such as Hyperstudio, Lego Logo, and MacGlobe were implemented into the curriculum of elementary schools in Raleigh, North Carolina. The Internet and spreadsheets were also used by the students. The

goal of this project was to reduce the gap between majority and minority students, without negatively effecting the majority. This goal was accomplished, because the gaps were reduced in most cases, and the majority continued to make gains. Technology recommendations were made in this study, and the aforementioned software was found to be effective with the appropriate age groups (Baenen, 1995).

Following the implementation of computer installation, inservice, and software selection, several rural school systems were outfitted with the equipment necessary to conduct a study with a maximum of thirty-two students per class. This research was conducted using WICAT software, due to its comprehensive format, and because it had been used in previous studies in which improvement had been achieved. The schools involved were located in New Jersey, Maryland, and Pennsylvania. The Waterford Basic Skills Test was used as a pretest and a posttest measure. Analysis of Covariance was performed on the tests. The results show a modest gain for the first year of implementation, but the second and third year scores were significantly higher. The author attributes the lack of first year gain to the fact that the students' keyboarding skills were weak, and teachers were not yet familiar enough with the software (Beyer, 1991).

The "literacy crisis" was addressed by the pilot study in San Antonio, Texas. The study conducted by Carlson consisted of a writing model called R-WISE (Reading and Writing in a Supportive Environment). The students used this software as an aid in creative writing and reading. Student papers were evaluated with a researcher-developed rubric before the program began, and then a second sample of writing was evaluated in the same manner after treatment. Independent scorers were retained to score twenty percent of the

papers to determine validity. Inter-Rater reliability was .79. Based on these samples, a statistically significant seven percent gain on the mean was found (Carlson, 1993).

Some research findings were either not conclusive, or the treatment group showed no significant gain, although the treatment was not detrimental to achievement. In a study of the program Hypercard, Myers discovered that the control group and the treatment group had similar gains on posttest. The treatment group only received six sessions on the computers, which could explain why the difference was not greater (Myers, 1994).

In a massive Nationwide study, "couples" of similar classes willing to be treatment and control groups were identified for a computer effectiveness study. There were ninety-six participating classes in all, each of which used the computer and software programs available to them. The standardized tests for each respective school was analyzed in the subject of mathematics only, and results were no substantial gains, with the exception of mathematic computation (Azevedo, 1992).

In testing the reading ability of second graders, CD-ROM books were utilized as software for the treatment group. Pretests determined another second grade class which had the most similar achievement scores to the treatment group, so the study was not randomized. The author of the study suggests that the time frame of one month was not sufficient for the students to benefit, since reading is a complex operation. She suggests that a period of one year would be adequate. The results of the posttest indicated no significant difference between the control and the experimental group (Standish, 1992).

Some studies dealt specifically with prescriptive software, or Integrated Learning Systems (ILS). One of these studies sought to find the effect

prescriptive software has on achievement. The software involved is Computer Curriculum Corporation, or CCC software. A group of ninth graders received mathematics training on the software, and through an instructor three days of the week. The students had significantly higher scores on the posttest (New Jersey Early Warning Test) than they had on the same pretest. The mean gain was nine points, and this was significant at the <.01 level (Schalago-Schirm,1995).

A second study by Alifrangis in 1990 addressed elementary students specifically. This study used a standardized pretest and posttest, as well as a qualitative study of documents, questionnaires, observations, and interviews.

The conclusion was reached that as long as the computer is "not an additional burden," and the curriculum is appropriate, computers will be a helpful addition to the classroom. In the quantitative study, students in the bottom group gained an average of 100 scaled score points. The results were not statistically significant, but the gains were impressive in some areas.

Another study which involves Computer Curriculum Corporation software was undertaken by Beckner. This study involves a nationwide study of several ILS systems. The study is an analysis of several past studies involving middle school and elementary school students. The findings differed according to individual situations, but generally the students using ILS systems did better than expected, and in some cases they did far better than expected (Beckner, 1990).

The scores on curriculum-specific tests went up after students in four elementary schools used the Computer Curriculum Corporation software. In a four-year study, students were exposed to software which included the subjects of mathematics, reading, and language arts, and then they were given

curriculum specific tests. In addition to these improvements, standardized test scores also were raised. (Ragosta, 1983).

A Personalized System of Instruction (PSI), which is a variation of ILS software, was found to raise higher order cognitive thinking skills. This finding supports the use of computers for more analytical subjects such as algebra and reading comprehension (Reboy, 1991).

The issue of actual time of computer instruction is significant to the study the researcher is investigating, in which the students will use the computers for thirty minutes a day, every other day. According to a study done in the area of computer assisted instruction, students made significant gains in reading comprehension in two twenty minute sessions a week. Ten minutes of this session were devoted to math programs, and ten minutes were devoted to reading programs. The findings are based on the National Curve Equivalent of the Stanford Achievement Test, and data were analyzed using ANOVA. The subjects were fifty-four sixth graders enrolled in the Chapter 1 program (Williams , 1993).

The age-appropriateness of the selected treatment and control groups may also be significant to this proposed study. In a study completed by Norton and Resta in 1986, students in fourth through sixth grade using problem-solving on the WICAT prescriptive system benefited more than other grade levels. The proposed study will include fourth graders using mathematics prescriptive software, and one strand of this software is problem-solving.

One facet of the evaluation of this research will include a qualitative analysis. This method of analysis is explained in detail by Bogdan and Taylor in the book Introduction to Qualitative Research Methods (1975). This research is also referred to as phenomenological research, and its purpose is to understand

behavior. The researcher tries his or her best to see situations through the eyes of his or her subject. Descriptive data is collected by means of participant observation, open-ended interviewing, and personal documents. The history of qualitative research can be traced back to Frederick LePlay, who produced a study based on his observations of 19th century European Families. After notes are gathered, the researcher examines the data and tries to identify common themes.

After searching the ERIC files, journals of educational and technological nature, and a search on the World Wide Web, no research was found comparing the achievement of students using prescriptive software as compared to students using multimedia software in the same classroom, so as to control for the instructional variable. This type of research would be beneficial to teachers, administrators, and any other individuals involved with selecting software for use in the classroom.

Chapter 3

Results

Quantitative Results

A quantitative analysis of this study was performed using data from 1996 and 1997 TCAP (Tennessee Comprehensive Assessment Program) tests. The experimental group, which used the CCC software was compared to the control group, which used Hartley Skills Collection software, supplemented by Math Ace, Troggle Math, and Blasternaut. These two groups were compared in two different ways: firstly, by a t-test comparing the NCE of the 1996 and 1997 TCAP tests, and secondly, by a t-test comparing the scaled scores of the control group and the experimental group on the 1997 TCAP test.

The comparisons between the TCAP NCE scores were made by first determining a historcial average for each subject. This was accomplished by adding the NCE score for total mathematics from 1994, 1995, and 1996, and finding the average. This average was then compared to the TCAP NCE total mathematics score reported on the 1997 TCAP test. A t-test was performed to accomplish this comparison.

This same process was used to compare the sub-areas of mathematic computation, and mathematics calculation and analysis. Summaries of findings are as follows: Table 1 compares total mathematics, Table 2 compares mathematic computation, and Table 3 shows mathematic calculations and analysis.

Table 1

Experimental Group: Historical NCE VS. Posttest NCE

Total Mathematics

	1st NCE	2nd NCE	3rd NCE	Three Year Average	4th NCE
#1	36	80	63	59.66667	71
#4	99	99	99	99	99
#5	99	92	99	96.66667	93
#7	69	74	71	71.3333	79
#9	69	77	64	70	53
#14	50	57	64	57	68

t-test result 0.88456

The total mathematics NCE averages for each student in the experimental group varied from a low of 57 to a high of 99. Student #1 has a historical average of 59.67, and his posttest NCE is 71, which is a gain of 11.33 on the NCE. Student #4 has a historical average of 99 in total mathematics, and she scored 99 on the posttest as well, for a gain of zero. Student #5 has a three year average of 96.67 on the NCE of the TCAP, and she scored 93 in 1997, for a loss of 3.67. The three year average for student #7 was 71.33, and his posttest score was 79, for a gain of 7.67. Student #9 has a historical average of 70, and her 1997 average is 53, which is a loss of 17 on the NCE. Student #14 has a three year average of 57, and he aquired a score of 68 on the posttest, resulting in a gain of eleven on the NCE. The average gain for the experimental group on the NCE of the TCAP test is 1.55. The historical average for females is 87.33, and 62.66. The average gain for females is -6.88, and the average gain for males is 9.99. The scores were not significantly different from the historical NCE averages to the 1997 posttest.

Table 2

Experimental Group: Historical NCE VS. Posttest NCE

Math Computation

	1st NCE	2nd NCE	3rd NCE	Three Year Average	4th NCE
#1	32	43	63	46	70
#4	99	99	81	93	99
#5	99	99	86	94.6667	99
#7	84	60	65	69.6667	74
#9	72	84	68	74.6667	63
#14	40	60	66	5.3333	66

t-test result 0.239306

In mathematics computation, student #1 has a historical average of 46 according to the NCE of the TCAP tests he has taken. His score on the posttest is 70, for a gain of 24. Student #4 has a three year average of 93, and the NCE on the posttest is 99, for a gain of seven. The historical average for student #5 is 94.67, and the posttest score is 99, for a gain of 4.33. Student #7 averaged 69.67 over three years, and his TCAP 1997 NCE is 74, for a gain of 4.33. Historically,student #9 averaged 74.67, and she scored 63 on the posttest, for a loss of 11.67. Finally, student #14 averaged 55.33 over the past three years, and he scored 66 on the posttest for a gain of 10.67. The average gain in mathematics computation for the experimental group is 6.44 on the NCE of the TCAP test, which is not statistically significant. These results may be found in Table 3.

Table 3

Experimental Group: Historical NCE VS. Posttest NCE

Mathematics Calculations and Analysis

	1st NCE	2nd NCE	3rd NCE	Three Year Average	4th NCE
#1	42	99	61	67.3333	68
#4	99	99	99	99	89
#5	99	83	99	93.6667	71
#7	56	84	74	71.3333	79
#9	6	72	60	66	46
#14	60	55	60	58.3333	66
				t-test result	0.317123

Mathematics calculation and analysis was also examined using a three year historical average as compared to the 1997 NCE posttest. Student #1 has a historical average of 67.33, and he has a posttest average of 68, for gain of .77. Student #4 has a three year average of 99, and her NCE is 89, for a loss of 10. Student #5 has a historical average of 93.67, and a posttest score of 71 on the TCAP NCE, for a loss of 22.67. The historical average for student #7 is 71.33, and his posttest score is 79, which shows a gain of 7.66. Student #9 has a three year average of 66, and a posttest score of 46, resulting in a loss of 20 on the NCE. The three year average for student # 14 is 75.94, and the posttest NCE is 69.83, which shows a loss of 6.11. Overall, on the mathematics calculations and analysis portion of the Tennessee Comprehensive Assessment, the experimental group averaged a loss of 8.38, which is not statistically significant.

The scaled scores of the control and the experimental group were examined to determine if there is a significant difference in gains between the two groups. This was done by computing the gain for each student in each group. The gains were then averaged and compared by means of t-test. There was not a statistically significant difference in the two groups, as can be observed in Table 4.

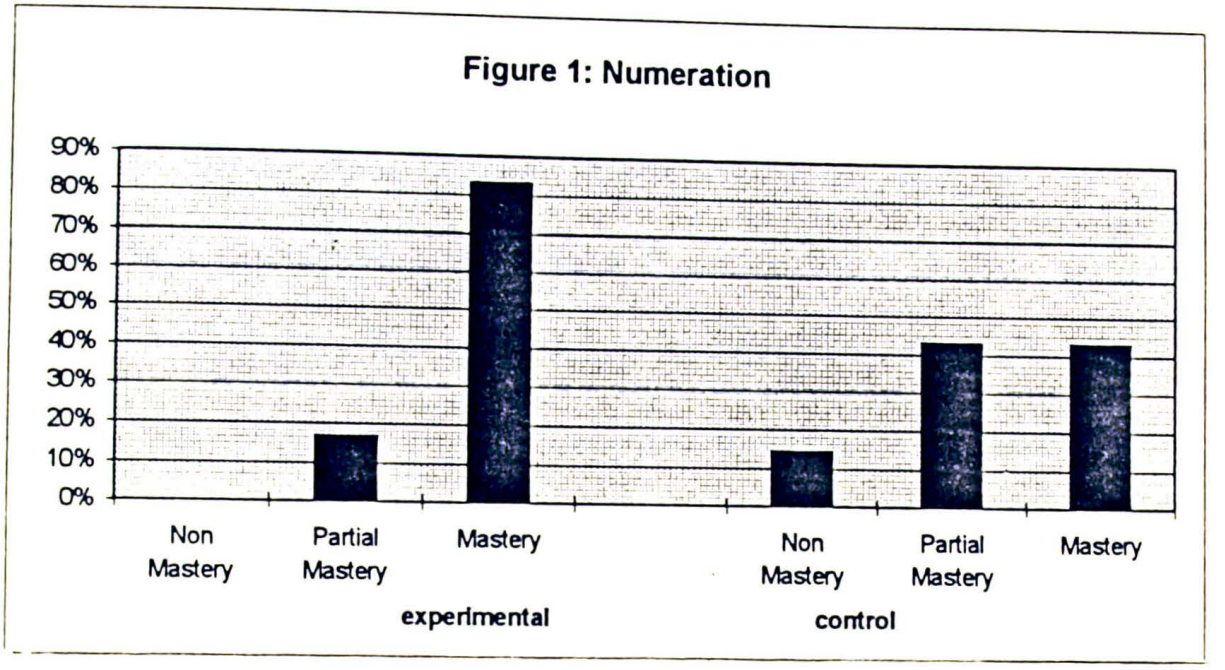
Table 4

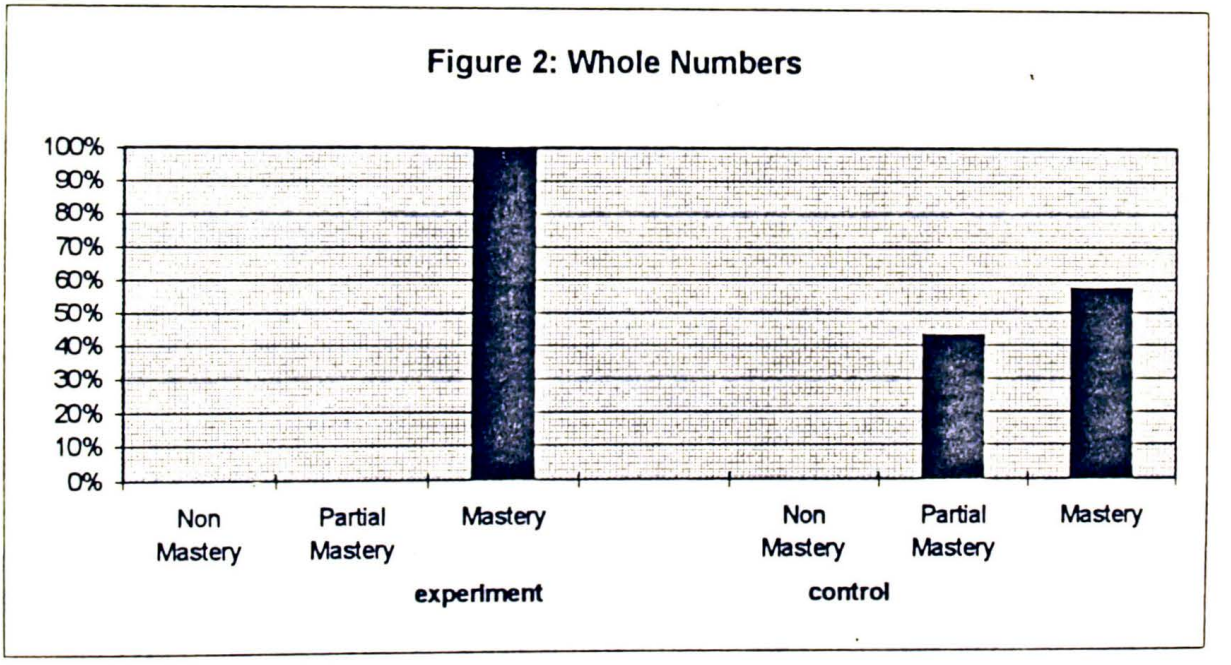
Experimental Group Scaled Scores				Control Group Scaled Scores			
	3rd	4th	gain		3rd	4th	gain
#1	700	735	35	#2	707	791	84
#4	787	800	13	#3	730	777	47
#5	794	772	-22	#6	524	707	183
#7	717	748	31	#11	686	723	37
#9	703	707	4	#13	692	729	37
#14	702	730	28	#15	648	711	63
				#22	663	715	52
	average gain		14.83		average gain		71.86

The TCAP test also provides specific feedback for each individual mathematical strand. These strands are numeration, whole numbers, fractions, decimals, graphs, measurement, geometry, and problem solving. Based on the percentage of correct responses in each of these strands, students are classified as having mastery, partial mastery, or non-mastery of a strand.

As can be observed in the graph in Figure 1, the data show 100 percent of the experimental group either mastered or partially mastered numeration; whereas 14.29 percent of the control group did not master numeration. The

control group only had 42.86 percent mastery of numeration, which is low when compared with 83.33 percent of the experimental group.





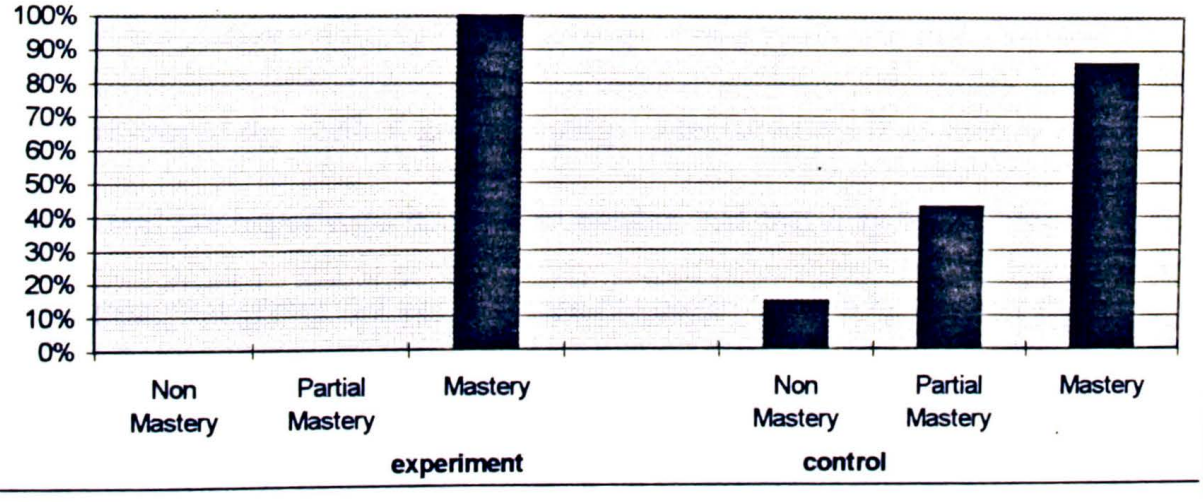
The strand of whole numbers was another area identified by TCAP results. The experimental group completely mastered whole numbers, with all students mastering that area. In contrast, 42.86 percent of the control group

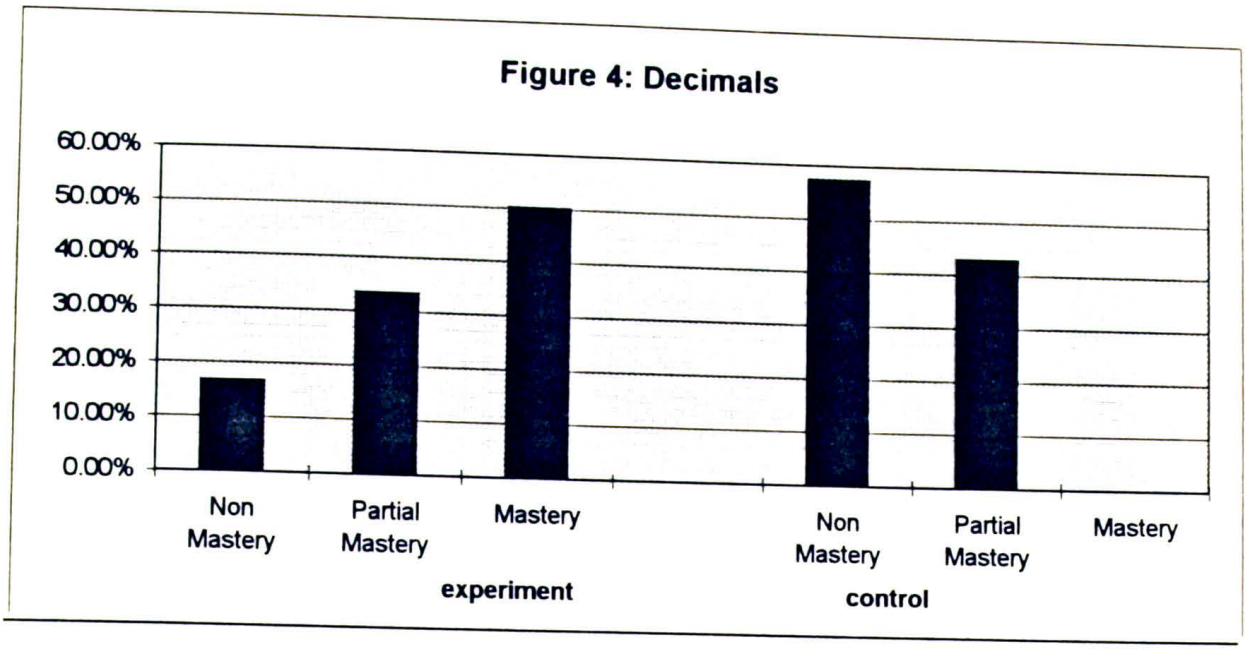
only achieved partial mastery, with the other 57.14 percent mastering whole numbers. This is evident in Figure 2.

Figure 3 shows fractions is another strand in which the experimental group excelled. Once again, one hundred percent mastery was achieved by this group. The control group has 14.29 percent non-mastery, with the other students in the group mastering fractions.

Decimals proved to be the highest percent of non-mastery for both groups. This area has been low for the fourth grade in Dickson County every year the TCAP test has been given. The experimental group has 50 percent mastery, in contrast to the control group which has zero percent mastery. The control group's scores follow the historical pattern for the teacher. This group is practically split in half between partial mastery and non-mastery of decimals, while only 16.67% of the experimental group failed to master decimals, as illustrated in Figure 4.

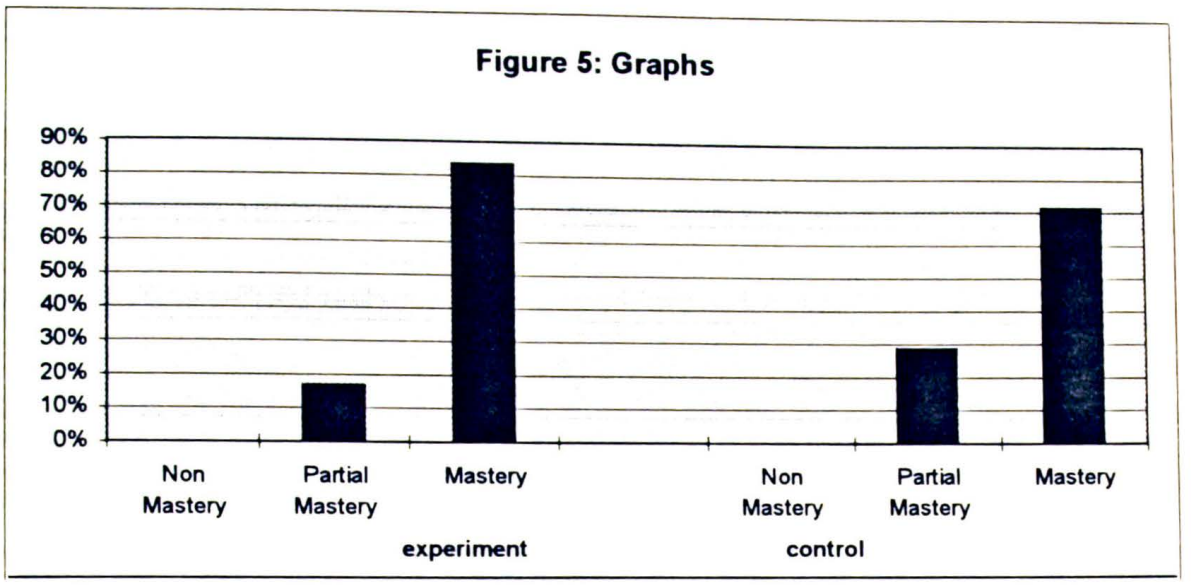
Figure 3: Fractions

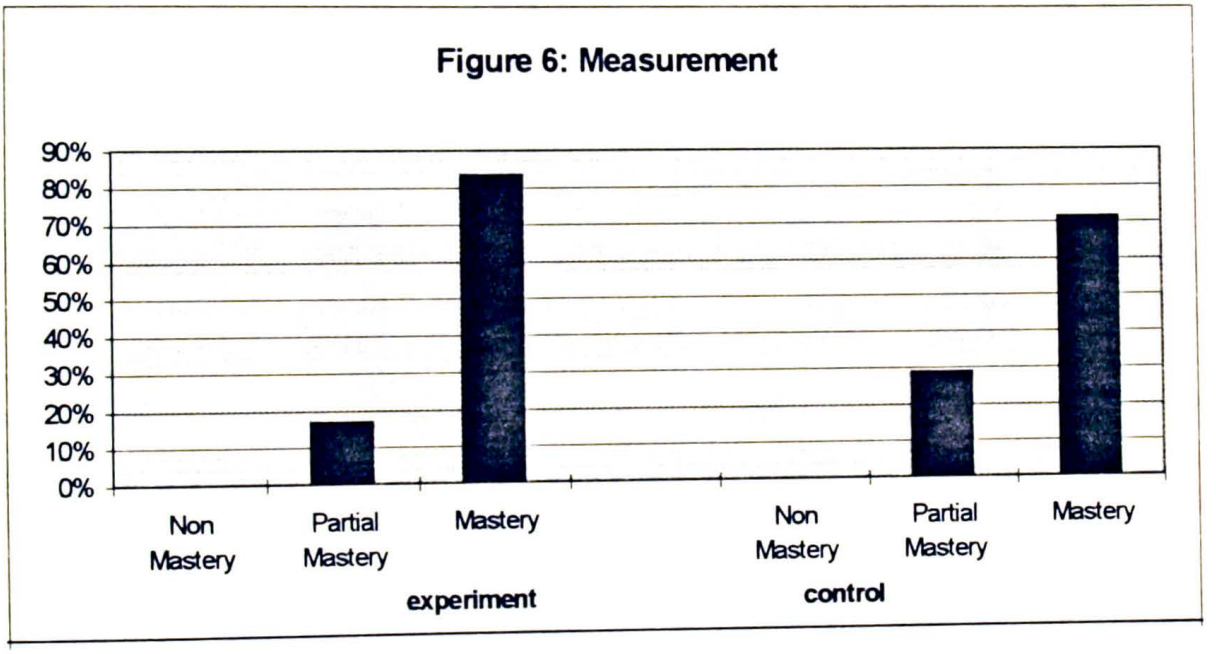




The experimental group's mastery of graphs is the most similar to the control group's mastery as compared to other strands. Both groups have zero percent non-mastery, and the experimental group has a slightly higher degree of mastery with 83.33 percent as compared to 71.43 percent in the control group In Figure 5 these scores are evident.

Measurement strand statistics (Figure 6), are identical to mastery in the graphing area. Since these are both skills which require application, the similarity in mastery scores is not surprising. Once again, the experimental group outscored the control group slightly. Measurement is an area which requires real life experience in order to master, and that may be another reason the experimental group did not outscore the control group by a larger margin. Both groups were exposed to equal amounts of hands on measuring experience, and so the treatment of software may not be as evident in this area.





In the strand of geometry, there is a difference in the performance of the two groups. The experimental group has zero percent non-mastery, and the control group has14.29 percent non-mastery. The control group is also lower in percent mastered, with 57.14 percent mastered, as compared to the experimental group's score of 83.33 percent. Figure 7 depicts this contrast below.

The strongest area for both groups is the final strand, problem solving. One hundred percent of the experimental group mastered this area. Eighty-five point seventy-one percent of the control group mastered this area, with 14.29 percent partially mastering problem solving. Refer to Figure 8 for a graphic representation of this strand.

Figure 7: Geometry

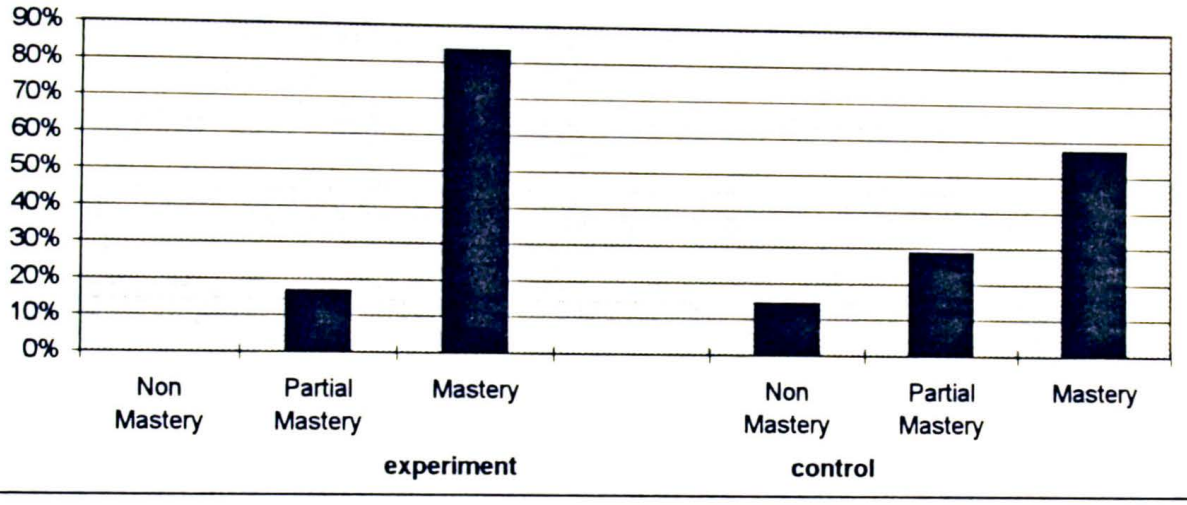
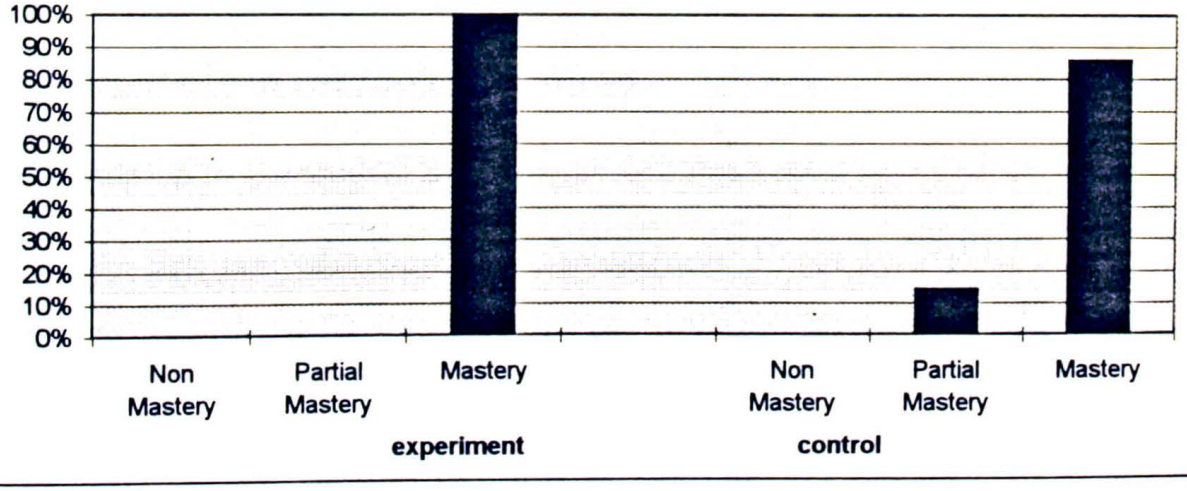


Figure 8: Problem Solving



In comparing the achievement of the experimental and control groups with regard to degree of mastery of each mathematical strand, it is clear that the experimental group's performance is superior to the control group. A higher percentage of experimental group students mastered each area as compared with the percentage mastered by control group students.

Qualitative Results

Because of the small sample size used in this study, it was decided to conduct a qualitative analysis of this field study to give more insight into the basic nature of the affect the computers have on the students. The students were asked to write in a log book beside the computer when they had any pleasant or unpleasant experiences to report. Some students used the log to record their progress in a certain area. Two log books were kept: one for the control group, and one for the experimental group. These will be discussed and scrutinized for common themes, as well as unusual differences. These notes are included in the Appendix. Teacher observation will also be considered in making connections and developing themes.

In addition to the student logs, the teacher also kept a log of her feelings during this first year of computer implementation. Notes were taken, and from them a monthly log was developed. Common themes were extracted from this log as well.

The tone of the comments expressed by the control group are predominantly related to fun and enjoyment. For example, "played" is often

used to describe the action a student had in an exercise. The programs are referred to as "games", and students seem concerned with having the high score. "Fun" is the word which is often used to refer to the attitudes students have toward the exercises. The following are edited quotations from the Control Group Log (Appendix A):

Student # 16, "Sometimes I don't really understand it. That is only sometimes. My highest score or level I should say was on the seventh level. It is really hard because instead of one virus there are two viruses. That's what I like about computers."

Student #6, "I played on the computers. I played Troggle Math. It was fun to me. Today, I did better than I do. I had fun on them, I do."

Student #2, "Today I played Math Blaster. It was fun. I only got one wrong, then I had to quit."

Student #19, "I played Math Troggle. It was fun."

Student #13, "I played a new, new game with fractions."

Student #15, "I played Hartley Adding with Fractions. It was fun."

Another theme that is evident in the control group log is a measure of frustration due to the students' lack of experience with computers. For most, this was the first year they had been exposed to keyboarding, using a mouse, and using a CD-ROM. Some students logged on to the computer under the wrong identification code, or inserted the wrong CD. Some students experienced a "locking up" or freezing of the exercise as they were responding.

Most students were disappointed when their time was up, and they were somewhat upset due to the interruption of their exercise. The following are some comments, which have been edited for clarity, illustrating this theme:

Student #2, "I played Troggle Math and got two dog bones. I got all the math questions right, and then I had to go."

Student #13, "I played Troggle Math and [I had] a little trouble."

Student #19, "I played Math Ace and I made the icon disappear."

Student #13, "Today I played Blasternaut and I couldn't get out."

Student #22, "I played Troggle Trouble. I got attacked. I got to level three. It was a little bit hard. I think it could be easier."

Student #22, "There was someone else on the computer that my name was on so I had to start over."

Considering the enjoyment these students experienced when they were familiar with the programs, it is evident that experience is the key to having a positive experience with computers. It seems a necessity to adequately introduce the students to the operating instructions for the computer as well as each individual CD-ROM, which is difficult with a twenty to one student teacher ratio. Brief individual instruction was given, but most instructions were given by means of a large screen television in a whole group situation. It may have been more effective if the students had been exposed to computers previously to a larger extent. If these students were going to use the same software next year, they would probably have very few problems in operation of the CD-ROMs.

The experimental group's log differed from the control group's log primarily in one area: the students were more serious about their sessions. Instead of "fun", more students used the word "work" to refer to their sessions on the CCC software. The word "work" was not necessarily given a negative connotation by the students, according to the context. The students were slightly discouraged at first, because the software they were using did not have the same quality graphics that the Hartley software had, but they were eventually so involved in improving their scores and receiving printouts that they were happy to be using the CCC software. Here are some examples from the experimental group's log representing the theme of work and improvement. The entire log may be seen in Appendix B:

Student #5, "Sometimes the work is hard and sometimes the work is easy. Last time I made 350 in the math speed games."

Student #4, "Today I played Math Skills and Concepts. Sometimes it is fun and sometimes it is boring. I do a lot of multiplication. My favorite is Math Speed Races. I like going to the computer because I get to do odds in math. Today my work was hard but last week it was easy. I can't wait for next computer day."

Student #1, "I like to play the computer. I learn how to do more stuff now."

Student #9, "Today I did multiplication [and] Tick Tock Clock. That is when you tell what time it is."

Student #7, "I got 390 in Math Speed Races."

Student #4, "I like to play the computer. It is getting harder now because the year is almost through."

Even though the students in the experimental group were more studious about their involvement in computer technology, they did express feelings of enjoyment. They were also more specific in commenting on the source of their entertainment. The quotations which follow are also from the experimental log:

Student #14, "I play on the teacher's computer. I play math on it and math speed games. It is fun and I get 20 min., or 15 min., or 10 min."

Student #7, "I like playing math speed games. If you get problems right you get points. It is very fun!"

Student #5, "Today I played on the computer. I did adding decimals and regular numbers, and multiplied numbers. It was FUN!"

Student #7, "I got my highest score today on math speed games! Fun!"

Comparatively, both groups seemed to enjoy their time on the computers, and both groups wanted to have more time for their sessions. Unfortunately, only one computer is equipped with the CCC software, which is the ILS (Integrated Learning System). The other four computers are stand alone Compaq units with CD-ROM drives. The CCC software package was relatively more expensive than the Hartley Skills Collection bundle. The CCC was installed on one computer each of five different classrooms in the Dickson County school system. The classrooms are piloting the software, and it is

possible that if the response is favorable enough that it will be installed on all computers in the county. Also, since there are only five computers per Twenty-First Century Classroom, it is difficult to allow all twenty-one students to have a great amount of time on the computers. Even with the previously mentioned drawbacks, the students had an altogether favorable response to the computers, and that impacted the entire affective domain in regard to learning.

In addition to the two student logs, the teacher kept a log of her observations and feelings toward the program as well. This log is located in Appendix C. The log includes a detailed description of each student participating in the experimental group, problems encountered, successes attained, and descriptions of circumstances in which the students and teacher were working. Some of the noted observations of the teacher correlate with the outcome on the posttest.

One example of a comment by the teacher which seems to be supported by the TCAP 1997 posttest can be found in an entry made in November of 1996. According to previously conducted studies, computation skills have improved with computer use, but the teacher finds improvement in an additional area as well. The passage states:

"The computers are routine now, and I am beginning to see an improvement in an area which surprises me. I had originally thought the computers would be helpful in aiding students to increase retention of mathematical facts such as addition, subtraction, multiplication, and division

facts. Instead, it seems that the students are improving more in the area of problem solving."

This observation correlates well with the outcome of the posttest, in which all of the experimental group mastered problem solving. The teacher states in the same entry that she feels the reason for this improvement may be due to the fact that the computers drill students on mathematical facts, which frees more of her instructional time for problem solving and logical thinking.

Another relationship that can be found between the teacher log and the posttest is the commentary on students which had problems at home and the lack of improvement in their scores. For example, student #5 had losses on the NCE and scaled score portion of the posttest, and the teacher wrote in October 1996:

" Student #5 is having problems at home which are effecting her performance at school, but she also enjoys the computers and is doing well on them. She is not working up to her ability."

A similar comment was made about student #9, and her posttest scores were also down. The teacher stated that she was having problems at home which were causing her grades to suffer in all academic areas. This student also has Attention Deficit Hyperactive Disorder, which may have hindered her progress.

Problems were also encountered by the teacher in her first attempt at implementing a computer curriculum into the classroom. Some of the issues

mentioned were lack of training, lack of access to technical support, student inattention during whole group instruction, and other miscellaneous problems. Below is a depiction of several such episodes:

"It first, the computers were a distraction, causing the students in the whole group to give their attention to the sights and sounds generated by the computer."

"The computers seem to be a blessing and a curse at this point. It is very difficult finding time to allow the students to work on them as well as not miss any instruction which is necessary."

"One problem the students have all had at one time or another is the CCC software shutting down in the middle of their sessions, and we have limited time. When the program shuts down, the entire window closes and the small CCC icon is displayed. When you click on it either singly or doubly, it does not open."

Another passage describes interruptions due to unforeseeable circumstances. These interruptions caused scheduling to become difficult, and caused some students to fall behind on their computer time. It states:

"We are far behind schedule due to inclement weather, special programs, and other distractions. . .Also, one of the CD-ROMs is not working."

Even though they were critical, most of these obstacles occurred early in the year, and were overcome eventually. The benefits provided by the

computers seemed to far outweigh the difficulties. The teacher noted many benefits provided by the computers, such as individualization, report output capabilities, immediate feedback for students, and teacher management systems. Examples of certain reports are located in Appendix D. The names of the students have been covered to reserved their anonymity. Entries from the teacher log are excerpted below.

"We have a math contest approximately four times a year, and she [student #4] is tied with another child for the top score in the fourth grade."

"Student #30 is extremely anxious to help with computers and work on them. He was voted by the class to be a computer helper. He helps boot up the computers in the morning and load software. He also helps other students when they have problems on the computer."

"Student #7 is adjusting nicely to school now. He is turning in work and doing well. He loves the computers. He is very excited about any problem solving opportunity, and he is making progress according to the gains report."

"He [student #14] is making some progress, but not at the rate I would expect him to be. I hope he will start comprehending more because the computer will stay on the level he needs to be on rather than the level of the class."

"There are still a few students having trouble with rote facts, but none that are in the CAI [experimental group] software. They are averaging as

follows on multiplication facts quizzes: Student #4- 100, student #1- 85, student #5-100, student #7- 98, student #9- 90, and student #14- 80."

As the school year continued, the teacher became more acquainted with the management system of the CCC software, and found its features to be invaluable. These options include parental reports, worksheets individualized for each student which may be geared to challenge or remediate each student, progress reports, and even graphing capabilities. An example of the graphing may be found in Appendix E. The teacher expressed student improvement in specific terms due to the computer management system available to her:

"I continue to see improvement in student #14, especially concerning computation skills. He also seems anxious to try to solve problems. Student #4 is truly benefiting by being able to excel above grade level."

"I am excited about recently learning how to print out reports to the parents of my students. I used the parent report form to print out the current enrollment and gains of my students in the experimental group."

The aforementioned comments are only a small representation of the value the teacher feels the computers and software afforded her class. Time is the basic commodity which had to be expended to extract the computers' benefits, and time is the offering the computers return for the investment.

Chapter 4

Summary, Discussion, and Conclusions

Summary

The purpose of this study was to determine the effectiveness of ILS software as compared to non-ILS software in a qualitative as well as a qualitative study. The research was conducted by dividing a class of fourth graders into two groups: one which would use the ILS software, and the control group, which would use software which was equal in material introduced, but without the ILS placement capability. The students were divided based on the 1996 TCAP scores, which served as a pretest. Both groups of students kept logs expressing their feelings about the computers, and the teacher kept a log about her experiences as well. These logs served as a means of information for the qualitative study, along with teacher observations and student comments. The 1997 TCAP posttest revealed that the performance of the six students in the experimental group did not differ significantly from the performance of the seven students in the control group. The experimental group did outscore the control group in each mathematical strand when the results are broken down by topic. In the qualitative portion of the study, it was determined that some problems were encountered during the study due to the inexperience of the teacher and the students. These problems were solved, and the computers became a valuable teaching tool, as well as an introduction to technology use for the students.

Discussion

The findings of quantitative portion of this study were inconclusive, but they nevertheless revealed some interesting issues. Because of the small sample size, finding statistical significance was not likely, but the differences in achievement of the two groups cannot be ignored. The experimental group outscored the control group in each individual mathematical strand, even though they scored similarly on both the NCE and the scaled score portion of the test. This difference indicates the control group may have scored very well in specific areas, but they also may have scored relatively low in others. This performance may be because of a lack of frequent review of skills in which these students were weak. On the contrary, the experimental group received frequent review in problem areas, and they consistently mastered or partially mastered practically every mathematics strand. In spite of this review and impressive scoring in the strand area, the NCE and scaled score analysis did not reveal a difference between the two groups. This may imply that the experimental group knew enough about each strand to make educated guesses; therefore, they mastered a broader area of knowledge than the control group. It is possible that if this pattern were continued for another year with the same group, that the percentage mastered would increase even more due to the repetitiveness of the computer drill in areas of weakness for the students in the experimental group, and the lack of individualization of the control group. It is also possible that continuing the study for another year would eliminate the

variable of inexperience with the computers and software. In this situation, the students would immediately begin gleaning the benefits from the direct instruction, and could possible have higher posttest scores as a result.

Qualitatively, observation which is noted by the teacher deals with the improvement of the students' technological skills. Students were exposed to the use of the computer on a daily basis, and they responded with enthusiasm and pursuit of knowledge about all aspects of the computer. These students displayed little if any reluctance to utilize technology. The students were able to boot up the computers and properly insert CDs into the drive, and they were able to open the proper windows and click on the appropriate icons in order to complete their assignments. Since the computers were not networked to the printer, the students were also required to save their work to a formatted disc. Due to this early exposure, these students will likely experience less anxiety when using computers in the future, and they will be more inclined to elect to take courses which involve technology. Students may even elect to stay in school longer due to the positive impact computers have had on the affective domain. This may in turn lead to a lowered dropout rate and a higher rate of college enrollment.

The reseacher sought an answer to the following question: Is computer assisted instruction more effective if the software being used is prescriptive? The information assembled from the study implies further research is necessary in order to answer this question. The quantitative study yielded no conclusive

results, but the mathematical strand mastery tables certainly arouse curiosity about continued use of the programs. In order to accumulate enough data to make a firm decision, several years of study may be necessary. Each bundle of software did benefit most students, and the TCAP scores do indicate a total gain for both groups. Because of this gain, both the Hartley and the CCC software were effective in supplementing the fourth grade mathematics curriculum. Since the total mathematics scores on the TCAP test were not significantly different, it is reasonable to speculate on the possible causes of the difference in the mastery scores. First of all, the students on the CCC software were given a variety of mathematical problems each day; whereas, the control group concentrated on one area for one to two weeks before beginning a new area. This method would explain why the experimental fared well in mastery, because they have a partial understanding of a broad amount of strands. The control group, on the other hand, has a deep understanding of a narrower area. Also, the students in the experimental group were constantly reevaluated by the computer as they worked. The computer changes the student level of each strand during each session. Specificity of this degree was impossible in the control group, because the teacher had to oversee twenty-one students at once. Objectives were taught and reviewed by the teacher until all students had at least partial comprehension, which kept some students who were ready from moving to new topics. Conversely, the computer is able to individualize for each student as well as each strand. Therefore, the students who are in the

experimental group were exposed to a broader subject area with specificity given to their areas of need, which resulted in a higher mastery of more strands.

Recommendations

One very important area which needs to be addressed is the area of teacher training. The teacher in this study was trained in a one day session to use the CCC software. The trainer explained that she was doing a week's worth of lessons in this single day. This was not an adequate amount of time for even experienced computer users to learn to use the software, much less the inexperienced teachers who were not familiar with some of the basic terminology. It will be costly, but a more thorough training must be done if the computers are going to provide any benefits for the students and teachers. Another option which would solve this problem is to have a lab technician at each school, and this person could be responsible for providing computer time for all the pupils. In this way, the students would probably get less time on the computer, but the time would be completely devoted to the subject area rather than being divided between the subject and technical problems. A third option would be to hire a technician who would be available to the classroom teachers during the school day. This person could be on call, and he or she would be able to come in the teacher's room who is having a problem in a timely manner. This person could also be responsible for regular maintenance of the computers, so that the teacher could devote her time to student needs.

Another recommendation is to replicate this study over a longer period

of time with a larger population. Since only one teacher was involved in this study, the class of twenty-one students was the only available subject group. Although permission was obtained from all parents to participate in the study, many of the students have incomplete testing histories due to frequent moving and absences.

The first year of implementation is often a factor mentioned in previously conducted studies (Standish, 1992). After this adjustment period, many students scores have significantly risen in the past (Beyer, 1991).

It is also possible that subjects need a longer period of time on the computer in order to show significant gains. Since no student in the experimental group had perfect attendance of school and some students in the control group did have perfect attendance, it is possible that the difference in direct instructional time effected the scores. The students were allowed to make up computer sessions, though, when it was possible.

It would also be simpler to implement one brand of software at a time in a classroom, rather than several at once. Software seemed to be arriving each month, and just as the teacher had enough experience demonstrate its use to the students, another package would arrive. For future use, it would be beneficial to choose either the CCC or the Hartley software and train the teachers before school begins in one of these programs. It would be helpful to concentrate on one subject area the first year, and a new one each year until all subjects are incorporated.

Computers may benefit some students more than others, and an individualized scheduling may be necessary to optimize results. For example, the two students representing the low population of students (#1 and #14), both improved dramatically in all mathematics strands. The two high students (#4 and #5) made little if any improvement. If computers benefit the students who have more problems in math, and they are not beneficial to strong math students, time on the computers may be better divided if this information is known about the students. More research needs to be done comparing high and low ability mathematics students to see if this finding holds true with a large population.

Finally, teachers need to be aware of the curriculum taught in the software and make sure it is in alignment with the curriculum taught in the classroom. The CCC software used in this study was selected by the computer technician with the aid of the elementary supervisor, so it supplemented the traditional curriculum very well. If the objectives being presented are not the ones being tested, there is no valid way to judge the success of the program, so software selection is the key to a successful implementation of computers in the classroom.

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Appendices

Appendix A
Control Group Log

Oct. 23, 1996

#18 - I played Froggle Math. I do like it but, it doesn't help me at all. All I like is the adventures.

#3 - I played Froggle Math. I like it because it has cool adventchers. I only got to level four today.

#13 - I played math Workshop got to level four.

2# - I played Froggle Math and got to dog bones I got all math questions right and then I had to go.

6# I played math workshop I did good I missed some but I did good it was fun.

#2 Campers they are fun i like campes i like math gams i like frog rag and math and Math blaster it is fun some math is hard in math blastad a lot of it is hard. in ~~fide~~ Forge math is ok i like campes.

#10 I liked it because was very fun and edicatshinal. i expeshely like the Dolls.

#19- I was playing Math Ace. I think it mainly help me on graphs and desenals. I also beat Math ace. I'm the first person to beat Math Ace. I also have the highest score. Lloyd Neal and me are playing each other so if one of us is ahead we can play.

Michael Stokes

Oct. 24

#16 Today I played Math Ace. It is a cool game. Sometimes I don't really understand it. That is only sometimes. My highest score or level I should say was on the 7 seventh level. It is really hard because instead of one virus there was 2 two viruses. That's what I like about computers.

#17. Today I played Froggle math I got a lot of points and I got to level two. Froggle math teaches children everywhere how to add and subtract.

#15 Today I played Math Ace. I got up to the 4th level. But I lost. and I got back to the #4 level and then I got to the 7th level.

22# I played on the computer today. I like Math Workshop and Math Baster. It helps me with my math it is fun. (P.S) We are luckey to have Mo. Allison. She lits us play on them.

17#

6# I played on the computers. I played Froggle math it was fun to me. today, I did better then I do. I had fun on them when I do.

10-28-96

#3- I played troggle math against it gets harder when you get higher I got to level 5 this time.

#13- I played Troggle Math and a little trouble.

#19- I played Math Ace And I made the Icon disappear
#18 I played math workshop. I didn't help me any.
#17 I like it because it is fun to play/create
#2 I like math and this software the best thing in my class on computer math blaster is getting harder to play I solved the last math subject on computer there is the list game on computer.

10-2896

Today I played Mathblaster
it was fun I only got one wrong
Then I had to quit.

Dec. 10, 1996

22# I played trogge trobble. I got a tack it. I got to save 3. It was a little bit fade it think it could be ever.

16th I got to play Math Blaster and I was the top highest score on my list so I played again and I was the second highest on the list. I like Math Blaster it teaches you if you don't know your x's tables

17. I played math Blaster. It was fun. I beat the game. I went to options and tried a long quest.

#20 Today I played a math game

Dec. 12. 1996

#16 I played Math Blaster long mission division. It was fun, but it was really long. I really like it.

17. I had a good time and I played math Blaster.

18 I played the workshop and had fun

22# I played Math workshop I played bolins and I played the bird thing. it was fun.

Jan. 7, 1997

7/1997

I played Meter Baster it was fun

17. I played Troggle math and got to level #16 I played Math Blaster long mission division. It was ☺

#19 Today I played "Math Blaster" I got second place

January 23, 1997

#16 I played Joggle Math and got to level 4 it's the farthest I've ever been. I like that game a whole lot.

#17. I played math blaster on long mission and it was fun. I got past the part where you zap trash and the part where yo fill up your tanks.

1-24-97

#3 I played a fraction game
#18 I played on easy level game of fractions.
#13 - I played a new new game with fractions.

3-10-97

19- Today I played hartley. I got 3 more before I move on to the next box, 3 more boxes before moving to next CD.

6- I played on the computer today. I'm getting better. I finish a when I played today it is fun

13. Today I played Hartley I got them all correct it was fun. I have a lot more to go til next CD it is kinda hard.

3-10-97

2- Today I played Hartly I am in shapes and figures I did okay in measurment and I am going to another little session.

Appendix B
Experimental Group Log

Oct. 23, 1996

#5 - Today I played on the Computer. I like it when I play Computer because I only have to do odds in math. Sometimes the work is hard & sometimes the work is easy. Last time I made 350 in the math speed games.

#9 I liked playing on the Computer today. It was teaching me alot. The most I have made in the math speed games are 295. Sometimes I can figure out the problems.

Oct. 24

#4 Today I played Math Skills and Concepts. Sometimes it's fun and sometimes it's boring. I do a lot of multipication. My favorite is Math Speed Races. I like going to the computer because I get to do odds in math. Today my work was hard but last week it was easy. I can't wait for next computer day.

Oct. 29, 1996

#14 I play on the teachers computer. I play math on it and math speed games. It is fun and I get 20 min. or 15 min and 10 min.

#7 I play on the Teachers computer. I like playing math speed games. If you get problems right you get points. It is soooo fun!!

October 2

#4 I like to play the computer. It is fun, I play Math Skills and Concepts. I like it because I get to do odds in math.

#30 I like to play the computer. I learn who to do more stuff now

October 28, 1996

#5, Today I played on the computer. I did adding decimals & regular #'s & multiplyed #s. It was so FUN!!!

October 29, 96

#1 I, got [illegible] today on math speed [illegible]

November 19, 96

#5 Today I played on the computer. I did adding, subtracting, decimals. IT WAS OK!!! ☺

9# Today I playe all sort of things.

#5 Today I am glad I played on the computer because I don't have to do all my math. ☺

November 20, 96

#5 Today I played the computer for 15 min. It was fun.

#13. Today I did multiplication, I
tick tock clock I had 3 when
you tell what time it is.
#14. Today I played on
the computer, I was
playing math skills.
It was fun and
I played math speed
Games.

#5 today I played the computer. It was FUN!!!!!

Dec. 12

#4 Today I had fun. I did a lot of dividing. I made a worse grade than I did last time. I get to do odds in math.

December 12,

#7 Today I fun I beat my relord in math speed games. It was Fun, Fun, Fun !!!

#14 Today I played Math Games and I did good on it the computer.

#5 Today I played the computer. I have a new #. I was OK.

#5 today I played the computer. It was FUN!!!!!

Dec. 12

#4 Today I had fun. I did a lot of dividing. I made a worse grade than I did last time. I get to do odds in math.

December 12,

#7 Today I fun I beat my relord in math speed games. It was Fun, Fun, Fun !!!

#14 Today I played Math Games and I did good on the computer.

#5 Today I played the computer. I have a new #. I was OK.

March 14, 1997

#4 I like to play the computer. It is getting harder now because the year is almost through.

#5 I got 495 in math speed games. The computer is fun.

#7 I got 590 in math speed

Appendix C
Teacher Log

9/10

Last week was the first full week of implementation of the computers. The students are definitely enjoying their time on the computer, and they are doing well working independently while I do whole group instruction with the rest of the class. At first, the computers were a distraction, causing the students in the whole group to give their attention to the sights and sounds generated by the computer. The sound is turned down now until we get the headphones. The novelty of the computers is wearing off, and the students now realize they will get a chance, and they are listening to instruction.

The students in the study group include the following:

Student #4 is a very bright student. She is a white female, and she started school a year later than the others, causing her to be about six months older than most fourth graders. She had nine stanines on her TCAP scores in all math areas. She has experience on the computer, and she has adapted very well. The computer has placed her in higher math already. A problem was given to her one day which had a constant in it. She said, "Oh, this is algebra!" She was very excited to be in an accelerated subject.

Student #14 is a white male. He is low average in math, and he is enjoying using the computers. He is not showing improvement on his math skills at this point. He has had trouble with facts such as 5+7, and now we are beginning multiplication. I am concerned about his lack of progress, and I have asked the parents to help him at home with flash cards.

Student #30 is a black male. He is high average in math, but he is sometimes careless with his work. I am hoping the computer will help remediate this problem, because it makes the student do the work over and over until he is successful. This will cause student #30 to try to be more accurate rather than rushing through his work. He will also be more challenged by the difficulty of the work.

Student #9 is a white female. She is average in math. Her work habits are good, although she has Attention Deficit Disorder. She is not on medication, and in my opinion, she does not need it. The computer seems to be very good at holding her attention, because she is always on task when I look over to see what she is doing on the computer.

Student #5 is also a white female. She is very bright in math and verbal ability. She is very quiet and the type of student who normally does not ask for attention. She is a good independent worker, which is a good trait to have in working with computers.

Student #7 is a white male. He is new to our school. His mother told me he didn't like it here at first because we have too many rules, but she was supportive of the school and he is better now. He is a high average student, but because of impulsivity he is likely to make careless mistakes on any assignment. He has not commented on the computers yet, but I feel he enjoys using them.

10/10

The computers seem to be a blessing and a curse at this point. It is very difficult finding time to allow the students to work on them as well as not miss any instruction which is necessary. The students enjoy the computers, and they are quick to point out if I am late calling them back for their turn. Student #4, who has some experience on the computers, is doing very well and working independently. According to the gains report,

she is gaining twice as fast as the other students. We have a math contest approximately four times a year, and she tied with another child for the top score in the fourth grade. Even though she is doing quite well, she sometimes gets frustrated when it takes time for her to figure out the problems. She checks her "report card" and is concerned that it only shows 80% mastery. I have explained to her that the computer moves her up to harder problems when she gets really good at something, but she is still concerned.

Student #9 is beginning to have problems in school relating to all academic areas. She is seeing the guidance counselor, but her grades are not as good as they were at the beginning of school. The computer is a perk for her, and I think she enjoys working on it by all indications. She seems to be unhappy, and I don't know the cause. Hopefully it is only temporary. I have talked with her, but she only mentions problems and home which are preoccupying her during school, and I have limited ability to address those problems. She is progressing well on the computers.

Student #30 is extremely anxious to help with computers and work on them. He was voted by the class to be a computer helper. He helps boot up the computers in the morning and load the software. He also helps other students when they have problems on the computer. One problem all the students have had at one time or another is the CCC software shutting down in the middle of their session. This is really a problem since the students have timed sessions, and we have limited time. When the program shuts down, the entire window closes and the small CCC icon is displayed. When you click on it either doubly or singly, it does not open. In order to resume operation of the CCC program, you must reboot the computer and start completely over. We are not sure what is causing this to happen. I have tried multiple times to get the CCC customer assistance on the phone, but since the phone is in the office and I don't have access to a phone and the computer at the same time, it makes it difficult. I have also asked for help from our local computer technicians, but the two of them are trying to wire all the schools for internet capability, so I have not been able to get help from them either. I will continue to watch to see what is causing it to close.

Student # 7 is adjusting nicely to school now. He is turning in work and doing well. He loves the computers. He is very excited about any problem solving opportunity, and he is making progress according to the gains report. He does well in memorization of facts, but has a bit of trouble with application.

Student #5 is having problems at home which are effecting her performance at school, but she also enjoys the computers and is doing well on them. She is not working up to her potential, and I have spoken with her mother about that. She is very independent and rarely if ever asks for help with the computer. I am very pleased with her progress on the computer, and I am hoping that it will encourage her to do better in other areas.

Student #14 is a very poor math student, and I have given his parents ways in which they might help him catch up. He is making some progress, but not at the rate I would expect him to be. I hope he will start comprehending more because the computer will stay on the level he needs to be on rather than the level of the class.

11/10

The computers are routine now, and I am beginning to see an improvement in an area which surprises me. I had originally thought the computers would be helpful in aiding

students to increase retention of mathematical facts such as addition, subtraction, multiplication, and division facts. Instead, it seems that the students are improving more in the area of problem solving. The students using the multimedia software are not receiving as much instruction in this area as the computer-assisted group, but they are all showing improvement beyond expectation at this point. One reasonable answer to why this is occurring is that the computers drill students on facts, which allows me to spend more time on logical thinking and problem-solving activities. I try to devote at least one day a week exclusively to problem-solving activities. These are sometimes done in small groups or with a partner, but they are also done individually. The students receive immediate feedback on their answers, and they must continue to try to answer until they have the correct answer or until time is up. A student who got the answer then shares his or her method with the class, and then the rest of the students have the opportunity to explain what method they tried. The ones which worked are accepted, but we try to determine which answer was reached with the least trouble. Other methods are discussed, and we focus on how they could be altered to produce a correct answer. This kind of in-depth process was not done as often before the computers were implemented due to the fact that I had to devote more time to factual problems and rote memorization. There are still a few students having trouble with rote facts, but none that are in the CAI software. They are averaging as follows on multiplication facts quizzes: Student #4 - 100%, student #30 - 85%, student #5 - 100%, student #7 - 98%, student #9 -90%, and student #14 - 80%. Although the 80% sounds low, this student has improved dramatically from 50% when we first began quizzes a month ago. The students continue to enjoy their time on the computers, but student #4 asked me if it was going to be more challenging. I was glad she wanted it to be, because earlier she is the student who expressed stress over the fact that her "report card" never reached 100%. She now understands she is doing well, and she is looking forward to learning new material.

Another factor has entered into the experiment. I have had an observer in my classroom for 40 hours. She will be student teaching starting in the second week of January, but she will only teach math for approximately two weeks, or 10 sessions. I will be guiding her in planning and subject matter, and I will be observing her, so this should not be detrimental to the students in any way, nor should it effect the outcome of the computer experiment since I will still be guiding it.

12/10

I am finally feeling somewhat comfortable with accessing information to assess student progress using the CCC program. It is very detailed, although the students have not logged quite enough time on the computer for their long-range progress to be predicted by the computer. I continue to see improvement in student number 14, especially concerning computation skills. He also seems more anxious to try to solve problems. Student number 4 is truly benefiting by being able to excel above grade level. This was difficult for her at the beginning because she was not used to being challenged to this extent. Now I think she is enjoying the challenge. I have also noticed I have several students struggling with math as well as other subjects, and none of them are the students using the CCC software. It makes me wonder if the CCC software is serving as a motivational tool as

well as a learning tool. All the students who are struggling with two exceptions have as much or more ability than the students using the CCC software.

One thing I am noticing in reading the student log books, is the students using the CD-ROM software seem to feel they are having lots of fun, whereas the students on the CCC software are focusing on learning. The comments in the CD-ROM book rarely tell what subject they are working on, but they tell about getting to "level 3" or "getting the bone" or making the high score. The CCC students tell more about what they are working on. Comments are made in the book such as "I practiced decimals" or "I did speed drills" or "sometimes I don't understand the word problems." They seem a bit more focused on learning according to their comments.

1/10

We are very far behind schedule due to inclement weather, special programs, and other distractions. I find it difficult to get the students on the computer when I feel direct instruction has to be made up. Many students have been out sick with strep throat, flu, and bacterial infections. I am not able to follow our normal computer schedule, because so many are out. Instead, I am just fitting people in as they finish other assignments, and the absent people will have to do extra shifts when they return. Also, one of the CD-ROM drives is not working properly. The computer is not able to read from the drive at all. Sometimes when I reboot the computer, it reads from the D drive just fine. Other times, I must let students using that computer wait until someone else is done and let them use theirs. This is very frustrating in light of the lost instructional time to begin with. The students have still not done enough sessions on the computer to have a long range forecast, and I am very disappointed with that. Hopefully, we will be back on track this coming month. TCAP testing will be in early April, and I am hoping the computers have made a positive impact on math acheivement, but unless they have enough time on them, they can't!

2/10

I am excited about recently learning how to print out reports to the parents of my students. I used the parent report form to print out the current enrollment and gains of my students in the experimental group. The gains reports show the following:

Student #14 has been on the computer 18 hours and 06 minutes. His initial placement level was 3.69, and he is now working on 4.54 (years, months). He has done 1139 exercises correctly, and he has gained 0.85 years. This is the largest gain, but it is also the longest time logged on the computer.

Student #4 has been on the computer 13 hours and 16 minutes of total time. Her initial placement was 4.91, which was almost a year above grade level. She has gained 0.21 which is the least gain, but she is working on harder problems and she started at a higher level. She is now on 5.12 level. She has done 792 exercises correctly.

Student #5 started initial placement at 4.02, and she is now at 4.42, having gained .40. She has logged 12 hours and 54 minutes of computer time. She has correctly worked 913 problems.

Student #30 had an initial placement of 3.50, and is now on 4.14 level. He has been on the computer 11 hours and 58 minutes, and he has gained 0.64. He has worked 714 problems correctly.

Student #9 has gained 0.35, working 785 problems correctly in 11 hours and 22 minutes. She was initially placed at 4.08, and now is at 4.43.

Student #7 was initially placed at 3.53, and is now at 4.02. He has gained 0.49 years in the course, and has worked 592 problems correctly.

3/10

The computers are feeling more comfortable for me and the students now. I see an absolute trend in gains as far as ability is concerned. My two students from the top of the group initially have made the least gain, approximately half of a year, even though student #4 continues to work half a grade level above the other students. The other student from the top group, student #5, is working on grade level, but not above. She is showing this pattern in all academic areas, though. She seems to be losing ground this year, and she is having emotional problems at home according to her mother. She seems to enjoy school, but she is preoccupied because her father died when she was young and now her mother is very ill. She has been having sessions with the school guidance counselor.

Students in the middle group have gained about three quarters to one year from their initial placement. They seem to truly enjoy using the computers, and look forward to having their turn. Decimals and problem solving are still weak for these students, but computation skills have dramatically increased. I am very pleased with their progress. Student #9 has been taking ritalin for ADHD, and that may have also increased her performance. Student #7 is moving at the end of the school year, and he is upset about it. He is acting out and beginning to have some troublesome behaviors, such as disrespectfulness and talking out in class, but he continues to show academic progress, especially on the computer.

The most exciting group is the low group. Both of these students have made remarkable progress, both gaining more than one year at this point. Both love the computer. Student #30 has shown progress not only academically, but socially as well. His behavior and work habits are much improved from the beginning of the year. He asks for extra time on the computer frequently, and he helps in the mornings and afternoons to boot up the computers and load software. Student #14 has gained much confidence concerning his math skills. He has come up to grade level for the first time since he has been in school.

4/10

We have taken the TCAP test and now I must wait on the scores to evaluate the effectiveness of the CCC software versus the Hartley Skills Collection. I am very pleased with all of the students' progress in math, and I have ordered the Hartley Reading Collection for next year. The students have certainly enjoyed having computer time each day. I feel the computer skills they have acquired will enable them to accomplish much more learning in any future classes they have involving computers. Much of the beginning of the year was used to familiarize the students with the keyboard and mouse, and I think they will do even better using computer-assisted learning programs in the future.

We have done very well on the Continental Mathematics League Contest program, and I think that is due to the computers at least in part. Out of the entire fourth grade, student

#4 scored the highest, getting 25 out of 30 problems correct. A non-experimental student scored second, students #5 and #7 scored above average, as well as another control group student. I chose student #14 to compete (even though he was one of the weakest math students at the beginning of the year) to see how he had progressed, and he scored 14 out of 30, which was higher than some of the top math students in fourth grade. I am very pleased with his progress. Whether or not the students show significant gains on the TCAP test, I very definitely feel they have gained a knowledge of computer technology which will benefit them greatly in their academic careers and their lives.

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Appendix D
CCC Reports

*** CCC History Check and Repair Program - Read Only ***
Version WC16.01B5

This program checks each student history for filesystem damage but does not repair any damage it finds. To correct any damage, rerun the program in its normal mode.

While the program runs, messages reporting the progress of the check will be printed. This procedure will take approximately 25 minutes.

Working on ENROLL File.

Working on CLASSES File.

Working on course: ALS1.

Working on course: ALS2.

Working on course: AT.

Working on course: CLS.

Working on course: DE.

Working on course: FAB.

Working on course: IR.

Working on course: KS.

Working on course: MCS.

Working on course: MCSS.

Working on course: MI.

Working on course: MP.

Working on course: PFB.

Working on course: RA.

Working on course: RI.

Working on course: RR.

Working on course: RW.

Working on course: SD.

Working on course: SPS.

Working on course: TSD.

Working on course: WE.

Working on course: WPS.

Experimental Group CCC Software
Course Report Sun Jun 22 1997 11:06

For student(s) 4,5,7,9,14,30

MATH CONCEPTS AND SKILLS

		SES	TIME	TATT	TCOR	%TC	CRI	IPML	Course Report AVG	GAIN
4	Mar 21 1997	42	20:31	1651	1297	79	90	4.91	5.48	0.57

COMPUTATION STRANDS								APPLICATION STRANDS							
AD	DC	DV	EQ	FR	MU	SG	SU	AP	GE	ME	NC	PR	PS	SA	WP
5.65	5.20	5.80	5.30	5.30	5.50	5.90	5.40	5.50	5.10	5.15	5.60	----	5.50	5.70	5.60
4	38	0	6	21	1	2	4	6	23	24	9	0	8	6	7
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

MATH CONCEPTS AND SKILLS

		SES	TIME	TATT	TCOR	%TC	CRI	IPML	Course Report AVG	GAIN
5	Apr 02 1997	45	20:12	2178	1474	68	70	4.02	4.58	0.56

COMPUTATION STRANDS								APPLICATION STRANDS							
AD	DC	DV	EQ	FR	MU	SG	SU	AP	GE	ME	NC	PR	PS	SA	WP
4.65	4.65	4.60	4.60	4.56	4.65	4.90	4.35	4.40	4.50	4.53	4.70	----	4.50	4.60	4.60
10	16	6	6	10	12	9	6	2	4	9	14	0	10	4	7
1	1	0	0	1	0	5	2	0	0	0	0	0	1	0	0

MATH CONCEPTS AND SKILLS

		SES	TIME	TATT	TCOR	%TC	CRI	IPML	Course Report AVG	GAIN
7	Apr 03 1997	42	20:17	1689	1308	77	89	3.53	4.45	0.92

COMPUTATION STRANDS								APPLICATION STRANDS							
AD	DC	DV	EQ	FR	MU	SG	SU	AP	GE	ME	NC	PR	PS	SA	WP
4.40	4.40	5.00	4.40	4.40	5.00	4.40	4.40	4.40	4.35	4.35	4.40	----	4.37	4.20	4.40
16	15	2	10	12	2	9	17	7	12	13	21	0	14	2	9
0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0

MATH CONCEPTS AND SKILLS

		SES	TIME	TATT	TCOR	%TC	CRI	IPML	Course Report AVG	GAIN
9	Apr 02 1997	44	20:37	2105	1578	75	84	4.08	4.85	0.77

COMPUTATION STRANDS								APPLICATION STRANDS							
AD	DC	DV	EQ	FR	MU	SG	SU	AP	GE	ME	NC	PR	PS	SA	WP
4.65	4.75	5.00	5.00	4.90	5.05	5.10	4.80	4.70	4.80	4.70	4.85	----	4.87	4.70	4.90
8	20	3	9	14	5	10	10	5	9	9	14	0	15	5	10
0	0	0	0	1	0	5	0	0	0	0	0	0	0	0	0

MATH CONCEPTS AND SKILLS

		SES	TIME	TATT	TCOR	%TC	CRI	IPML	Course Report AVG	GAIN
14	Mar 31 1997	39	20:10	1791	1262	70	86	3.69	4.60	0.91

COMPUTATION STRANDS								APPLICATION STRANDS							
AD	DC	DV	EQ	FR	MU	SG	SU	AP	GE	ME	NC	PR	PS	SA	WP
4.55	4.44	4.50	4.50	4.20	4.55	4.70	4.35	4.40	4.35	4.50	4.53	7.00	4.27	4.50	4.40
9	15	0	8	8	9	10	12	5	8	12	20	0	7	3	8

Experimental Group CCC Software
Course Report Sun Jun 22 1997 11:06

0	1	0	0	1	0	4	0	0	0	0	0	0	0	0	0

MATH CONCEPTS AND SKILLS Course Report

			SES	TIME	TATT	TCOR	%TC	CRI	IPML	AVG	GAIN
* 30	[illegible]	Apr 03 1997	45	21:24	2335	1667	71	85	3.50	4.68	1.18

COMPUTATION STRANDS								APPLICATION STRANDS							
AD	DC	DV	EQ	FR	MU	SG	SU	AP	GE	ME	NC	PR	PS	SA	WP
4.85	4.75	5.00	4.80	4.54	4.65	4.90	4.50	4.70	4.50	4.60	4.60	----	4.40	4.70	4.80
8	27	2	13	15	15	14	19	5	7	19	29	0	14	6	18
0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0

Total 6 Student(s).

Experimental Group CCC Software
Grouping Report Sun Jun 22 1997 11:07

For student(s) 4,5,7,9,14,30

MATH CONCEPTS AND SKILLS

Grouping Report

		TIME	ATT	COR	%COR	AR	TO	HLP	TUT	AVG
4	Mar 21 1997	0:31	33	21	64	0	0	0	0	5.48

AD	DC	DV	EQ	FR	MU	SG	SU
0	0	0	0	0	0	0	0

AP	GE	ME	NC	PR	PS	SA	WP
0	0	0	0	0	0	0	0

CURRENT COMPUTATION SKILLS IN DELAYED PRESENTATION
No Skills
CURRENT APPLICATION SKILLS IN DELAYED PRESENTATION
No Skills
SKILLS NOT MASTERED
No Skills

MATH CONCEPTS AND SKILLS

Grouping Report

		TIME	ATT	COR	%COR	AR	TO	HLP	TUT	AVG
5	Apr 02 1997	0:31	69	53	77	0	1	1	0	4.58

AD	DC	DV	EQ	FR	MU	SG	SU
0	0	0	0	0	0	0	1

AP	GE	ME	NC	PR	PS	SA	WP
0	2	0	0	0	0	0	0

CURRENT COMPUTATION SKILLS IN DELAYED PRESENTATION
SU435 Subtract vertically (regrouping from 10's and 100's places).

CURRENT APPLICATION SKILLS IN DELAYED PRESENTATION
GE430 Mark the quadrilaterals that are parallelograms.

SKILLS NOT MASTERED
PS427 Identify open number sentence that represents soln. to add./sub. problem.
FR452 Mark the fraction that has a greater value (halves-eighths).
SU420 Subtract horizontally (minuends 25-98, subtrahends 16-89, regrouping).
AD430 Fill in the missing addend (sums 30-99, regrouping).
DC420 Add, subtract tenths (horizontal, sums less than 3.0, regrouping).
SU415 Subtract three digits vertically (regrouping from 10's place).

MATH CONCEPTS AND SKILLS

Grouping Report

		TIME	ATT	COR	%COR	AR	TO	HLP	TUT	AVG
7	Apr 03 1997	0:31	46	27	59	0	2	4	0	4.45

AD	DC	DV	EQ	FR	MU	SG	SU
0	0	0	0	0	0	0	0

AP	GE	ME	NC	PR	PS	SA	WP
0	0	0	0	0	0	0	0

CURRENT COMPUTATION SKILLS IN DELAYED PRESENTATION
No Skills
CURRENT APPLICATION SKILLS IN DELAYED PRESENTATION
No Skills
SKILLS NOT MASTERED
SU435 Subtract vertically (regrouping from 10's and 100's places).

Experimental Group CCC Software
Grouping Report Sun Jun 22 1997 11:07

MATH CONCEPTS AND SKILLS

		TIME	ATT	COR	%COR	AR	TO	HLP	TUT	Grouping Report AVG
9	Apr 02 1997	0:31	29	19	66	0	0	0	0	4.85

AD	DC	DV	EQ	FR	MU	SG	SU	AP	GE	ME	NC	PR	PS	SA	WP
0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0

CURRENT COMPUTATION SKILLS IN DELAYED PRESENTATION
DC475 Add, subtract horizontally (sums less than 10.00, tenths and hundredths).

CURRENT APPLICATION SKILLS IN DELAYED PRESENTATION
ME457 Convert customary units (lb-oz, ft-in., gal-qt, dozens).

SKILLS NOT MASTERED
FR415 Select subset of pictures of shaded areas according to a given condition.

MATH CONCEPTS AND SKILLS

		TIME	ATT	COR	%COR	AR	TO	HLP	TUT	Grouping Report AVG
14	Mar 31 1997	0:30	54	32	59	0	0	0	1	4.60

AD	DC	DV	EQ	FR	MU	SG	SU	AP	GE	ME	NC	PR	PS	SA	WP
0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0

CURRENT COMPUTATION SKILLS IN DELAYED PRESENTATION
No Skills
CURRENT APPLICATION SKILLS IN DELAYED PRESENTATION
PS420 Find the missing numbers in a sequence of arithmetic steps.

SKILLS NOT MASTERED
FR415 Select subset of pictures of shaded areas according to a given condition.
DC385 Identify position of decimal number between 1.1 and 5.9 on number line.

MATH CONCEPTS AND SKILLS

		TIME	ATT	COR	%COR	AR	TO	HLP	TUT	Grouping Report AVG
* 30	Apr 03 1997	0:23	109	23	21	0	1	45	0	4.68

AD	DC	DV	EQ	FR	MU	SG	SU	AP	GE	ME	NC	PR	PS	SA	WP
0	1	0	0	0	0	0	0	0	2	2	0	0	6	0	0

CURRENT COMPUTATION SKILLS IN DELAYED PRESENTATION
DC475 Add, subtract horizontally (sums less than 10.00, tenths and hundredths).

CURRENT APPLICATION SKILLS IN DELAYED PRESENTATION
GE430 Mark the quadrilaterals that are parallelograms.
ME440 Solve word problem containing irrevelant info. (customary/ metric units).
PS427 Identify open number sentence that represents soln. to add./sub. problem.

SKILLS NOT MASTERED
FR452 Mark the fraction that has a greater value (halves-eighths).
PS425 Identify computational method to solve a problem involving division.

xperimental Group CCC Software

CUMULATIVE GAINS REPORT FOR COURSE MCS

tudent # Name ate Collected	Ses.	Part. Time	Cum. Time Since IPM	Part. Gain	Cum. Gain Since IPM	AVG
	ENR Level: 3.48					
4 2/12/97	30	--	11:52	--	0.24	5.15
	ENR Level: 3.49					
5 2/12/97	31	--	12:23	--	0.40	4.42
	ENR Level: 3.21					
7 2/12/97	26	--	10:48	--	0.55	4.08
	ENR Level: 3.21					
9 2/12/97	29	--	9:45	--	0.42	4.50
	ENR Level: 0.01					
14 2/12/97	35	--	17:41	--	0.85	4.54
	ENR Level: 3.49					
30 2/12/97	29	--	12:37	--	0.72	4.22

IPS REPORT

Math Concepts and Skills

Jun 22, 1997

Class 1 Experimental

Student	# Ses	Time Spent	AVG	AVG Gain	Learning Rate	Time Needed +.25	Time Needed +.50	Target Gain	Target Time
4	22	7:21	5.57	0.57	STUDENT IN REVIEW				
5	41	19:09	4.58	0.56	.022(L)	N/A	N/A	1.00F	N/A
7	36	18:14	4.45	0.92	.039(L)	N/A	N/A	1.25F	N/A
9	37	17:25	4.85	0.77	.045(L)	N/A	N/A	0.54F	*
14	35	19:44	4.60	0.91	.000(L*)	N/A	N/A		
30	42	20:32	4.68	1.18	.048(L)	N/A	N/A		

Total students = 6

Experimental Group CCC Software
Gains Report Sun Jun 22 1997 11:21

For student(s) 4,5,7,9,14,30
Jun 22, 1997 11:21am

MATH CONCEPTS AND SKILLS Gains Report

SESSIONS	GAIN IN PARTIAL PERIOD	SESS IN PARTIAL PERIOD	GAIN LAST PERIOD	TIME LAST PERIOD	GAIN SINCE IPM	TIME SINCE IPM	COURSE AVERAGE
4 42	0.44	17.00	0.13	9:25	0.57	18:05	5.48
5 45	0.01	1.00	0.27	9:51	0.56	19:09	4.58
7 42	0.37	16.00	0.55	10:48	0.92	18:14	4.45
9 44	0.40	17.00	0.37	8:41	0.77	17:25	4.85
14 39	0.53	15.00	0.38	9:56	0.91	19:44	4.60
30 45	0.01	2.00	0.55	9:47	1.18	20:32	4.68
SAMPLE SIZE 6	N/A	--	6	6	6	6	6
MEANS 42.8	N/A	N/A	0.38	9:44	0.82	18:51	4.77
STANDARD DEVIATIONS 2.1	N/A	N/A	0.15	0:37	0.22	1:03	0.34

Number of students = 6.

Your student,
has been taking computer-assisted instruction in mathematics for
approximately 0:29 minutes a day. This report shows Loren's progress
as of Jun 22, 1997.

is enrolled in a course called Math Concepts and Skills.
From an initial placement level of 4.91, Loren is now
at 5.48 (years.months).

has done 1297 exercises correctly in 20 hours and 31 minutes
total time. The total gain is 0.57 years in the course.

Your student,
has been taking computer-assisted instruction in mathematics for
approximately 0:27 minutes a day. This report shows Sarah's progress
as of Jun 22, 1997.

is enrolled in a course called Math Concepts and Skills.
From an initial placement level of 4.02, Sarah is now
at 4.58 (years.months).

has done 1474 exercises correctly in 20 hours and 12 minutes
total time. The total gain is 0.56 years in the course.

Your student, ,
has been taking computer-assisted instruction in mathematics for approximately 0:29 minutes a day. This report shows Jeremy's progress as of Jun 22, 1997.

is enrolled in a course called Math Concepts and Skills.
From an initial placement level of 3.53, Jeremy is now at 4.45 (years.months).

has done 1308 exercises correctly in 20 hours and 17 minutes total time. The total gain is 0.92 years in the course.

Your student, ,
has been taking computer-assisted instruction in mathematics for approximately 0:28 minutes a day. This report shows Cortney's progress as of Jun 22, 1997.

is enrolled in a course called Math Concepts and Skills.
From an initial placement level of 4.08, Cortney is now at 4.85 (years.months).

has done 1578 exercises correctly in 20 hours and 37 minutes total time. The total gain is 0.77 years in the course.

Your student, ,
has been taking computer-assisted instruction in mathematics for
approximately 0:31 minutes a day. This report shows Justin's progress
as of Jun 22, 1997.

is enrolled in a course called Math Concepts and Skills.
From an initial placement level of 3.69, Justin is now
at 4.60 (years.months).

has done 1262 exercises correctly in 20 hours and 10 minutes
total time. The total gain is 0.91 years in the course.

Your student, ,
has been taking computer-assisted instruction in mathematics for
approximately 0:29 minutes a day. This report shows Jyrod's progress
as of Jun 22, 1997.

is enrolled in a course called Math Concepts and Skills.
From an initial placement level of 3.50, Jyrod is now
at 4.68 (years.months).

has done 1667 exercises correctly in 21 hours and 24 minutes
total time. The total gain is 1.18 years in the course.

Worksheets Generated by CCC Software

30 Sun Jun 22 1997 12:18
Math Concepts and Skills Worksheet

(1)
```
   1 5
x  8 0
-------
```

(2) 30 numbers. 6 numbers in each column. How many columns?

a) 5 x 6 b) 30 / 6

(3)
```
  1 9 4
+ 5 8 6
-------
```

(4)
```
   1 2
x  7 0
-------
```

(5)
```
  3 7 8
+ 1 3 7
-------
```

(6) W / 7 = 6

W = __

(7) 30 numbers. 6 numbers in each column. How many columns?

a) 30 / 6 b) 5 x 6

(8) Write the equivalent decimal

$\frac{1}{4}$ = ___

(9) 2 hours after 7:00 a.m. = ____ a.m.

(10) Circle the multiples of 3.

21 25 15 18 24

---

(1) 1 2 0 0 (2) b (3) 7 8 0 (4) 8 4 0 (5) 5 1 5 (6) 42
(7) a (8) .25 (9) 9:00 (10) 15,18,21,24

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Math Concepts and Skills Worksheet

---

(1)
```
  5 5 1
- 1 5 7
-------
```

(2)
```
$  8.0 1
+   .5 0
---------
$
```

(3)
```
  5 3 6
- 2 8 9
-------
```

(4) 6 7 8 9 10 11 12 13 14

Find the number that lies midway between 6 and 14.

Add 6 and 14. ___
Divide the sum by 2. ___

(5) Circle the number exactly divisible by 2.

a. 9
b. 13
c. 17
d. 8

(6) Suppose you buy a pen for $.90.

You pay for it with 4 quarters.

How much change should you get back? $___

(7)
```
$  9.7 5
+   .9 1
---------
$
```

(8) 4 5 6 7 8 9 10

Find the number that lies midway between 4 and 10.

Add 4 and 10. ___
Divide the sum by 2. ___

(9)
```
$  5.7 6
+   .4 5
---------
$
```

(10)
```
  9 1 6
+ 7 4 8
-------
```

---

(1) 3 9 4 (2) 8.5 1 (3) 2 4 7 (4) 20, 10 (5) d (6) .10
(7) 1 0.6 6 (8) 14, 7 (9) 6.2 1 (10) 1 6 6 4

Worksheets Generated by CCC Software

Sun Jun 22 1997 12:18

Math Concepts and Skills Worksheet

---

(1) Write the equivalent decimal

$$\frac{2}{4} = \underline{\quad}$$

(2) 3 hours after 5:00 a.m. = ____ a.m.

(3)
$$\begin{array}{r} 4\ 9 \\ 6 \\ +\ 9\ 5 \\ \hline \end{array}$$

(4)
$$\begin{array}{r} 1\ 9\ 8\ 5 \\ -\ \ 3\ 8\ 9 \\ \hline \end{array}$$

(5)

10 ? 5 = 2

Circle the operation that makes the number sentence true.

a. addition
b. subtraction
c. multiplication
d. division

(6) $\frac{16}{9} = \frac{9}{9} + \frac{\quad}{9}$

$= \underline{\quad}\frac{7}{9}$

(7)
$$\begin{array}{r} 7 \\ 8\ 7 \\ +\ 8\ 5 \\ \hline \end{array}$$

(8) $2\overline{)49}$

(9) 5 hours after 6:00 a.m. = _____ a.m.

(10) $8\overline{)90}$

---

(1) .5 (2) 8:00 (3) 1 5 0 (4) 1 5 9 6 (5) d (6) 7, 1
(7) 1 7 9 (8) 24 R 1 (9) 11:00 (10) 11 R 2

Worksheets Generated by CCC Software

7 Sun Jun 22 1997 12:18

Math Concepts and Skills Worksheet

---

(1) Tim is eleventh in line.
There are 0 people behind him.
How many people in line altogether?

(2)
```
  -----
8) 9 7
   -
   ---
```

(3) Tim is last in line.
There are 4 people in front of him.
How many people in line altogether?

(4)
```
$   .8 8
+  1.8 1
---------
$
```

(5) Eva is third in line.
There are 3 people behind her.
How many people in line altogether?

(6)
```
$  5.6 5
+   .3 1
---------
$
```

(7) __ - 27 = 47

(8) 18 19 20

Find the number that lies midway between 18 and 20.

Add 18 and 20. ___
Divide the sum by 2. ___

(9) Suppose you buy a pen for $.93.

You pay for it with 4 quarters.

How much change should you get back? $___

(10) Heather is last in line.
There are 9 people in front of her.
How many people in line altogether?

---

(1) 11 (2) 12 R 1 (3) 5 (4) 2.6 9 (5) 6 (6) 5.9 6 (7) 74
(8) 38, 19 (9) .07 (10) 10

Worksheets Generated by CCC Software

4 Sun Jun 22 1997 12:18
Math Concepts and Skills Worksheet

(1)
```
   3 0
x  8 8
-------

-------
```

(2)
```
   1 2 0 5
-  8 0 7
---------
```

(3) ESTIMATE this sum by rounding each number to the nearest ten.

EXAMPLE:
42 + 89

40 + 90 = 130

28 + 24

____ + ____ = _____

(4) $\frac{Y}{4} - \frac{1}{4} = \frac{1}{4}$

Y = _

(5)
```
     8 0
x    2 1
---------

---------
```

(6) 9.3 kg + 9.9 kg = ____ kg

(7) ESTIMATE this sum by rounding each number to the nearest ten.

EXAMPLE:
42 + 89

40 + 90 = 130

74 + 46

____ + ____ = _____

(8)
```
$    9.4 6
x        5
------------

$
```

(9) $\frac{3}{4} - \frac{K}{4} = \frac{2}{4}$

K = _

(10) 5.9 m + 5.9 m = ____ m

---

(1) 2 4 0, 2 4 0, 2 6 4 0 (2) 3 9 8 (3) 30, 20, 50
(4) 2 (5) 8 0, 1 6 0, 1 6 8 0 (6) 19.2 (7) 70, 50, 120
(8) 4 7.3 0 (9) 1 (10) 11.8

Worksheets Generated by CCC Software

5 Sun Jun 22 1997 12:18

Math Concepts and Skills Worksheet

(1) 2 3 4

Find the number that lies midway between 2 and 4.

Add 2 and 4. ___
Divide the sum by 2. ___

(2) 90 / 3 = __

(3) Write < or >

$\frac{1}{7}$ _ $\frac{1}{6}$

(4)
```
  6 7 8
- 4 7 9
-------
```

(5) 250 / 50 = _

(6) 6 / L = 3

L = _

(7)
```
  6 6 3
- 5 7 5
-------
```

(8) Write < or >

$\frac{1}{6}$ _ $\frac{1}{7}$

(9)
```
  7 9 7
- 5 9 8
-------
```

(10) 13 14 15 16 17 18 19

Find the number that lies midway between 13 and 19.

Add 13 and 19. ___
Divide the sum by 2. ___

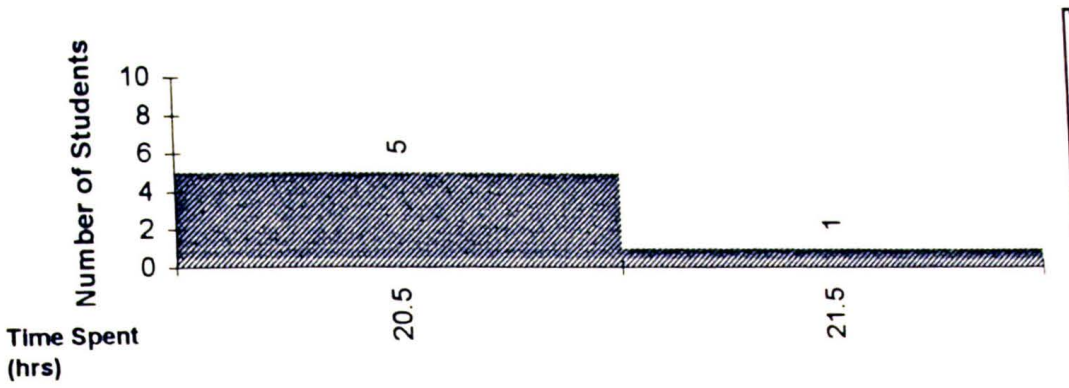
---

(1) 6, 3 (2) 30 (3) < (4) 1 9 9 (5) 5 (6) 2 (7) 8 8
(8) > (9) 1 9 9 (10) 32, 16

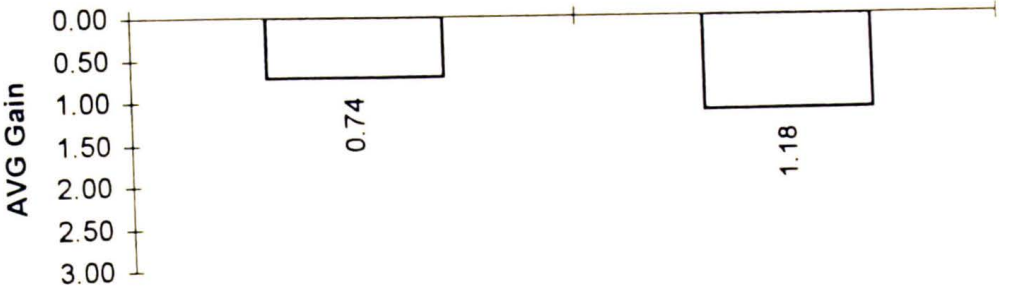
Appendix E
CCC Graphs

Class Numbers : Student Numbers : 4,5,7,9,14,30
Course : MCS Number of Students : 6

Time Spent Grouped Frequency Distribution with AVG Gains



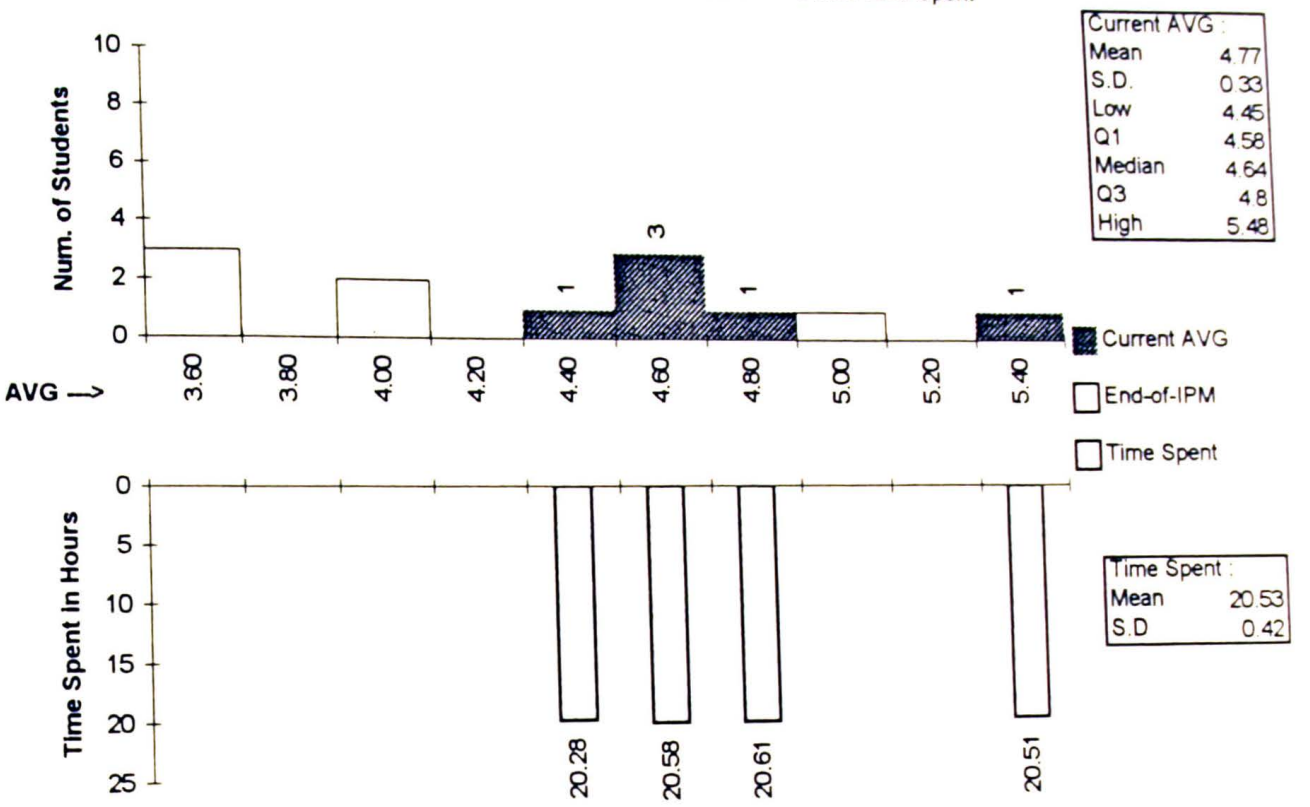
Time Spent (hrs) :	
Mean	20.53
S.D.	0.42
Low	20.16
Q1	20.22
Median	20.4
Q3	20.59
High	21.4



AVG Gain :	
Mean	0.81
S.D.	0.21
Low	0.56
Q1	0.62
Median	0.84
Q3	0.91
High	1.18

Class Numbers :
Course : MCS
Student Numbers : 4,5,7,9,14,30
Number of Students : 6

Grouped Frequency Distribution of End-of-IPM AVG and Current AVG with Time Spent



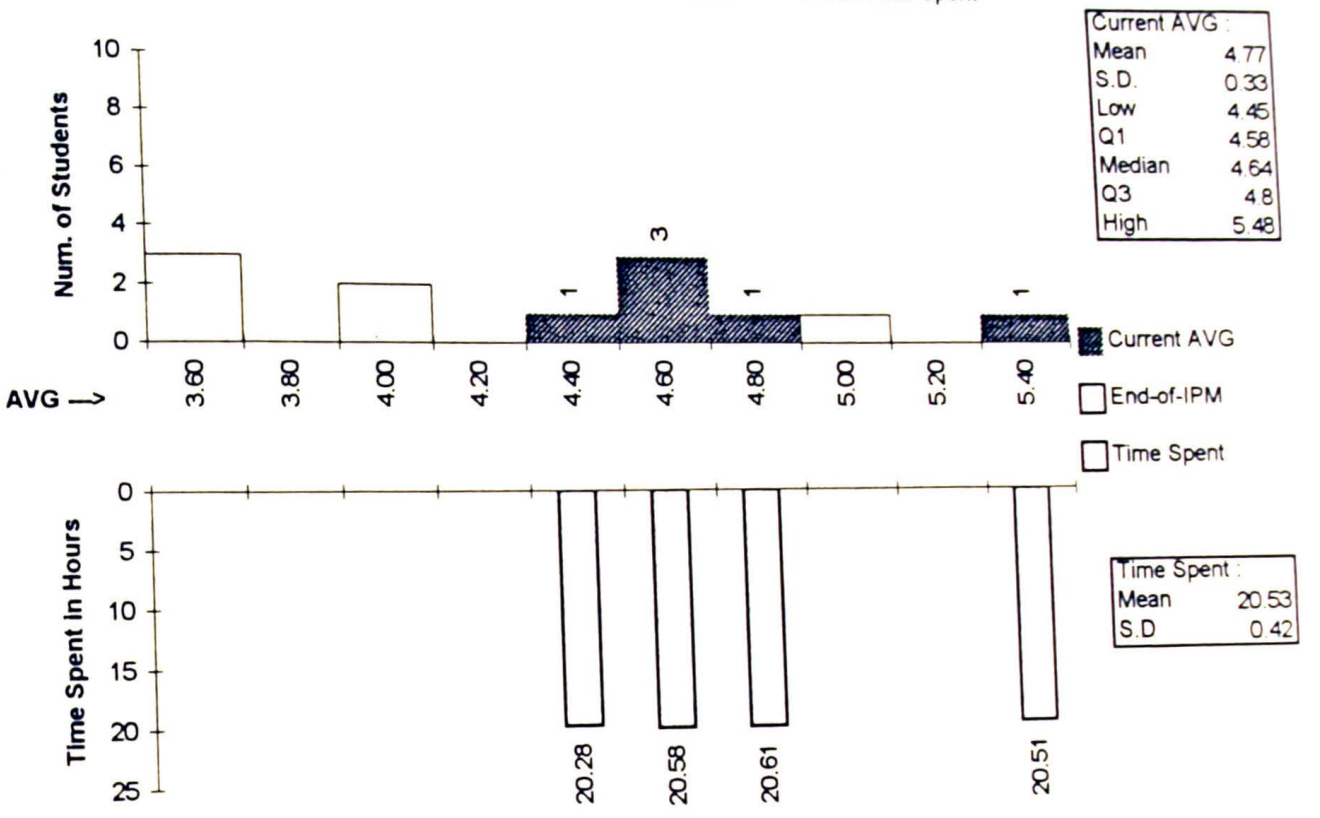
Current AVG :	
Mean	4.77
S.D.	0.33
Low	4.45
Q1	4.58
Median	4.64
Q3	4.8
High	5.48

Time Spent :	
Mean	20.53
S.D	0.42

Class Numbers : Student Numbers : 4,5,7,9,14,30

Course : MCS Number of Students : 6

Grouped Frequency Distribution of End-of-IPM AVG and Current AVG with Time Spent



VITA

Dawn Allison Curd was born in Charlotte, North Carolina on January 5, 1968. She lived there until age five, when her family moved to Bellevue, Tennessee. She attended kindergarten in Bellevue, and the family then moved to Dickson, Tennessee, where she attended elementary school and junior high school, and graduated from Dickson County Senior High School in 1986. In the fall of 1986 she entered David Lipscomb University in Nashville, Tennessee, and she received a Bachelor of Science degree in Elementary Education in 1990. In 1991, she entered Austin Peay State University, and she received her Master of Arts in Education degree in Administration and Supervision in 1992. In the summer of 1994, she attended the Governor's Academy for Teachers of Writing at the University of Tennessee at Knoxville. September of 1996 she reentered Austin Peay State University to work toward an Education Specialist degree.

She is presently employed by the Dickson County Board of Education as a fourth grade teacher at Sullivan Elementary School.