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ABSTRACT

This study evaluated an instructional model entitled "Integrating Computer Software into the Functional Mathematics Curriculum: A Diagnostic Approach," which was intended to prepare middle-school special education students for the Maryland Functional Mathematics Test. The model consisted of eight major components: pretests/posttests, diagnostic evaluations, domain directories, software matrix, software summaries, skill sheets, computer software, and miscellaneous materials. The model was evaluated by comparing math performance and attitudes of students who received instruction based on the model with those of matched control students, and by conducting interviews with teachers using the model. Analysis of scores of 26 experimental and 26 comparison subjects on the 9th-grade Maryland Functional Mathematics Test indicated that 27% of experimental subjects passed the test, while 12% of the comparison students passed. Interviews with 17 teachers indicated that teachers felt that their students benefited from the model. Scores on the attitude test were not correlated with posttest scores, time on the computer, or other factors under consideration except gender. Appendices contain a description of the model components, a data recording form, copies of measurement instruments, a reliability analysis of measurement instruments, and a report of interview responses. (JDD)

PROJECT ON EFFECTIVE COMPUTER INSTRUCTION FOR EFFECTIVE SPECIAL EDUCATION, PRINCE GEORGE'S COUNTY PUBLIC SCHOOLS

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Evaluation of Instructional Model Applied to Functional Math

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METHODOLOGY

Purpose of the Study

This study was conducted by the Project on Effective Computer Instruction for Effective Special Education to evaluate an instructional model entitled Integrating Computer Software into the Functional Mathematics Curriculum: A Diagnostic Approach (1989). This model was intended to prepare middle school special education students for the Maryland Functional Mathematics Test which is given as a graduation requirement to high school students in Maryland. The model consisted of eight major components:

1. Pretests/Posttests
2. Diagnostic Evaluations
3. Domain Directories
4. Software Matrix
5. Software Summaries
6. Skill Sheets
7. Computer Software
8. Miscell eous Materials

(The eighth component, Miscellaneous Materials, is not included in the final version of the instructional model as distributed by the school district, but was included in the version used in this evaluation study.) These components are described in Appendix A of this report.

The following main evaluation questions were posed:

1. What effect does the program have on math performance and attitudes?

2. How do teachers use the program?

Question 1 was answered by means of a comparison study in which the math performance and attitudes of students who received instruction based on the instructional model were compared with the performance and attitudes of matched students from other schools in the school district.

Question 2 was answered by means of a series of structured interviews conducted during the course of the academic year in schools in which the instructional model was being used.

The remainder of this report describes (1) the procedures followed in this evaluation study, (2) the results of the comparison study, and (3) the results of the structured interviews.

Procedures

Three middle schools were selected as experimental sites on the basis of (a) special education program of sufficient size, (b) interest in the project expressed by school administrators and staff, (c) geographic distribution across the county, (d) inclusion of nonmagnet and magnet sites (two and one, respectively). The evaluation activities taking place at these three schools are depicted in the timeline in Figure 1 and described below.

Figure 1
Timeline of Evaluation Activities

```
          1988                      1989
Month:    Sep  Oct  Nov    Dec     Jan    Feb    Mar    Apr    May    Jun

Model     [=====================================================]
  Use

Data Col-          [====================================]
  lection

Interviews    [=]              [=]                                    [=]


Comparison                                                     [==]
 Sample

Posttest                                                           [==]


9th-Grade                                                      Oct, 1989=>
  MFMT
```

Model Use

Project staff members delivered school-based training on the use of the instructional model to teachers at the three experimental schools. On August 30 and 31, an initial training session of 2 1/2 hours was conducted in each school to introduce the instructional model and its components. The teachers practiced using the materials by scoring a mock diagnostic test to identify specific skill deficits. Next, teachers used the matrices to identify software activities that correlated with the skills. Before viewing the software, they consulted the Software Summaries that described the programs. The teachers also reviewed the Student Progress Sheet (found in the appendix of the guide) to visualize how they would develop a plan of computer instruction for their students. Each of the participating special education teachers received a copy of the instructional guide, and each school received the necessary software.

Subsequent training took place in the new schools prior to data collection when the project staff met with the teachers individually and in groups. During these sessions project staff further explained the model, reviewed software programs, answered teachers' questions, and discussed computer management and scheduling problems.

After receiving this training, teachers in the three experimental schools were requested to use the instructional model for the remainder of the school year, and (to the degree possible) to give each student three computer sessions per week, each session of at least 15-minutes duration. Project staff members were instructed to answer teacher questions about computers and the instructional model, and to provide basic levels of support, but to refrain from dealing directly with students or becoming directly involved with the instructional process.

Data Collection

Each week, teachers completed a data form recording their students' use of computers (see Appendix B). These forms, which had student names preprinted, recorded the number and length of computer sessions and the topic (by Maryland Functional Math Test Domain) covered by the computer. Each week, project staff members visited the schools to distribute new data recording forms and collect completed forms. Questions concerning computer use and data recording procedures were addressed in these visits. This phase of the intervention was 25 weeks in duration, but data records for one week were lost leaving a total of 24 weeks' data.

Interviews

At three points during the school year, project staff members met individually with teachers to conduct a structured interview on the use of the instructional model and computers, and to obtain general teacher feedback. Each of these interviews lasted approximately twenty minutes. The first interview included only teachers from the three experimental schools, but the second and third interviews included teachers from three schools involved in the previous year's activities. These three schools had been involved in the development of the model and had been given a complete set of the materials.

The interview was comprised of questions on each component of the model: Pretest, Diagnostic Evaluation, Domain Directory, Matrix, Software Summaries, Skill Sheets, Software, and Miscellaneous Materials. After each round of interviews, project staff members refined the questions and procedures for subsequent interviews.

The first interview (September and October) ascertained which components had been used and how they had been used. For example, the first question was:

> "Have you used any of the pretests?"
> If yes, "Which pretests? Please describe how the tests were given, scored and interpreted. How were the results used?"
> If no, "When do you think you might use the pretests?"

The second interview (December and January) asked about the same components, but addressed not only use but also frequency of use. Teachers were requested to suggest changes in components that had not been used. For example, the first question was:

> "Are you making regular use of the pretests?"
> If yes, "Please describe how tests are given, scored and the results used?"
> If no, "Is there something we can do to make the pretests more usable or useful?"

The third interview (June) asked which components of the model were in regular use and why some were discontinued. For example, the first question was:

> The pretest assesses the student's skill in the following domains: Number Concepts.....Problem Solving. Did you make use of this test?
> For which domains? Please describe how the tests were given, scored and results used.
> Why did you continue/discontinue use of this test? Was there something that we could have done to make the pretest more useful to you?

The third interview also included questions of a general evaluative nature about the instructional model and computers.

Comparison Sample

Each student who had received the instructional model in an experimental school was matched with a special education student in one of the comparison schools. Students in the one experimental magnet school were matched with comparison students in three comparison magnet schools, and students in the two experimental nonmagnet schools were matched with comparison students in six comparison nonmagnet schools. Matching was done on the basis of the following variables obtained from the school district's special education database: sex, race, level of service, category of handicap, grade, special education grade and age (within six months).

This study had certain limitations associated with quasi-experimental designs. Although a rigorous matching procedure was employed, the comparability of experimental and comparison groups can not be assumed with the confidence that would have been possible with random assignment of subjects to groups. Also, the nature of the comparison condition was not controlled or documented.

Posttest

In May and June, posttests and attitude tests were administered in the three experimental schools and nine comparison schools. See Appendix C for copies of tests. The posttest was a criterion-referenced test on three of the seven domains of the Maryland Functional Math Test--whole numbers, mixed numbers, and decimals. The other domains were excluded because students in the experimental schools spent negligible amounts of computer time on these areas. The posttest was divided into two parts with 24 and 28 items respectively. Test items were selected from a practice test developed previously by the school district, with additional items on prerequisite fraction skills. With the exception of the items on whole number addition and subtraction, a multiple choice format similar to the Maryland Functional Math Test was used.

Reliability analysis was conducted on the overall posttest and on the items in each of the domains (see Appendix D). The overall reliability coefficient (Cronbach's alpha) was .93, and the coefficients for whole numbers, decimals and mixed numbers were .85, .70 and .88 respectively.

To measure student attitudes toward math, the Survey of School Attitudes--Intermediate Form A (Hogan, 1975) was adapted to include only 15 items on math and five distractor items on other topics. The reliability coefficient on the 15 math attitude items was .83 (see Appendix D).

Test administration. Project staff members administered the posttest in the schools on two consecutive days (with later makeups scheduled as needed). On the first day, students completed the attitude test and part one of the posttest. On the second day, students completed part two of the posttest. Test administrators delivered a standard set of test directions and were instructed to remove obvious aids (e.g. multiplication charts) from display in the room.

9th-Grade Maryland Functional Mathematics Test

The Maryland Functional Mathematics Test is administered statewide to 9th-grade students, giving them their first opportunity to fulfill the minimal competency graduation requirement in mathematics. During the school year following our study, a follow-up study was conducted of the 8th-grade students who had been included in our posttest analysis and who had subsequently taken the 9th-grade Maryland Functional Mathematics Test. The purpose of this follow-up study was to determine the long-term effects of the model.

RESULTS OF THE COMPARISON STUDY

Subject Characteristics

Experimental subjects were eliminated from the analysis if (a) they left the experimental school prior to posttesting, (b) they were not perfectly matched with a comparison student, or (c) they or their matched student failed to complete the posttesting procedures. After these criteria were applied, a total of 136 subjects, 68 in each condition, remained for the analysis. Tables 1 and 2 display characteristics of these subjects.

Table 1
Average Age and Score on the 7th-Grade Practice MFMT for Experimental and Comparison Subjects

	Average Age (in months)		Average Score on 7th-grade MFMT	
	Mean	Std Dev	Mean	Std Dev
Experimental Subjects	164.6	9.4	287.2	16.3
Comparison Subjects	164.3	8.8	287.7	18.5
Entire Population	164.5	9.1	287.4	17.4

Table 2
Numbers of Matched Pairs of Experimental and Comparison Students by Grade, Level of Service, Handicapping Condition, Sex and Race

	Number of Pairs	Percent
*Grade		
7	36	53%
8	32	47%
Level of Service		
2	5	7%
3	38	56%
4	25	37%
Category		
Speech/Lang. Impaired	1	1%
Specific Learning Dis.	67	99%
Sex		
Male	46	68%
Female	22	32%
Race		
Black	60	88%
White	8	12%

* The term "grade" here and in the remaining analysis refers to the "special education grade" as recorded by the school system.

Table 3 compares the composition of the experimental sample with the special education populations of the experimental schools and the school district. The male/female percentages in the sample appear to mirror the district special education population. However, the percentage of Black and learning disabled students is higher in the sample than in the experimental schools or the district. This deviation in percentages may have resulted from the specific classrooms and programs selected for the study. Also, the rigorous matching procedure used to identify comparison subjects may have amplified disproportionalities occurring in the population (i.e. finding satisfactory matches may have been increasingly difficult for smaller segments of the population). In any case, in generalizing the findings of this study, one should consider that the proportion of learning disabled and Black students in our sample was higher than in the special education population of the school district.

Table 3
Comparison of Sample with Special Education Populations in the District and the Experimental Schools

	District	Experimental Schools	Experimental Sample
Male	67%	64%	68%
Female	33%	36%	32%
Black	67%	76%	88%
White	30%	22%	12%
Other (American Indian, Asian and Hispanic)	3%	2%	0%
Specific Learning Dis.	56%	76%	99%
Speech/Lang. Impaired	24%	2%	1%
Other Handicaps	20%	22%	0%

Computer Experiences

The 68 experimental subjects received a mean of 1.6 (SD = .63) computer sessions per week, ranging from an individual average of .5 sessions to 2.8 sessions per week. These subjects spent a mean of 1189.6 (SD = 659.7) total minutes at the computer, which averaged to approximately 49.6 minutes per week. The predominant use of computer time was on three domain areas: whole numbers, mixed numbers and decimals. These data are displayed on Tables 4 and 5.

Table 4
Time and Sessions on Computer

Variable	Mean	Std Dev	Minimum	Maximum
Minutes on Computer	1189.6	659.7	180.0	2895.0
Average Minutes per Week	49.5	27.5	7.5	120.6
Total Sessions	37.6	15.1	11.0	68.0
Average Sessions per Week	1.6	.6	.5	2.8

Table 5
Time Spent on MFMT Topics
(in minutes)

Variable	Mean	Std Dev	Minimum	Maximum
Number Concepts	39.2	112.8	0.0	525.0
Whole Numbers	589.1	542.3	90.0	1940.0
Mixed Numbers	261.6	390.1	0.0	1320.0
Decimals	200.2	208.7	0.0	1100.0
Measurement	4.4	13.0	0.0	45.0
Using Data	1.1	3.9	0.0	15.0
Problem Solving	93.2	209.3	0.0	835.0
Other	.8	4.9	0.0	35.0

Posttest Performance

The mean posttest score for the entire group was 26.7 (SD = 10.5), or 51.4% of the 52 possible points. The question of primary interest--the effect of the instructional model on posttest performance--was tested by means of an analysis of variance on posttest scores. Other factors--grade level, level of service, sex and race--were also included in the analysis. One issue of possible interest--the effect of category of handicap--was excluded from the analysis because all but two of the subjects were classified as learning disabled.

Although the procedure of matching subjects functioned effectively to generate similar groups, the correlation between matched subjects' posttest scores was found to be nonsignificant ($r(66) = .02$, $p = .86$). Therefore, the subject pairings were not used in the analysis of the posttest scores.

On some analyses, the student's score on the 7th-grade practice administration of the Maryland Functional Math Test was used as a covariate to control for prior ability. This score was found to be highly correlated with the posttest score ($r(110) = .63$, $p < .001$). However, several factors limited the usefulness of this covariate. First, 24 students (17.6% of the sample) did not have recorded scores on this practice Maryland Functional Mathematics Test. Also, the absence of the covariate was found to be significantly related to the level of service (Chi-Square (2) = 22.67, $p < .001$), with 38% of the level 4 students missing this score, as compared with 10% and 5% respectively for the level 2 and 3 students. Finally, the homogeneity of regression assumption was not met for several of the variables involved in the analysis, and violating this assumption may distort the results of analysis of covariance. Thus, while the results of the analysis of covariance are reported at several points in the following discussion, the preceding limitations regarding the use of the covariate should be recognized.

Table 6
Analysis of Variance on Posttest Score

Factor	Sum of Squares	DF	Mean Square	F	p
Main Effects					
Condition	16.9	1	16.9	.2	.69
Grade Level	461.8	1	461.8	4.4	.04
Level of Service	609.8	2	304.9	2.9	.06
Sex	153.4	1	153.4	1.5	.23
Race	0.5	1	0.5	.0	.95
Residual	13602.2	129	105.4		

Table 6 displays the results of an analysis of variance on posttest score. In this analysis, the posttest was found to be significantly affected by grade level. With the inclusion of the covariate, the effects of level of service ($F(2,104) = 6.0$, $p < .01$) and sex ($F(1,104) = 3.8$, $p = .05$) became significant. Means and standard deviations for the levels of the factors are displayed in Table 7. The factor of primary interest--the instructional model--had no significant main effect upon posttest performance with or without the covariate.

Table 7
Means and Standard Deviations on Posttest

Factor	Level	Mean	SD	Cases
Condition	Exper.	27.0	10.7	68
	Compar.	26.3	10.4	68
* Grade Level	7	24.8	10.1	72
	8	28.8	10.7	64
** Level of Service	2	28.4	11.9	10
	3	28.5	9.5	76
	4	23.6	11.2	50
** Sex	Male	26.1	10.3	92
	Female	27.9	10.9	44
Race	Black	26.6	10.4	120
	White	27.4	11.6	16

* Statistically significant difference without covariate

** Statistically significant difference with covariate

To eliminate empty cells and allow interactions to be analyzed, the data set was modified as follows. Level of service was collapsed by combining levels 2 and 3, thus creating a factor with two possible values--level 2/3 and level 4. Also, race was dropped from the analysis due to the small number of subjects in one subgroup. An initial analysis revealed that no three- or four-way interactions were significant, and the analysis was repeated with these higher order interactions suppressed. The results are displayed in Table 8.

Table 8
Main Effects and Two-Variable Interactions on Posttest Score

Factor	Sum of Squares	DF	Mean Square	F	p
Main Effects					
Condition	16.9	1	16.9	.2	.68
Grade Level	464.7	1	464.7	4.8	.03
Level of Service	637.6	1	637.6	6.5	.01
Sex	154.2	1	154.2	1.6	.21
2-way Interactions					
Condition by...					
...Grade Level	1106.4	1	1106.4	11.3	<.01
...Level of Service	1.5	1	1.5	0.0	.90
...Sex	18.7	1	18.7	.2	.66
Grade Level by...					
...Level of Service	97.2	1	97.2	1.0	.32
...Sex	27.2	1	27.2	.3	.60
Level of Service by...					
...Sex	194.5	1	194.5	2.0	.16
Residual	12202.9	125	97.6		

This analyses revealed a strong interaction between grade level and condition. The nature of this interaction can be seen in the subgroup means displayed on Table 9. At the 8th grade level, the experimental group was significantly higher than the comparison group ($F(1,62) = 6.9$ $p = .01$). At the 7th grade level, the comparison group was significantly higher than the experimental group ($F(1,70) = 4.0$ $p = .05$).

Table 9
Mean Posttest Scores by
Condition and Grade Level

Grade Level:		7th	8th
Experimental	mean	22.5	32.1
	SD	8.3	10.9
	number	36	32
Comparison	mean	27.2	25.4
	SD	11.3	9.5
	number	36	32

Tables 10, 11 and 12 display means for the three types of problems on the posttest. Overall, the students averaged 10.3 (SD = 4.0) on whole number operations, 8.6 (SD = 5.1) on mixed number operations, and 7.8 (SD = 2.9) on decimal operations. All three types of problems showed the same pattern of interaction noted on the overall posttest score--the experimental group higher than the comparison group at the 8th grade level but the reverse at the 7th grade level. Thus, it does not appear that the overall posttest interaction arose from differential means among the various types of problems.

Table 10
Mean Posttest Scores on
Whole Number Operations
by Condition and Grade Level

	Grade Level:	7th	8th
Experimental	mean	8.8	12.1
	SD	3.7	3.5
	number	36	32
Comparison	mean	10.3	10.0
	SD	4.2	4.2
	number	36	32

Table 11
Mean Posttest Scores on
Mixed Number Operations
by Condition and Grade Level

	Grade Level:	7th	8th
Experimental	mean	7.0	10.8
	SD	4.1	5.9
	number	36	32
Comparison	mean	9.2	7.5
	SD	5.4	4.3
	number	36	32

Table 12
Mean Posttest Scores on
Decimal Operations
by Condition and Grade Level

	Grade Level:	7th	8th
Experimental	mean	6.7	9.2
	SD	2.6	3.0
	number	36	32
Comparison	mean	7.6	7.8
	SD	2.9	2.5
	number	36	32

Interaction Between Condition and Grade Level on Posttest Performance

The following analyses explored the interaction between condition and grade level on posttest performance. These analyses were intended to determine if the effect was spurious (e.g. resulting from prior differences between subject groups or from other uncontrolled variables), or if certain aspects of the intervention could be identified as contributing to the effect.

Preexisting differences between groups. To determine if preexisting differences in subject groups contributed to the interaction between condition and grade level, analysis was conducted of the scores on the 7th-grade practice Maryland Functional Math Test (which preceded our intervention and was highly correlated with the posttest). Table 13 displays mean scores on this test broken down by grade level and condition. No significant effects were found for grade level ($F(1,108) = .52$, $p = .48$) or condition ($F(1,108) = .02$, $p = .89$) or for the interaction between grade level and condition ($F(1,108) = .03$, $p = .87$). Also, Chi-square analyses revealed that the two grade levels did not differ significantly in composition by level of service (Chi-square (2) = 1.9, $p = .38$), sex (Chi-square (1) = 2.4, $p = .12$), or race (Chi-square (1) = 0.3, $p = .58$).

Table 13
Mean 7th-Grade Practice MFMT Scores
by Condition and Grade Level

Grade Level:		7th	8th
Experimental	mean	285.8	288.7
	SD	16.4	16.5
	number	28	26
Comparison	mean	286.8	288.6
	SD	20.6	16.3
	number	30	28

School effects. Posttest means for individual schools were analyzed to determine if posttest scores differed significantly from school to school and to study the nature of the distribution of scores across schools. Table 14 displays means of the posttest performance by school, grade level and condition. Analyses of variance suggested that in all cells but the 7th grade experimental schools, the school factor had a significant or nearly significant effect on posttest performance.

Table 14
Posttest Means Broken Down by
School and Condition

Experimental Schools

School	7th Grade Posttest Mean	7th Grade SD	7th Grade Number of Cases	8th Grade Posttest Mean	8th Grade SD	8th Grade Number of Cases
School 1	21.4	9.1	8	23.3	10.8	6
School 2	23.3	10.0	16	34.5	7.4	10
School 3	22.3	5.5	12	33.9	11.6	16

7th Grade: $F(2,33) = 0.1$ $p = .88$ 8th Grade: $F(2,29) = 2.7$ $p = .09$

Comparison Schools

School	7th Grade Posttest Mean	7th Grade SD	7th Grade Number of Cases	8th Grade Posttest Mean	8th Grade SD	8th Grade Number of Cases
School 4	25.7	12.1	3	29.2	4.8	5
School 5	15.5	3.5	2	31.0	0.0	1
School 6	29.0	10.3	5	19.0	11.1	5
School 7	26.0	9.9	2	37.0	0.0	1
School 8	12.7	6.5	3	14.0	0.0	1
School 9	27.5	6.2	6	21.1	8.0	9
School 10	34.5	13.4	2	39.5	10.6	2
School 11	20.8	9.2	6	29.0	8.4	6
School 12	39.4	8.1	7	23.5	0.7	2

7th Grade: $F(8,27) = 3.7$ $p < .01$ 8th Grade: $F(8,23) = 2.2$ $p = .06$

Since the factor of individual schools tended to influence posttest performance, this factor was analyzed further to determine if the inclusion of specific schools, particularly in the comparison group, had an extreme effect on mean posttest scores. Figure 2 displays histograms of posttest means for experimental ([E]) and comparison ([C]) schools at the 7th and 8th grade levels. The numbers in the brackets are the number of student scores represented at each school and grade level. Because of the smaller numbers of students at each of the comparison schools, the means for these schools at both grade levels were distributed more widely than for the experimental schools.

One comparison school (School 12 in Table 14) had a relatively large number of 7th-grade students (7) with a high mean posttest score (39.4) and thus contributed substantially to the high cell mean. The 7th-grade comparison subjects at this school scored significantly higher on the posttest than the remaining 7th-grade comparison subjects (t (27) = 4.1, p <.001). When the 7th-grade students at this school and their matched experimental subjects were excluded from analysis, the condition by grade level interaction remained significant (F (1,121) = 5.3, p = .02), but the difference in posttest means for the 7th-grade experimental and comparison groups was decreased (22.7 and 24.2, respectively) and was no longer significant (F (1,57) = .37, p = .55).

In summary, the interaction between condition and grade level could not be explained by any identifiable prior differences in student abilities or group compositions. The apparent superiority of the 7th-grade comparison group was eliminated upon the removal of one comparison school and its matched experimental subjects. However, the overall interaction of condition by grade level remained significant.

Figure 2
Histograms of Mean Posttest Scores
by School, Grade Level and Condition

Mean Posttest Score for School	7TH GRADE	8TH GRADE
13	[C 3]	
14		[C 1]
15		
16	[C 2]	
17		
18		
19		[C 5]
20		
21	[E 8][C 6]	[C 9]
22	[E12]	
23	[E16]	[E 6]
24		[C 2]
25		
26	[C 3][C 2]	
27		
28	[C 6]	
29	[C 5]	[C 5][C 6]
30		
31		[C 1]
32		
33		
34		[E16]
35	[C 2]	[E10]
36		
37		[C 1]
38		
39	[C 7]	
40		[C 2]
	I....I....I	I....I....I
	0 1 2	0 1 2
	Frequency	Frequency

<u>Factors contributing to the interaction</u>. Since the interaction between grade level and condition could not be dismissed as spurious, the analysis turned to specific aspects of the intervention which might have contributed to the interaction. The computer experiences of 7th and 8th grade students did not differ significantly in mean number of computer sessions per week or on total time on computers (see Table 15). However, when time spent on specific domain topics was analyzed, significant differences were found in the amount of time spent on whole numbers and on mixed numbers. As a group, 7th graders spent significantly more time on whole number operations and number

concepts and significantly less time on mixed number operations than did 8th graders.

Table 15
Comparison of 7th and 8th Grade Experimental Subjects

	7th Grade mean	7th Grade SD	8th Grade mean	8th Grade SD	F-stat	p
Computer Sessions per Week	1.5	0.6	1.7	0.6	1.5	.23
Total Time on Computer	1166.0	606.1	1216.1	724.2	1.0	.76
Time on Number Concepts and Whole Numbers	819.3	628.8	413.4	333.1	10.7	<.01
Time on Mixed Numbers	117.2	193.0	424.1	485.1	12.2	<.01
Time on Decimals	164.7	228.2	240.0	179.7	2.2	.14
Time on Measurement Using Data and Problem Solving	64.7	84.3	136.9	298.3	1.9	.17

Correlations were calculated between computer experience variables and posttest performance. To reduce the effects of prior abilities, three factors were partialled out--level of service, score on the 7th-grade practice Maryland Functional Math Test, and grade level. Together, these had a multiple R of .65, and thus accounted for 42% of the variance in posttest performance. Table 16 displays partial correlations between the remaining variables and posttest performance. The amount of computer time spent on the most basic skills--number concepts and whole numbers--had a significant negative partial correlation with posttest performance; while the amount of time spent on a more complex skill--mixed numbers--had a significant positive partial correlation. The amounts of computer time spent on decimals, measurement, using data and problem solving were not significantly related to posttest performance.

Table 16
Partial Correlations Between
Intervention Variables and Posttest Score

Variable	Partial Correlation	T-Stat	p
Total Time on Computer	-.07	-.6	.57
Total Sessions on Computer	.00	.0	.97
Time on Number Concepts and Whole Numbers	-.30	-2.5	.02
Time on Mixed Numbers	.39	3.3	.00
Time on Decimals	-.07	-.5	.61
Time on Measurement, Using Data and Problem Solving	-.12	-.9	.36

Causality cannot be inferred from these statistics. However, it may be noted that the two topics upon which 7th and 8th grades differed significantly in computer time also had significant partial correlations with posttest performance. The 7th graders spent significantly more time on the topic that was negatively correlated with performance and significantly less time on the topic that was positively correlated with performance.

Attitude Test Results

The students scored an average of 21.0 (SD = 5.9) on the attitude test. This score was not significantly affected by any of the factors under consideration except sex (F (1,134) = 5.1 p = .03) (see Table 17). It was not significantly correlated with the score on the 7th-grade practice Maryland Functional Math Test (r (110) = .03, p = .39) or the posttest score (r (134) = .07, p = .39). For the experimental group, the attitude test score was not significantly correlated with sessions on the computer (r (66) = .07, p = .30), time on the computer (r (66) = .00, p = .48), or time on any of the topics. The observed posttest interaction between condition and grade level was not mirrored in the attitude test. The interaction between condition and grade level on the attitude test was nonsignificant (F (1,132) = .87 p = .35).

Table 17
Means and Standard Deviations on Attitude Test

Factor	Level	Mean	SD	Cases
Condition	Exper.	21.3	5.9	68
	Compar.	20.7	6.0	68
Grade Level	7	20.6	5.8	72
	8	21.5	6.1	64
Level of Service	2	22.2	6.9	10
	3	20.8	5.8	76
	4	21.2	6.1	50
*Sex	Male	21.8	5.9	92
	Female	19.4	5.9	44
Race	Black	21.3	6.0	120
	White	19.1	5.1	16

* Statistically significant difference

Results of 9th-Grade Maryland Functional Mathematics Test

Of the 64 eighth grade students included in the preceding analysis, 57 (89.1%) took the 9th-grade administration of the Maryland Functional Mathematics Test the following academic year. This represented 87.5% of the experimental subjects and 90.6% of the comparison subjects. Follow-up analysis was conducted on the scores received on this test and on the rate of passing the test (i.e. receiving a score of 340 or above). Subjects were excluded from this analysis if either they or their matched subject did not have a recorded score. This resulted in a sample of 26 experimental and 26 matched comparison subjects.

Table 18 displays the performance on the 9th-grade Maryland Functional Mathematics Test and Table 19 displays the results of an analysis of variance on the various factors.

Table 18
Means, Standard Deviations and
Percent Passing on 9th-Grade MFMT

Factor	Level	Cases	MFMT Mean	SD	Percent Passing
Condition	Experimental	26	324.3	22.2	27%
	Comparison	26	313.1	18.8	12%
Level of Service	2 and 3	34	323.1	19.9	24%
	4	18	310.4	21.4	11%
Sex	Male	36	319.8	20.4	22%
	Female	16	316.2	23.1	13%
Race	Black	46	316.9	19.7	15%
	White	6	332.7	28.3	50%

Table 19
Analysis of Variance on 9th-Grade MFMT

Factor	Sum of Squares	DF	Mean Square	F	p
Main Effects					
Condition	1628.5	1	1628.5	4.3	.05
Level of Service	1867.3	1	1867.3	4.9	.03
Sex	3.2	1	3.2	0.0	.93
Race	1185.8	1	1185.8	3.1	.09
Residual	17973.8	47	382.4		

A log-linear analysis was conducted on the rate of passing the 9th-grade Maryland Functional Mathematics Test as a function of condition, level of service, sex and race. This method of analysis was selected because it is appropriate for categorical data and permits simultaneous analysis of a number of variables. The results are summarized in Table 20. Since no significant effects were observed for interactions of more than two variables, Table 20 includes only single-variable and two-variable associations with rate of passing the test. The interaction between race and condition should be interpreted with caution because of the small number of white students included.

Table 20
Partial Associations with
Rate of Passing 9th-Grade MFMT

Effect with Rate of Passing MFMT:	DF	Partial Chi-Square	p
Condition	1	2.270	.13
Sex	1	.125	.72
Race	1	3.048	.08
Level of Service	1	1.342	.25
Condition by Sex	1	.000	1.00
Condition by Race	1	4.919	.03
Sex by Race	1	.000	1.00
Condition by Level of Service	1	1.252	.26
Sex by Level of Service	1	.825	.36
Race by Level of Service	1	.002	.97

RESULTS OF THE STRUCTURED INTERVIEWS

A total of seventeen teachers were interviewed. Teacher responses to components of the model were compiled across the interviews and judged by the project staff as indicating that the teacher (a) used the component, (b) did not use the component, or (c) that degree of use could not be accurately determined. Following are summaries of these findings. Appendix E contains a complete report of teacher responses with teachers designated by the letters "A" through "Q" to maintain anonymity.

Teacher Use of the Components of the Model

Pretest/Posttests:

Used = 13 Did Not Use = 2 Undetermined = 2

Thirteen teachers reported using the pretests/posttests. Two did not use them at all. Two teachers were not clear in their report of using them.

The pretests tended to be used in ways not intended by the designers, and only two teachers, "E" and "K", used the pretests specifically as designed. Teachers "F", "I" and "Q" used the tests as a baseline or an assessment to help with instructional planning. "C" used the pretests/posttests to have her students compare their progress and see if they had made any of the same errors.

Four teachers, "B", "K", "N", and "P" discontinued use of these tests after a few uses, for a variety of reasons. And two, "J" and "L", reported that they did not use these tests at all. "L" said she already knew what domains and objectives to work on, and "J" didn't work with any component of the model except the software.

Diagnostic Evaluations:

Used = 11 Did Not Use = 4 Undetermined = 2

The diagnostic evaluation was designed to reveal student weaknesses in specific skill areas. Eleven teachers said they used the diagnostic evaluations, but similar to the pretests not all of them were given as they were intended to be used. Teacher "C" used them as warm-ups and worksheets, while teacher "M" used them as teaching tools for presenting material that was not yet covered by her students. "Q" used them midyear to prepare her students for the California Achievement Tests. "P" used them as they were intended, and to put students into groups for computer work and finally, "D" used these tests as a baseline at the beginning of a unit and again as a posttest to compare results after teaching the material.

Four teachers did not use these evaluations. "H" gave them to his students because they were copied for him by someone but he did not use the results. Teachers "K" and "L" used them early on but then discontinued. Teacher "L" commented on her large class size and how difficult it was for her to individualize instruction. Both of these teachers went directly to the matrices for software selection, skipping the diagnostic process. Based on the comments from teachers "A" and "B" it was difficult to determine whether they used the diagnostic evaluations or not.

Domain Directory:

Used = 9 Did Not Use = 8 Undetermined = 0

Nine teachers reported use of this directory for assistance with their teaching. For example, teachers "E" and "O" used it mainly for the suggested teaching strategies, while "A", "C" and "M" reported using the directory predominantly for the vocabulary. In fact, teacher "M" sent this list home to parents for extra reinforcement of the words. "P" and "Q" used the directory for help when working on specific skills with a specific group of students.

Eight teachers did not use the domain directory on a regular basis. Teachers "K" and "L" thumbed through it once or twice early in the year to become acquainted with the project. "G" commented that she liked the way it was organized, but she felt no need for it. And finally teachers "F" and "H" never looked at the directory.

Matrix:

Used = 9 Did Not Use = 8 Undetermined = 0

The matrices were apparently very helpful to teachers "M" and "N" who used them regularly to identify software activities that correlated to specific skills. "M" commented that she enjoyed putting the students on different disks and her students enjoyed the variety of software, especially doing something different than what their neighbor was doing. Teacher "O" duplicated them and put them in her planbook for a quick reference to the software that was available for the skills she was covering in class.

Several of the teachers from one school reported that they didn't use the matrices themselves, but the computer director used them regularly for selecting their classes' software. They gave him examples of the material that their students were working on or the results of the diagnostic evaluations and he consulted the matrices for software selection. "E" helped other teachers to understand how to use the matrices, but she had the computer aide select most of her software.

"I", "K" and "L" all discontinued using the matrices by midyear because much of the software identified for the skills did not run on the Apple II+. "K" said this was too frustrating, and instead went to the box of software and read the software summaries to help review the programs.

Software Summaries:

Used = 11 Did Not Use = 6 Undetermined = 0

All of the teachers who used the summaries expressed satisfaction with the information that they included. Teachers "A" and "B" said reading the summaries helped them to better explain how to use the software programs to their students and this in turn helped the students catch on more quickly. "B" was particularly impressed with the Teacher Options section because it was easier to read about the options offered on a program rather then "playing around" with it. "F" began reading the summaries by the second half of the school year. She said that reading them was quicker than reviewing the software manually. Two teachers "K" and "L", who earlier reported that they did not use the matrices, frequently used the summaries for the software review and the correlation to skills.

Skill Sheets:

Used = 13 Did Not Use = 4 Undetermined = 0

The Skill Sheets were intended to be used as quick paper and pencil assessments following computer practice. Teachers "C", "E" and "K" used them in this way. "P" said she used the Skill Sheets on every third visit to the computer lab as a quick post computer assessment "to see if there was a screen to paper transition." Teachers "B" and "D" used them in class before going to the computer lab.

Most of the teachers reported using the Skill Sheets for classwork, homework, warm-ups and quizzes. Teacher "H" said he "used the heck out of them" but mostly as work sheets. He often added more problems to the back of a page. "M" used them to teach from in class when a student was having a problem with a skill.

Teacher "G" said she did not use them because they were not challenging enough for her students. "N" also did not use them because the courseware series that he used, provided work sheets that directly matched the software.

Software:

Used = 17 Did Not Use = 0 Undetermined = 0

Every teacher in the project used software that was provided with the materials. The most popular software program was Conquering Whole Numbers by MECC, which was used by twelve of the seventeen teachers.

Other popular programs were:

Speedway Math - 7
Milliken - 6
Multiplication Puzzles - 6
Number Munchers - 4
Fraction Munchers - 3
Clockworks - 1
Arithmetic Critters - 2
Subtraction Puzzles - 1
The Market Place - 2
Mindscape - 2
Decimal Concepts - 2
Fraction Concepts - 1

Miscellaneous Materials:

Used = 1 Did Not Use = 17 Undetermined = 0

The miscellaneous materials were a compilation of worksheets gathered from several counties and organized by domain in a portable file box. They were included with the math materials for supplementary use. Only one teacher reported using these materials, and even he commented that he did so because he thought he had to as a participant in the study.

General Evaluative Responses

The final teacher interview included five questions on the general impact of the instructional model upon the teachers and students.

Question 1: What changes have occurred in your method and approaches toward teaching math, since becoming part of the Middle School Math Project?

Analysis of the responses revealed that two different types of changes occurred. In some cases, the changes reflected a process of simply fitting the computer and other elements of the model into the teachers' instruction. Since the participating teachers were expected to make this type of change, these responses are not discussed further.

The second type of change reflected a more generalized change in teaching as a result of the experience with the model. Five of the sixteen teachers reported this second type of change. Several of them reported that they individualized their instruction more. For example, Teacher "M" reported that as a result of the training provided by this project, her overall teaching of math improved. "I individualize more and have become more aware of specific skills and concepts that kids lack and the way kids process information." Teacher "P" stated that she was more "analytical" as a result of the project due to the task analysis component of the model. She said, "The computers helped me to see exactly where the students were having a problem because of the immediate feedback [of the software]. During classwork paper and pencil tasks, teachers will often miss the errors."

Teachers also reported changes in their use of computers. Teacher "D" said she became more "aware" of the fact that she can use the computer room for "practical application and math practice," while another said she uses the computer for "remediation."

Question 2: Have the students benefitted from this project? Do you think they learned more?

Each of the sixteen teachers interviewed indicated that their students' benefitted from this project. Five stated that their students' learned more and three teachers noted specific skill improvements such as counting and multiplication facts. Teacher "A" said: "[Student Name] could not count and now he can count and tell time from using Clockworks, (by MECC)." Teacher "B" told us, "Their math has improved and they have been forced by using the computer, to memorize their multiplication facts." Teacher "O" said she had seen a marked improvement on the math portion of the Woodcock Johnson Test.

Two teachers indicated their students didn't "learn more." Teacher "N" stated that his students probably didn't learn more because of prior exposure to this kind of information, but he was certain that they "retained" more. Teacher "M" said, "They are not as afraid to learn new things because they are not afraid of making mistakes. Therefore there is less fear in learning new concepts."

Five teachers mentioned an increase in their students' motivation to do math. Teacher "P" stated, "Students are much more motivated to get it right when problems are presented on the computer, it must be something about them being up on the screen verses paper and pencil." Teacher "C" stated, "Most kids enjoy math or want to enjoy it, and they <u>do</u> enjoy it with the computer." Teacher "K" commented that the math teacher with whom he works noticed an increase in student attendance on the days they were scheduled to go to the computer lab.

Question 3: **Rate your level of comfort (on a scale of 1 = very uncomfortable to 5 = very comfortable) with using computers in teaching before becoming a part of the Middle School Math Project and what changes have occurred in your attitudes and approaches toward using computers, since becoming part of Project?**

Eight of the sixteen teachers gave themselves pre-project ratings below a comfort level of three. Each of these said their level of comfort has increased greatly.

Five teachers gave themselves pre-project ratings of three. Of these, all said they have increased either their positive attitude or their awareness of the usefulness of computers as a teaching tool.

As a result of their contact with the math project, eight of the teachers reported overcoming an initial reluctance regarding computer use and/or an interest in integrating computers into other content areas.

Question 4 **In the coming school year, how do you perceive yourself using computers and the Instructional Model without the requirement of data collection and a `three times a week' minimum of computer time for students?**

The responses indicated that all the teachers plan to use the computers and the instructional model in much the same way as this year and/or expand the use of the computers to other content areas.

Nine teachers viewed themselves as continuing computer use consistent with this year's requirements, three times a week for twenty minutes at a time. Two said they would like to make the instructional model their math curriculum for next year and four more mentioned they would like to use computers in other content areas such as English and Reading. Teacher "E" expressed a desire to have her students begin using computers for word processing.

Another four teachers mentioned that they would like to use computers next year, but are subject to certain conditions such as computer lab schedule, magnet program schedule, and re-arrangement of class size (for smaller groups).

Question 5 Name one positive event that has happened since the implementation of this model in your school.

Six teachers said that their students were more motivated to perform well when they were scheduled to work in the computer lab. Teacher "J" had a student from another country who had undeveloped skills in math, "he was excited and motivated to learn on the computer." Teacher "D" said, "The students have become more interested in math, they look forward to using the computers." Teacher "P" said, "The kids have a 'hands on' [approach] to math and it is exciting and enjoyable for them." Teacher "H" said that his students were "more enthusiastic on lab days, than when they are in the classroom."

Three of the teachers said their students' skills have actually increased. Teacher "B" said, "The students have gained in self confidence and their math knowledge has increased." Teacher "L" said, "The kids are processing information better, their skills have improved."

Two of the teachers reported a change in their students perceptions of the computer from a medium for fun and games to a medium used for work and learning. For example, Teacher "A" overheard a student tell someone that, "We come here [the computer lab] to learn, not just to play games." Teacher "C" noted an increased computer literacy on the part of her students, who are beginning to recognize a correlation between skills covered on project software and other programs they have used in other math classes.

Teacher "Q" said that her students are more aware of when they need help, "Before they didn't even know where they were lacking. Now they say, "I'm having problems with this, can I work on the computer and get some practice?"

Finally, two of the responses indicated a positive impact on teacher functioning. For example Teacher "R", who is a computer coordinator, mentioned that all the project teachers have become more literate, which means all involved have gained. Teacher "N" told us that the skill level for each student has become more concrete, "At the beginning of the year, when you read student records, it is very difficult to determine where they really are." He has used the task analysis (component of the model) to write skill levels for his students' Individual Education Plans (IEP).

Appendix A
Description of the Components of the Instructional Model

Appendix A
Description of the Components of the Instructional Model

1. Pretest/Posttests

Multiple choice tests used to measure performance on objectives within the MFMT domains.

MFMT results are usually expressed in the form of an overall score for the test and numerical scores for each of the seven domains. These scores do not reveal information about the specific objectives within each domain. For example, the domain score for Whole Numbers does not indicate if poor performance was in Addition, Subtraction, Multiplication or Division. Pre/posttests originally developed by Harford County were adopted for use in this project as domain assessments. These tests allow the teacher to narrow the focus of instruction to particular objective(s) within the domains.

2. Diagnostic Evaluations

Tests used to measure performance on component and prerequisite skills of the MFMT objectives.

The project staff and cooperating teachers performed task analyses of the objectives of the MFMT. The diagnostic evaluations (one per objective) have several test items for each of the skills identified in this task analysis. These evaluations isolate skill deficiencies, thus giving better indications of where instruction should focus.

For example, on Adding Whole Numbers (an objective within the Whole Numbers domain) we identified twelve component or prerequisite skills, such as adding two digit numbers without regrouping, adding three numbers with two digits and regrouping, etc.

3. Domain Directory

A teacher-reference document which provides information on the skills covered in the Maryland Functional Math Test.

The Domain Directory is divided according to the seven domains of the MFMT. Each domain is further divided into objectives which are reviewed according to: content scope, question format, a teaching strategy, vocabulary, and students' common errors.

It is suggested that the directory be studied prior to the start of instruction on a domain to provide instructional ideas and to ensure that the instruction is consistent with the MFMT.

4. **Software Matrix**

A grid that matches software programs and activiti‹s to skills and objectives.

The instructional model includes a software matrix for each MFMT objective. Each matrix is a grid that lists skills in the objective and the software products and activities that correspond to those skills. The matrices have x's and o's in the spaces that have software to skill matches. An "x" represents software that does not run on the Apple II+. A blank space indicates that no software has been identified for the skill.

5. **Software Summaries**

One or two-page summaries with valuable information about the software programs and activities.

The software summaries provide easily readable, practical information about the instructional software, including screen pictures, activity summaries, teacher options and management suggestions. Step-by-step information is given on what is expected of the student user and what the user see on the screen. The Teacher Options section is a brief description of the options available for modifing the software (e.g. selecting activities, speed, content, etc.). The Management Suggestions section is based on observations of the software being use in middle school classes. An example of a suggestion one might read is: "Turn the game options off until the student has completed all of the problems".

6. **Skill Sheets**

Short paper-and-pencil quizzes that assess achievement of a particular skill and the degree of transfer from the computer.

Teachers often have difficulting monitoring student performance on the computer. One of the options we suggest is for teachers to test performance with paper-and-pencil materials away from the computer. Because of software's immediate feedback, sound effects and motivational design, skill achievement may be higher on the computer than on paper and pencil activities. The skill sheets were designed to be given to the students after computer work to test mastery of the skill and gauge transfer.

7. **Computer Software**

Two math courseware series: <u>Microcomputer Workshops</u> by Mindscape and <u>Math Sequences</u> by Milliken; and a number of specific software programs by MECC.

The software was selected to correspond to the domains, objectives and skills in the instructional model. It was primarily in drill-and-practice or instructional game formats. The selected software was included in the software matrices, and a software summary was prepared for each item. The two courseware series were selected to cover a broad range of skills in the whole numbers, fractions and decimal domains.

The Prince George's County Public School System has a site license to copy and distribute MECC software to its schools. These programs were therefore reviewed and included in the instructional model.

8. **Miscellaneous Materials**

A collection of worksheets and other instructional materials gathered from several counties and organized by domain in a portable file box.

The miscellaneous materials were provided for supplementary use at the teacher's discretion. Teachers could use some materials directly with their students, and refer to other materials for teaching ideas.

Appendix B

Data Recording Form

COMPUTER TIME FORM

SCHOOL: Wirt TEACHER: Davis WEEK:

DAY:

__(1) [redacted] __Alone __Grouped with (number) ____________________
Number of Minutes: 5 10 15 20 25 30 35 40 45 50 more
__Num Con __Whol Num __Mixed Num __Decimals __Meas __Use Data __Prob Solv __Other

__(2) [redacted] __Alone __Grouped with (number) ____________________
Number of Minutes: 5 10 15 20 25 30 35 40 45 50 more
__Num Con __Whol Num __Mixed Num __Decimals __Meas __Use Data __Prob Solv __Other

__(3) [redacted] __Alone __Grouped with (number) ____________________
Number of Minutes: 5 10 15 20 25 30 35 40 45 50 more
__Num Con __Whol Num __Mixed Num __Decimals __Meas __Use Data __Prob Solv __Other

__(4) [redacted] __Alone __Grouped with (number) ____________________
Number of Minutes: 5 10 15 20 25 30 35 40 45 50 more
__Num Con __Whol Num __Mixed Num __Decimals __Meas __Use Data __Prob Solv __Other

__(5) [redacted] __Alone __Grouped with (number) ____________________
Number of Minutes: 5 10 15 20 25 30 35 40 45 50 more
__Num Con __Whol Num __Mixed Num __Decimals __Meas __Use Data __Prob Solv __Other

__(6) [redacted] __Alone __Grouped with (number) ____________________
Number of Minutes: 5 10 15 20 25 30 35 40 45 50 more
__Num Con __Whol Num __Mixed Num __Decimals __Meas __Use Data __Prob Solv __Other

__(7) [redacted] __Alone __Grouped with (number) ____________________
Number of Minutes: 5 10 15 20 25 30 35 40 45 50 more
__Num Con __Whol Num __Mixed Num __Decimals __Meas __Use Data __Prob Solv __Other

__(8) [redacted] __Alone __Grouped with (number) ____________________
Number of Minutes: 5 10 15 20 25 30 35 40 45 50 more
__Num Con __Whol Num __Mixed Num __Decimals __Meas __Use Data __Prob Solv __Other

__(9) [redacted] __Alone __Grouped with (number) ____________________
Number of Minutes: 5 10 15 20 25 30 35 40 45 50 more
__Num Con __Whol Num __Mixed Num __Decimals __Meas __Use Data __Prob Solv __Other

__(10) __Alone __Grouped with (number) ____________________
Number of Minutes: 5 10 15 20 25 30 35 40 45 50 more
__Num Con __Whol Num __Mixed Num __Decimals __Meas __Use Data __Prob Solv __Other

COMMENTS:

Appendix C
Measurement Instruments

Part 1

Name ____

Examples:

1. Add:

$$\begin{array}{r} 5 \\ +\,5 \\ \hline 10 \end{array}$$

2. Subtract:

$$\begin{array}{r} 10 \\ -\,5 \\ \hline 5 \end{array}$$

A. 10

B. 5

C. 1

D. 0

Part 1

1. Add:

$$\begin{array}{r} 8254 \\ +\ 7603 \\ \hline \end{array}$$

3. Subtract:

$$\begin{array}{r} 8924 \\ -\ 1082 \\ \hline \end{array}$$

2. Add:

$$\begin{array}{r} 14 \\ 363 \\ +\ \ 88 \\ \hline \end{array}$$

4. Subtract:

$$\begin{array}{r} 9447 \\ -\ 5846 \\ \hline \end{array}$$

Part 1

5. Multiply:

$$\begin{array}{r} 38 \\ \times\ 74 \\ \hline \end{array}$$

7. Divide:

$$14\overline{)84}$$

6. Multiply:

$$\begin{array}{r} 206 \\ \times\ \ 53 \\ \hline \end{array}$$

8. Divide:

$$6\overline{)768}$$

Part 1

9. Add:

$$\begin{array}{r} 75.53 \\ +\,117.91 \\ \hline \end{array}$$

A. 193.44
B. 182.44
C. 19344
D. 511.14

11. Multiply:

$$\begin{array}{r} 4.6 \\ \times\ 3.2 \\ \hline \end{array}$$

A. 147.2
B. 16.82
C. 2.30
D. 14.72

10. Subtract:

$$\begin{array}{r} 40.70 \\ -\ 6.39 \\ \hline \end{array}$$

A. 34.31
B. 47.09
C. 46.49
D. 44.41

12. Divide:

$$5\overline{)50.5}$$

A. 10.1
B. 50.1
C. 101
D. 1.01

Part 1

13. Solve:

4% of $216 =$

A. 86.4
B. 8.44
C. 8.64
D. 2.58

15: Simplify:

$\frac{3}{9} =$

14. Simplify:

$\frac{3}{6} = \frac{}{2}$

16. Add and Simplify:

$$\begin{array}{r} 2\frac{1}{5} \\ +\,4\frac{3}{5} \\ \hline \end{array}$$

A. $6\frac{4}{10}$
B. $6\frac{4}{5}$
C. $6\frac{2}{5}$
D. $2\frac{4}{5}$

Part 1

17. Subtract and simplify:

$$\begin{array}{r} 6\frac{4}{7} \\ -2\frac{2}{7} \\ \hline \end{array}$$

A. $8\frac{6}{7}$

B. $4\frac{6}{7}$

C. $4\frac{2}{14}$

D. $4\frac{2}{7}$

19. Multiply and simplify:

$$2 \times \frac{3}{5}$$

A. $3\frac{6}{15}$

B. $3\frac{2}{15}$

C. $1\frac{1}{5}$

D. $7\frac{1}{2}$

18. Simplify:

$$\frac{5}{4} =$$

A. $3\frac{4}{5}$

B. $3\frac{1}{4}$

C. $1\frac{1}{4}$

D. $1\frac{1}{5}$

20. Find the missing term:

$$\frac{18}{24} = \frac{6}{N}$$

A. 3

B. 4

C. 8

D. 30

Part 1

21. Multiply:

$$\begin{array}{r} 86.3 \\ \times\ 4.71 \\ \hline \end{array}$$

A. 94.93

B. 406.473

C. 403.61

D. 4064.73

22. Solve:

10% of 486 =

A. 4.86

B. 4860

C. 48.6

D. 486

23. Subtract and simplify:

$$\begin{array}{r} 9\frac{3}{4} \\ -\ 3\frac{1}{2} \\ \hline \end{array}$$

A. $6\frac{1}{4}$

B. $6\frac{2}{2}$

C. $6\frac{2}{4}$

D. $6\frac{4}{6}$

24: Simplify:

$\frac{40}{7} =$

A. $\frac{7}{40}$

B. $5\frac{5}{7}$

C. $5\frac{5}{40}$

D. $7\frac{5}{40}$

Part 2

Name ____

Examples:

1. Add:

$$\begin{array}{r} 5 \\ +5 \\ \hline 10 \end{array}$$

2. Subtract:

$$\begin{array}{r} 10 \\ -5 \\ \hline 5 \end{array}$$

A. 10

B. 5

C. 1

D. 0

Part 2

1. Add:

$$\begin{array}{r} 5763 \\ +\quad 78 \\ \hline \end{array}$$

3. Subtract:

$$\begin{array}{r} 4806 \\ -2485 \\ \hline \end{array}$$

2. Add:

$$\begin{array}{r} 46 \\ 31 \\ +72 \\ \hline \end{array}$$

4. Subtract:

$$\begin{array}{r} 6395 \\ -5763 \\ \hline \end{array}$$

Part 2

5. Multiply:

$$\begin{array}{r} 303 \\ \times\ 47 \\ \hline \end{array}$$

7. Divide:

$$12 \overline{)\,168}$$

6. Multiply:

$$\begin{array}{r} 79 \\ \times\ 42 \\ \hline \end{array}$$

8. Divide:

$$15 \overline{)\,555}$$

Part 2

9. Subtract:

$$\begin{array}{r} 803.09 \\ -\ \ 52.35 \\ \hline \end{array}$$

A. 851.34
B. 855.44
C. 851.74
D. 750.74

11. Divide:

$$26\overline{\smash{)}2.86}$$

A. 1.1
B. 0.11
C. 10
D. 1.6

10: Multiply:

$$\begin{array}{r} 9.73 \\ \times\ \ 4.8 \\ \hline \end{array}$$

A. 11.676
B. 46.704
C. 45.784
D. 16.031

12. Solve:

25% of 200 =

A. 5000
B. 50
C. 5
D. 25

Part 2

13. Add:

$$\begin{array}{r} 7.42 \\ 35.6 \\ +\,122.3 \\ \hline \end{array}$$

A. 232.7
B. 165.32
C. 154.38
D. 311.18

14. Add:

64.5 + 6.27 + 18.31 =

A. 31.03
B. 78.08
C. 89.08
D. 310.3

15. Simplify:

$$\frac{5}{20} = \frac{}{4}$$

16. Simplify:

$$\frac{2}{10} = \frac{}{}$$

Part 2

17. Add and simplify:

$$\begin{array}{r} 3\frac{2}{7} \\ +\ 5\frac{3}{7} \\ \hline \end{array}$$

A. $8\frac{5}{14}$

B. $8\frac{1}{7}$

C. $8\frac{5}{7}$

D. $8\frac{6}{7}$

18. Add and simplify:

$$\begin{array}{r} 3\frac{1}{2} \\ +\ 2\frac{1}{6} \\ \hline \end{array}$$

A. $5\frac{2}{8}$

B. $5\frac{4}{12}$

C. $5\frac{2}{3}$

D. $5\frac{1}{4}$

19. Add and simplify:

$$\begin{array}{r} 6\frac{4}{7} \\ +\ 2\frac{2}{5} \\ \hline \end{array}$$

A. $8\frac{6}{12}$

B. $8\frac{1}{2}$

C. $8\frac{6}{35}$

D. $8\frac{34}{35}$

20. Subtract and simplify:

$$\begin{array}{r} 6\frac{7}{9} \\ -\ 4\frac{2}{3} \\ \hline \end{array}$$

A. $2\frac{1}{9}$

B. $2\frac{5}{6}$

C. $2\frac{5}{9}$

D. $2\frac{9}{12}$

Part 2

21. Subtract and simplify:

$$\begin{array}{r} 7\frac{3}{5} \\ -\ 3\frac{1}{3} \\ \hline \end{array}$$

A. $4\frac{4}{15}$

B. $4\frac{2}{15}$

C. $4\frac{14}{15}$

D. $5\frac{9}{12}$

23. Multiply and simplify:

$$5 \times \frac{2}{3}$$

A. $3\frac{1}{3}$

B. $\frac{10}{15}$

C. $\frac{2}{15}$

D. $2\frac{1}{3}$

22. Simplify:

$$\frac{16}{5} =$$

A. $5\frac{1}{16}$

B. $3\frac{1}{16}$

C. $\frac{5}{16}$

D. $3\frac{1}{5}$

24. Find the missing term:

$$\frac{2}{5} = \frac{N}{15}$$

A. 10

B. 3

C. 30

D. 6

Part 2

25. Divide:

$$41\overline{)213.2}$$

A. 52

B. 5.3

C. 41.2

D. 5.2

27. Multiply and simplify:

$$\frac{3}{4} \times 5$$

A. 2

B. $\frac{3}{20}$

C. $\frac{15}{30}$

D. $3\frac{3}{4}$

26. Solve:

6% of 572 =

A. 3432

B. 33.62

C. 34.32

D. 25.32

28. Find the missing term:

$$\frac{N}{3} = \frac{8}{12}$$

A. 2

B. 24

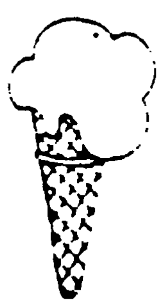
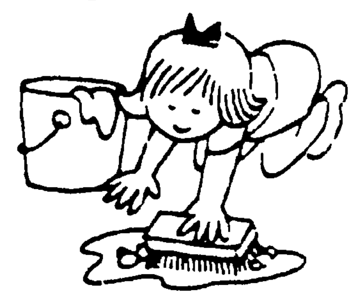
C. 4

D. 11

NAME: ______________________ SCHOOL ______________________

____

SAMPLES

A Eating ice cream cones	B Washing the floor
	
LIKE	LIKE
Not Sure or Don't Care	Not Sure or Don't Care
DISLIKE	DISLIKE

1. Learning what numbers mean

1,000 = one thousand
1,000,000 = one million

LIKE
Not Sure or Don't Care
DISLIKE

2. Finding words that have the same meaning

MARVELOUS

ROCKY WONDERFUL TINY

LIKE
Not Sure or Don't Care
DISLIKE

3. Adding numbers

$$\begin{array}{r} 29 \\ +\ 17 \\ \hline \end{array}$$

LIKE
Not Sure or Don't Care
DISLIKE

4. Telling which number comes next in the series

12 15 18 ?

LIKE
Not Sure or Don't Care
DISLIKE

5. Making words that sound alike

P<u>UFF</u> — T<u>OUGH</u>

L<u>EAVE</u> — REC<u>EIVE</u>

LIKE
Not Sure or Don't Care
DISLIKE

6. Multiplying big numbers

$$\begin{array}{r} 69753 \\ \times\ 726 \\ \hline \end{array}$$

LIKE
Not Sure or Don't Care
DISLIKE

7. Finding the missing number

$\square + 132 = 136$

$\square = ?$

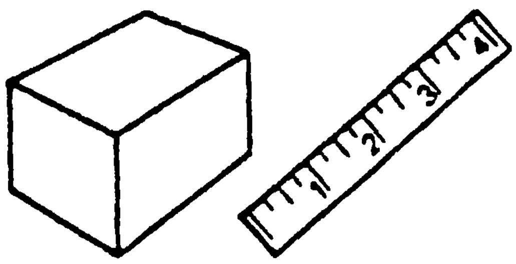
LIKE
Not Sure or Don't Care
DISLIKE

8. Doing hard subtraction problems

$$\begin{array}{r} 72145 \\ -\ 9897 \\ \hline \end{array}$$

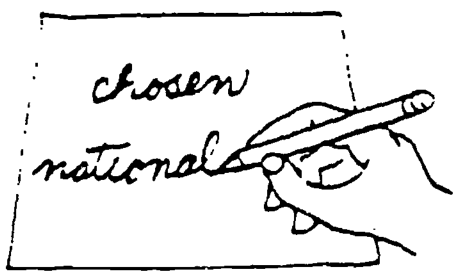
LIKE
Not Sure or Don't Care
DISLIKE

9. Measuring things



LIKE
Not Sure or Don't Care
DISLIKE

10. Learning to spell



LIKE
Not Sure or Don't Care
DISLIKE

11. Dividing numbers

$16 \div 4 =$

LIKE
Not Sure or Don't Care
DISLIKE

12. Solving word problems

A new basketball cost $4.50 plus 5% sales tax. How much does the basketball cost *including tax*?

LIKE
Not Sure or Don't Care
DISLIKE

13. Choosing a good word for a sentence

John is not sad
He is ______

LIKE
Not Sure or Don't Care
DISLIKE

14. Finding out about different kinds of numbers

$24_{FIVE} = 14_{TEN}$

X = 10
V = 5
XV = 15

LIKE
Not Sure or Don't Care
DISLIKE

15. Learning about fractions

$$\frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$$

LIKE
Not Sure or Don't Care
DISLIKE

16. Multiplying numbers in different ways

$$15 \times 3 = (10 + 5) \times 3$$
$$= (10 \times 3) + (5 \times 3)$$

LIKE
Not Sure or Don't Care
DISLIKE

17. Making up a title for a story

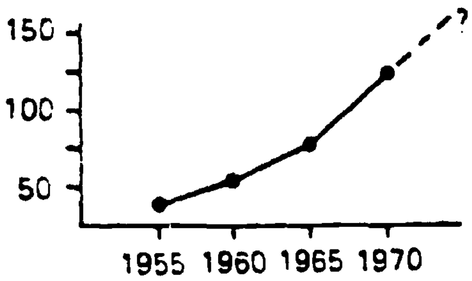
LIKE
Not Sure or Don't Care
DISLIKE

18. Learning about weights

1 kilogram = 2.2 lbs.
1 lb. = 16 oz.

LIKE
Not Sure or Don't Care
DISLIKE

19. Learning how to use charts



LIKE
Not Sure or Don't Care
DISLIKE

20. Working with sets

A = {○, □}   B = {○, ★, △}

LIKE
Not Sure or Don't Care
DISLIKE

LIKE
Not Sure or Don't Care
DISLIKE

LIKE
Not Sure or Don't Care
DISLIKE

LIKE
Not Sure or Don't Care
DISLIKE

LIKE
Not Sure or Don't Care
DISLIKE

Appendix D
Reliability Analysis of Measurement Instruments

Appendix D
Reliability Analysis of Measurement Instruments

Reliability Analysis for Attitude Scale

Number of Cases = 207
Number of Items = 15
Overall Coefficient Alpha = .83

	Corrected Item-Total Correlation	Coefficient Alpha if Item Deleted
Item 1	.46	.82
Item 3	.39	.83
Item 4	.38	.83
Item 6	.36	.83
Item 7	.44	.82
Item 8	.49	.82
Item 9	.42	.82
Item 11	.41	.82
Item 12	.46	.82
Item 14	.51	.82
Item 15	.53	.82
Item 16	.58	.81
Item 18	.57	.81
Item 19	.41	.82
Item 20	.43	.82

Reliability Analysis for Posttest

Number of Cases = 206
Number of Items = 52
Overall Coefficient Alpha = .93

	Corrected Item-Total Correlation	Coefficient Alpha if Item Deleted
Part 1		
Item 1	.22	.93
Item 2	.25	.93
Item 3	.41	.93
Item 4	.44	.93
Item 5	.49	.93
Item 6	.60	.92
Item 7	.53	.93
Item 8	.56	.93
Item 9	.26	.93
	Corrected	Coefficient

	Item-Total Correlation	Alpha if Item Deleted
Item 10	.46	.93
Item 11	.38	.93
Item 12	.49	.93
Item 13	.25	.93
Item 14	.59	.92
Item 15	.67	.92
Item 16	.41	.93
Item 17	.38	.93
Item 18	.55	.93
Item 19	.34	.93
Item 20	.37	.93
Item 21	.41	.93
Item 22	.31	.93
Item 23	.56	.93
Item 24	.40	.93
Part 2		
Item 1	.22	.93
Item 2	.15	.93
Item 3	.40	.93
Item 4	.38	.93
Item 5	.51	.93
Item 6	.53	.93
Item 7	.66	.92
Item 8	.58	.93
Item 9	.46	.93
Item 10	.43	.93
Item 11	.35	.93
Item 12	.17	.93
Item 13	.17	.93
Item 14	.27	.93
Item 15	.58	.93
Item 16	.61	.92
Item 17	.36	.93
Item 18	.34	.93
Item 19	.55	.93
Item 20	.51	.93
Item 21	.47	.93
Item 22	.52	.93
Item 23	.40	.93
Item 24	.42	.93
Item 25	.54	.93
Item 26	.32	.93
Item 27	.36	.93
Item 28	.38	.93

Reliability Analysis for Posttest Items on Whole Number Operations

Number of Cases = 206
Number of Items = 16
Overall Coefficient Alpha = .85

Part 1	Corrected Item-Total Correlation	Coefficient Alpha if Item Deleted
Item 1	.28	.85
Item 2	.34	.85
Item 3	.47	.84
Item 4	.46	.84
Item 5	.53	.84
Item 6	.60	.83
Item 7	.51	.84
Item 8	.55	.84
Part 2		
Item 1	.26	.85
Item 2	.27	.85
Item 3	.46	.84
Item 4	.49	.84
Item 5	.56	.84
Item 6	.51	.84
Item 7	.62	.83
Item 8	.46	.84

Reliability Analysis for Posttest Items on Decimal Operations

Number of Cases = 206
Number of Items = 15
Overall Coefficient Alpha = .70

Part 1	Corrected Item-Total Correlation	Coefficient Alpha if Item Deleted
Item 9	.22	.69
Item 10	.35	.67
Item 11	.31	.68
Item 12	.40	.67
Item 13	.22	.69
Item 21	.39	.67
Item 22	.27	.68
	Corrected	Coefficient

	Item-Total Correlation	Alpha if Item Deleted
Part 2		
Item 9	.38	.67
Item 10	.40	.67
Item 11	.29	.68
Item 12	.08	.71
Item 13	.17	.69
Item 14	.27	.69
Item 25	.43	.66
Item 26	.30	.68

Reliability Analysis on Posttest Items on Mixed Number Operations

Number of Cases = 206
Number of Items = 21
Overall Coefficient Alpha = .88

	Corrected Item-Total Correlation	Coefficient Alpha if Item Deleted
Part 1		
Item 14	.56	.87
Item 15	.65	.87
Item 16	.41	.88
Item 17	.36	.88
Item 18	.55	.87
Item 19	.38	.88
Item 20	.39	.88
Item 23	.60	.87
Item 24	.39	.88
Part 2		
Item 15	.55	.87
Item 16	.57	.87
Item 17	.34	.88
Item 18	.40	.88
Item 19	.61	.87
Item 20	.57	.87
Item 21	.49	.88
Item 22	.56	.87
Item 23	.43	.88
Item 24	.46	.88
Item 27	.41	.88
Item 28	.37	.83

Appendix E
Full Report of Interview Responses

Appendix E
Full Report of Interview Responses

The following are teacher responses compiled across the three interviews:

Interview One - Sept/Oct. (9 teachers)
Interview Two - Dec./Jan. (17 teachers)
Interview Three - June (17 teachers)

Teachers have been designated with letters to preserve anonymity.

PRETEST:

"A"
As of the second interview "A" said that she had not used these tests.

During the third interview she reported use of the Whole Numbers pretest as a needs assessment at the beginning of the year. She went on to say that her students "had trouble in Whole Numbers." She added some could not do subtraction and some could not add numbers if they were in a horizontal format." Therefore she didn't move on to any of the other pretests.

"B"
At the first interview "B" said that she didn't think the pretests were valuable, but she agreed to administer the Decimals pretest. As of the second interview, she said she had given the Whole Numbers and the Decimals pretests. The results were used to select the diagnostic evaluations.

By the final interview "B" used the Mixed Numbers pretest. She said the tests were given to the entire group and the results were used to select software programs. She discontinued use of these because the diagnostic test proved to be more valuable.

"C"
At the first and second interview "C" said she was too busy preparing for the MFMT to use the materials. She said she was skipping around the math curriculum to meet the needs of the school's test schedule.

As of the third interview she said she used the Number Concepts, Whole Numbers, Mixed Numbers, Decimals and Problem Solving pretests. She used them each time she "started a new unit to indicate where work was needed." At the end of the unit, "C" gave the posttest and gave both assessments back to students for comparison. She said she wanted the students to "see if they had made any of the same errors."She continued to use these tests to monitor student progress.

"D" (no interview #1)
At the time of the second interview she could not recall if she used any pretests.

During the third interview she reported that she used these tests but not on a regular basis early in the year. "D" prepared manipulations on her own and it would have been too much trouble for her to go downstairs and pull the materials each time she saw a problem.

[I think "D" was unsure of the purpose of the pretest. Also even though we gave each teacher a copy of the materials, they were stored in the computer lab downstairs]

"E"
"E" used the Whole Numbers and Number Concept pre-tests by the time of the second interview. She used the answer key to score them and the results determined which diagnostic tests to give. As of the third interview she used Mixed Numbers and Decimals pretests. The results were used in the same manner as stated above.

"F"
"F" gave the entire set of pre-tests at the beginning of the year as a baseline.

"G" (no int.#1)
As of the second interview she did not use the pretests. By the third interview she used the Whole Numbers, Mixed Numbers and the Decimals pretests. "G" said she used the answer key to score them.

"H"
"H" used the Whole Numbers and Number Concepts pretests. He scored them using the answer key. During the second interview he said his students were not ready to go any further. Yet, at the third interview he mentioned that he used the Problem Solving pretests. He didn't use these tests for other areas such as Decimals because of "class experience", he knew they would score low, so he used the text instead.

"I" (no int#1)
"I" used them early on with her students. She used the results to get an idea of where to begin instruction.

"J"
"J" reported using the Decimals pretest at the time of the first interview. She did not use any pre-tests since then because of the arrangement she and "I" had with their students. "J" only took the students to the computer lab.

After the first interview she stopped teaching math completely and only worked with them in the computer lab.

"K"
As of the second interview "K" used only the Decimals pretest. The results were used to select the diagnostic tests. He used the answer key to score it. By the third interview he used the Mixed Numbers test. "K" said he discontinued use of these tests for no particular reason.

"K" told us that the tests could be improved if the formatting was different and the print was made larger. The decimal points were too small and they blurred when reproduced.

"L"
As of the third interview "L" had used the Number Concepts pre-test only. She discontinued use of these tests because she said she already knew what domains and objectives to work on. The following teachers were not a part of the first interview:

"M"
"M" said she used the pre-tests based on the students need for work. The tests were used in conjunction with the students ability level within their math program with their regular math teacher. She gave the Decimals pretest using the scantron to score and the results to teach the students.

By the time of the third interview "M" had used the Number Concepts, Whole Numbers and the Mixed Numbers pretests. She continued to score the tests in the same way.

"N"
Gave the Whole Numbers pre-test at the beginning of the year. By the time of the third interview he gave the Number Concepts and Decimals pretests. The students answered the questions directly on the test so "N" could find out in which part they were falling down. He said that it was very helpful to have these tests a few weeks ago when he got a new student. He gave the student the tests and could find out right away where he needed to be.

"O"
By the second interview "O" had given the Whole Number and Decimal pretests. She is ready to do the Mixed Numbers one. As of the third interview she had given the Mixed Numbers, Number Concepts and Problem Solving tests. These were scored by using the scantron forms. However, she said her students had to hand in a separate sheet that showed the problems worked out, so they "wouldn't just guess at the answers."

"P" (THIRD INTERVIEW ONLY)
"P" gave these tests early on but not the second half of the year. The second semester she worked mostly on fractions/mixed numbers operations. She said the students needed everything.

She gave a total instruction approach so there was no need for these tests.

"Q" (THIRD INTERVIEW ONLY)
"Q" used these pretests at the beginning of the year only to prepare for the MFMT.

******

DIAGNOSTIC EVALUATION:

"A"
"A" did not use any diagnostic evaluations as of the second interview. By the time of the third interview she used the Number Concepts and Whole Numbers pretests. She gave the tests to assess "where they were" but did not use the task analyses part of the tests. She used the matrices initially to select software for students. Then she allowed the students to choose software based on the area they were working on in class. For example, if they were doing multiplication, the students would choose either Milliken or Multiplication Puzzles. Sometimes she made them do a harder program than they would select.

"B"
"B" used the diagnostic tests at the beginning of a new unit. She had used the Decimal and Whole Numbers at time of the first interview and she did not report use of any other ones by the second interview. "B" used the results to select software.

At the time of the third interview she used the Mixed Numbers pretest. The tests were given as group tests and were scored according to skill level and then used to correlate software from the matrix. She continued to use these tests because they were a quick way to see what else the students needed.

"C"
At the first interview "C" reported that she did use the diagnostic tests . She used Whole Numbers and Word Problems. They were duplicated and she scored them herself. During the second interview, she reported that she did not use these test regularly and she planned to start using them.

As of the third interview "C" reported using the Number Concepts, Mixed Numbers and Decimals diagnostic evaluations.

However, she ended up using these tests as worksheets and warm-ups which is not how they were intended to be used..[SEE MARY'S EXPLANATION OF THIS IN THE THIRD INTERVIEW]"

D" (no interview #1)
"D" worked with "G" at the beginning of the year and was not sure if it was given or not.

She gave the Mixed Number diagnostic evaluations only as a baseline. She then used these same tests for a comparison after teaching the material. She mentioned that she didn't include the scores in her grading. "D" corrected both tests without the answer key. She did not always take the answer key with her - as the materials were downstairs in the computer lab.

"E"
At the time of the first interview, "E" said the Number Concepts diagnostic evaluations were being copied for her use. She gave the students only the necessary diagnostic tests.

As of the final interview, "E" had used the Whole Numbers, Mixed Numbers and Decimals pretests. She used the results to see what the students already know and to identify the areas where the students needed work.

"F"
"F" never made use of these evaluations, she said the Pre-test was enough.

"G" (no interview #1)
As of the third interview, "G" used the Whole Number and the Decimals. She used the results as a needs assessment. She said that her students did very well on the tests and commented that she only used them "somewhat." "G" said that she charted all the information on her students early in the year and was able to come up with her own diagnostic materials. At one point in the interview she commented that all the materials were downstairs, in the computer lab and that was one reason why she just didn't get to more of them.

"H"
"H" gave the Whole Numbers diagnostic evaluation only. These were given because they were previously copied for him by the computer coordinator.

"I" (no interview #1)
As of the second interview, "I" did not use these tests. "I" was not interviewed again.

"J"
As of the time of the first interview, "J" had given the Decimals diagnostic evaluations. Results were used as a baseline. In subsequent interviews, "J" informed us that she no longer used any of the math materials, other that the software. "I" did all the math instruction and during "J"'s English period, she took the students to the computer room twice a week.

She would consult with "I" as to the level of the students and then would choose software accordingly.

"K"

"K" used the multiplication of Decimals and the Mixed Numbers diagnostic evaluations as of the third interview. He discontinued use of these tests, as with the pretests for no particular reason.

He used the software matrix and the software summaries to select the software for his students. He also used trial and error. "K" said that he concentrated on Whole Numbers, Decimals and fraction operations while in the lab. The Whole Numbers software was the most available. Often when they were working on Decimals and fractions, etc. they practiced with Whole Numbers on the computers. "K" said that not only is there more software in this

area, but also the apple computer does not run half of the software for the other domains.

"L"

As of the third interview, "L" used only the Number Concepts and Decimals diagnostic evaluations. She discontinued using these tests because she knew what areas to cover based on the Math teacher's discretion. She had to cover all areas in certain domains. She also mentioned that she had too many students, and to get so specific with each child was too much.

Instead, when she was covering fractions with her students, she went directly to the software that covered fractions.

"M" (no int. #1)

"M" reported using these evaluations in a variety of ways. She used the Number Concepts and Measurement evaluations as teaching tools since students had not been exposed to these things before and therefore a pretest would not be appropriate. She used the Mixed Number/Fraction diagnostic tests as continuing pre and post tests to keep on target with the fractions. It was a kind of a cycle where she had to keep checking to see if they were getting it.

"N" (no int. #1)

"N" gave all of the Whole Numbers, Number Concepts and Decimals diagnostic evaluations by the time of the final interview. He used the results to place students at appropriate levels. For each incorrect response, "N" marked the skill number by it to use r software selection from the matrix. He said he will really appreciate the revised materials that will have the skills noted next to each item on the test.

"O" (no int. #1)

"O" used only the Mixed Numbers Diagnostic Evaluations. She gave the tests to see where the students skills lied within the Mixed Numbers Operations domain. She did not use the other diagnostic

evaluations because the pre and posttests sufficient to her needs. The Milliken Math Sequences Courseware has a pre and post-test that correlates with the software.
"O" used the matrix to find the main categories of software needed. She then read the Software Summaries for those programs and finally she previewed disks to see if the software was appropriate.

Interviewed once for the third interview only:

"P"
"P" said she used these tests mainly as a way to pair kids and to get groupings. She matched the students in homogeneous pairs at first, then eventually led to a heterogeneous mix of groups matching them according to their behavior. This second approach worked best for her.

"Q"
"Q" used the diagnostic evaluations mid year to identify strengths and weaknesses for preparing the seventh graders for the CAT for next year.

******

DOMAIN DIRECTORY:

"A"
During the first interview, "A" said she used the vocabulary section in the appendix of the domain directory. By the final interview "A" had flipped through it glancing at the strategy, vocabulary, and common errors sections to get information about the area she was teaching.

"B"
"B" used the domain directory at the start of the year for the task analyses of the objectives. She said she stopped using it, because she didn't have a need for it.

"C"
"C" has been using the vocabulary section on an occasional basis. She has used the Strategies and Common Errors section at the beginning of a new uni

"D" (No int. #1)
"D" said she thumbed through it once looking at the sections that related to where her students need help. She has not referred to it since.

"E"
"E" used the Domain Directory occasionally throughout the year mostly for information about strategies and the task analysis.

"F"
"F" never looked at the Domain Directory. Her reason was lack of time.

"G" (no int. #1)
"G" reviewed the Domain Directory and during the second interview commented that she liked the way it was organized, but she did not use it and felt no need for it.

"H"
"H" never looked at the Domain Directory.

"I" (no int.#1)
"I" only looked at the Domain Directory one time.

"J"
"J" looked at the Domain Directory only once this year.

"K"
"K" used the Directory occasionally early in the year to get a feel for the model.

"L"
"L" used this part of the model at the beginning of the year to become acquainted with the project. She did not feel a need to continue using it.

THE FOLLOWING TEACHERS WERE NOT A PART OF INTERVIEW # 1

"M"
"M" used the Directory early in the year for various reasons. She used the strategy section when she needed to re-teach a concept to a student. She has also used the vocabulary section and sent a list home to parents so that they can help their children at home. She used the student progress sheet as well.

"N"
"N" reviewed the Domain Directory only at the start of the year. He used the student progress sheet all the time.

"O"
"O" used the Directory to get ideas for teaching beginning concepts in Number Concepts, Mixed Numbers and Whole Numbers. She used the vocabulary and strategy sections.

"P"
"P" said she used the Domain Directory twice in the second half of the school year to see the strategies for teaching Mixed Numbers Operations. She said it was very useful.

"Q"
"Q" used the Domain Directory occasionally for about a month when she was working with a group of five students who had a problem in one area. She wanted a strategy for adding and subtracting fractions that included borrowing, but the Domain Directory did not cover that.

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MATRIX:

"A"
"A" reported using the matrices at the first and third interviews but not at the second interview. She mentioned that the matrices were used to identify where the kids were already working.

[AGAIN, I THINK SHE WAS CONFUSED AS TO WHAT THE MATRIX SECTION WAS]

"B"
"B" used the matrices often and said that it was very helpful to have them.

"C"
When "C" started using computers in her lessons she told us that the computer aide helped her select software. By the final interview she was using the matrix at the beginning of a unit to make a list of available software.

"D" (no int. #1)
"D" did not use the matrices until midyear. At the second interview she said that "E" recently helped her use it for software selection. During the third interview she stated that she and the computer coordinator (director of the lab) looked at it together and he guided her as to whether software was appropriate or not.

"E"
"E" helped other teachers to understand and use the software matrices, but she rarely used them herself. She would tell the computer coordinator what her students were working on in class and he would select the software for her students to use.

"F"
The computer coordinator, who was in the lab with each class, selected software for "F"'s class as well.

"G"
"G" did not use the matrices until late in the year. Even then she said she used them occasionally because the computer coordinator did most of the software selection.

"H"
"H" did not use the matrices. He had the computer coordinator select all the software for him.

"I" (no int.#1)
"I" said that she became frustrated when she first started using these because they often didn't have the software that was suggested or the software did not run on the Apple II+. So she stopped using them and went directly to the box of software to select programs.

"J"
"J" did not use the matrices. She selected software by previewing it and she stayed with only a few programs the entire year.

"K"
"K" used these by mid year but he also became frustrated with them because the software listed was either not available or it did not run on the Apple II+. He would select software by seeing what was available in the box of programs and use the summaries to help with the review of them.

"L"
"L" did not use them either and went directly to the software for selection.

"M"(no int. #1)
"M" used the matrices regularly. She said she enjoyed the variety of software and putting the students on different disks. Her students also enjoyed working on something different than their neighbor.

"N"
"N" used the matrices to put the students on the next skill when they had completed one. He used them often.

"O"
"O" used the matrices occasionally. She duplicated them and put them in her planbook for a quick reference to the software that was available and related to the skills covered in class.

"P"
"P" said she used the matrices only once at the start of the school year.

"Q"
"Q" only used the matrices once this year when she was working with a small group of students who needed extra help in one area.

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SOFTWARE SUMMARIES:

"A"
"A" used these summaries often. She said they helped her to better explain a software program to her students. It was easier to answer students' questions about a program when she had read a summary.

"B"
"B" used the Software Summaries each time she needed a new program. She was particularly impressed with the Teacher Options section. She said it was easier to read about the options offered on a program rather then attempting to find out about them by "playing around" with the program. She read the Summaries and then told her students what to expect from a program. "B" mentioned that this process made it easier for the students to "catch on."

"C"
"C" referred to the Software Summaries often to get information about the appropriateness of a program for her students. She also read them to check on software that was selected for her class by the computer aide.

"D" (int. #1 only)
"D" said she used the Summaries early in the year to familiarize herself with software. As the year progressed she used the summaries less and began to work more with the computer coordinator. He helped her select software and she became more familiar with the MECC programs.

"E"
"E" rarely used the Software Summaries. She skimmed through them once but generally went to the software program and to the computer coordinator for software review.

"F"
"F" did not use the Summaries until the second half of the year. She said they were quicker to use, than previewing the software.

"G"
"G" only skimmed through the Summaries occasionally to become familiar with the software. She did not begin using these until the second half of the year.

"H"
"H" did not use the Summaries until the end of the school year. He used them to see what software is available for his daughter's use during the summer.

"I"(no int.#1 or #2)

"I" reviewed them once but did not continue to use them.

"J"
"J" used the Summaries early in the year but discontinued using them. She went directly to the programs for software selection.

"K"
"K" reported using them quite frequently. They provided him with the most information, so he would skip the matrices and go directly to the summaries.

"L"
"L" used the Software Summaries early in the year to become familiar with the software. She used them less as the year progressed and she became more familiar with the software.

"M" (no int. #1)
"M" said that she is already familiar with most of the software in the project and does not need the software summaries.

"N"
"N" said he used them frequently to get content information about software programs. He said he also appreciated the management options.

"O"
"O" did not report using the summaries until after the midyear interview. She then used them frequently to get an idea of what was on a disk for preplanning for her class. She said the summaries were helpful for determining what activities were appropriate for her students skill levels. "O" mentioned that all three sections of the summary were helpful. She used information in the Suggestions section, such as the vocabulary, to instruct students in the classroom before going to the computer lab.

"P"
"P" used the summaries to get more in depth information about software that she had general knowledge of. She used them when she was searching for software that handled unlike denominators. She also used the summaries to compare a program called Adventures With Fractions with Conquering Fractions and Fractions Concepts. She found that the strategies used in Conquering Fractions most resembled those used by the math teacher she worked with."Q""Q" did not use the Software Summaries because she felt familiar with the project software already.

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SKILL SHEETS:

"A"

"A" didn't begin using the Skill Sheets until after the time of the second interview. Once she began using them, it was quite frequent. She used them as quick quizzes and she sometimes taught from them.

"B"
Used the Skill Sheets as warm-ups in the classroom before going to the computer lab.

"C"
Used the Skill Sheets consistently through the year for warm-ups and quick post computer evaluations to measure the students progress.

"D" (int. #1 only)
"D" used the Skill Sheets in the classroom and the computer lab. In class the students worked with them for twenty minutes before going to the computer lab for the remainder of the mod. In the computer lab the Skill Sheets were used with small groups on tables in the back of the lab while other groups of students were at the computer.

"E"
"E" did not begin using the Skill Sheets until midyear, after the time of the second interview. She used them as they were intended to be used: as quick quizzes after the computer work, to see if her students were ready to move onto the next skill area.

"F"
"F" used them occasionally in class as warm-ups.

"G"
"G" did not use them because she felt they were not enough of a challenge for her students

"H"
"H" said he "used the heck out of them." He used them for classwork and homework. They were used as warm-ups and worksheets. He even added problems to the back of them increasing the number of problems from five to often twenty. They were never used as quick quizzes.

"I"(no int.#1)
"I" used the Skill Sheets as practice sheets for class and homework.

"J"
"J" discontinued use of the skill sheets because her involvement with her students was limited to the computer lab only. She did not provide any other math instruction.

"K"

"K" used the Skill Sheets consistently as they were intended to be used, as quick quizzes to evaluate transfer from computer work to paper and pencil. He also used them as warm-ups in class.

"L"
"L" used the Skill Sheets mainly for class and homework. She evaluated her students' performance by using the evaluations developed by the math teacher she worked with.

"M"(no int. #1)
"M" used the Skill Sheets as warm-ups and quick reviews. She used them to teach from in class when a student was having trouble with a skill.

"N"
"N" said he used the project Skill Sheets occasionally. He mostly used the worksheets provided by the Milliken software that his students practiced with, because they directly matched the software.

"O"
"O" used the Skill Sheets quite often for a variety of activities. They were used as timed activities, pop-quizzes, warm-ups and classwork.

"P"
"P" said she used the Skill Sheets occasionally on every third visit to the computer lab as a quick quiz after using the software "to see if there was a screen to paper transition." She said the students see them and see the connection to what they are doing in class.

"Q"
"Q" used the Skill Sheets often all year as homework and classwork.

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SOFTWARE:

"A"
"A" recalled using the following software programs throughout year: Number Munchers, Speedway Math, Clockworks, Arithmetic Critters, Fraction Munchers, Multiplication Puzzles and Conquering Whole Numbers by MECC and Milliken Math Sequences. The three programs that helped her students most this year were: 1) Number Munchers, because of the variety of ways to do basic math; 2) Multiplication Puzzles, because it helped to teach the students and reinforce their skills and 3) The Market Place because the students who used this had to "think and make decisions. They had to be shrewd business people."

"B"
"B" used software for each domain that she covered this year. She used the following software programs this year. Number Munchers, Speedway Math, Subtraction puzzles, The Market Place and Fraction Munchers by Mecc, and Milliken Math Sequences. The three software programs that "B" said were most useful to her this year were: 1) Challenge Math which was not on the project's list. This program apparently had a game-like format that forced the students to think about the problems that they were attempting to solve; 2) Space Subtraction and Subtraction Puzzles, because the students enjoyed them; and 3) Fraction Munchers, because she saw a carry over to the same problems that this program offered to similar tasks on paper and pencil

"C"
"C" listed the following software that she used this year: Milliken Math Sequences and Word Math, Mecc's: Number Munchers and Speedway Math and Mindscape's Microcomputer Workshop. The three software programs that she believed helped her students the most this year were: 1) Number Munchers, because it reinforces previous learning; 2) Fraction Concepts, because it takes the student through the different levels of fractions and 3) Challenge Math, which was not on our list of project software, because it has all types of problems and the students really liked it.

"D" (int. #1 only)
"D" said that Conquering Whole Numbers by Mecc was the most helpful software program used by her students this year. Additionally, she mentioned Mecc's Number Munchers and Fraction Munchers as programs that gave practice in factors and multiples plus were enjoyed by the students.

"E"
"E" said she used software for each of the domains that she covered in math this year (See Pretests). The software programs that helped her students most this year were Conquering Whole Numbers and Number Munchers by Mecc.

"F"
"F" reported that software was used for each domain that she covered this year. The program that was used the most during the first half of the year was Conquering Whole Numbers by Mecc. She said that this program eventually became "work" for them, so she used other programs to cover basic skills. The three software programs that she believed helped her students the most this year were: 1) Number Munchers, because it helped the kids with multiplication facts yet has a game-like format enjoyed most by the students; 2) Speedway Math and 3) Market Place were two other programs that "F" said were helpful.

"G"
"G" said that software was used in every domain covered this year except Percents. She could only recall the program Conquering Whole Numbers as the one used by her students. She said the computer coordinator would know about other programs that her students worked with.

"H"
"H" said that software was used in the Whole Numbers, Word Problems and Decimals domains. He said his students used the program Conquering Whole Numbers most of the time but the computer coordinator could name other programs used by his students.

"I" (no int.#1 or #3)

"I" used various Mecc software programs in the areas of Whole Numbers and Decimals.

"J"
"J" did not begin using software until after the first interview. The programs that she used initially with her students were: Conquering Whole Numbers, Multiplication Puzzles and Speedway Math. Further along into the year she began using simulation software with her students in small groups. The Market Place by Mecc, suggested by our project was one. Two other programs Oregon Trails and ODeer! were non-math software, but "J" considered them to be valuable because they required higher order problem solving. She said her students really enjoyed these programs.

"K"
By the time of the second interview "K" had just begun using software with his students. Software was used for each of the domains that he covered this year but not so much for the Fractions/Mixed Number Operations domain due to the incompatibility of software to hardware. (Much of the designated software did not run on the Apple II+ computer.) He listed many software programs that he used with his students this year and by the second interview he was already using: Conquering Whole Numbers, Speedway Math, Multiplication Puzzles, Decimal Concepts and The MarketPlace by Mecc. He also used Mindscape's Microcomputer Workshops Courseware. "K" ranked three software programs that were the most useful to his students this year: 1) Multiplication Puzzles; 2) Number Munchers and 3) Conquering Whole Numbers.

"L"
"L" used software as much as possible for each domain that was covered in math class this year. However, there were three domains, Number Concepts, Measurement and Using Data where the

software was either inappropriate or not available for the students. During two of the interviews "L" expressed a desire for a larger variety of software. For example she wanted programs that presented graphs with pre-existing information for the students to manipulate. She listed the following software as programs used this year: Number Munchers, Speedway Math, Conquering Whole Numbers, Decimal Concepts, Multiplication Puzzles and Quotient Quest. "L" never mentioned the top three software programs that were most helpful to her students.

"M" (no int. #1)
"M" used software for each math domain addressed this year. She used a variety of programs that included: Milliken's Math Sequences, Mecc's Study Guide, Quickflash, Multiplication Puzzles, Quotient Quest, Conquering Whole Numbers and Speedway Math. The three programs that were most helpful to her students were: 1) Milliken Math Series, 2) Mindscape's Microcomputer Workshops and 3) Mecc's Conquering Fractions, all because they operated in small steps.

"N"
"N" used many software programs for each of the domains that he addressed this year. He additionally used the program Clockworks by Mecc even though he didn't teach the domain that lists this program. He intended to use a program named Moneyworks but it did not run on the Apple II+ computers that were available to him. He used the program The Market Place as a reward for his students who had the appropriate reading ability. Other programs listed by "N" were: Milliken's Math Sequences, Mecc's Space Subtraction, Addition Logician, Multiplication Puzzles, Quotient Quest and Arithmetic Critters. "N" named two programs that were most useful to his students this year. The first one is Milliken's Math Sequences. He said this series deals with borrowing and carry over. "It tells them exactly when to do the borrowing." In class when they would do similar problems and forget what to do, "N" would tell them to"remember how the computer does it" and then they would remember. The strategy that "N" used to teach addition of decimals was the same as Milliken's strategy, so again his students benefitted from consistency of instruction. The second program is Mindscape's Microcomputer Workshop. He specifically told us that he appreciated the remedial feedback of this program. If a student responded incorrectly twice, the program graphically highlighted the numbers to be dealt with by enclosing them in a box. He said often the students would press the Return key twice just to get to this part.

"O"
"O" said that software was used in each of the domains that she covered this year. She used the following programs: Milliken Math Sequences, Mecc's Adventures with Fractions, Fraction Practice Unlimited, Fraction Munchers and Conquering Fractions.

The programs that she felt were most valuable for her students were Milliken Math Sequences because they were ordered sequentially and Mindscape's Microcomputer Workshop because of the way it presented fractions.

"P"
"P" said she used software to reinforce skills in the Whole Numbers and Mixed Number Operations domain. Even though the math teacher she worked with covered other domains, "P" reported that their students needed constant reinforcement in these areas. The three programs that helped her students the most this year were Conquering Fractions, because the presentation was similar to one used in the text, Conquering Whole Numbers and Number Munchers because they were very motivational and achievement oriented programs.

"Q"
"Q" used software all year with her students. She particularly enjoyed a program called Mecc Graph which she used for math, science and social studies classes. She said the students had to plot points in science using the x and y axis and social studies they had to learn longitude and latitude. "Q" used Mecc graph to show her students the similarities and her students were thrilled to figure out that the same kind of process would work in several of their classes. The math software that "Q" believed helped her students most this year were: 1) Milliken Math Sequences, because cf the gradual approach; 2) Fraction Munchers, because of the game-like approach to covering basic fraction skills and 3) Speedway Math, because it was a good reinforcement of skills before moving ahead.

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MISCELLANEOUS MATERIALS:

"A"
Did not use these materials.

"B"
Did not use these materials.

"C"
Did not use these

"D" (int. #1 only)
Did not use these.

"E"
Did not use them

"F"
Did not use them

"G"
Did not use them. Were not challenging enough for her students.

"H"
Did not use these materials.

"I"(no int.#1)
Did not use these.

"J"
Did not use these

"K"
Used them but was not pleased with them. [he basically used them because we asked him to give us feedback on them]

"L"
Did not use them.

"M"(no int. #1)
Did not use them

"N"
Did not use them.

"O"
Did not use them.

GENERAL EVALUATION

Question 1:
"What changes have occurred in your method and approaches toward teaching math, since becoming part of the Middle School Math Project?"

Question 2:
"Have the students benefitted from this project? Do you think they learned more?"

Question 3:
"Rate your level of comfort (on a scale of 1 = very uncomfortable to 5 = very comfortable) with using computers in teaching before becoming a part of the Middle School Math Project and what changes have occurred in your attitudes and approaches toward using computers, since becoming part of Project?"

Question 4
"In the coming school year, how do you perceive yourself using computers and the Instructional Model without the requirement of data collection and a `three times a week' minimum of computer time for students?"

Question 5

"Name one positive event that has happened since the implementation of this model in your school."

TEACHER RESPONSES

"A"

1. Teacher "A" taught more from our project materials than from a textbook. In fact, she has not been able to find a suitable textbook for her students.

2. She said the students have benefitted tremendously. She also believes they learned more. One student, could not count and now he can do so and tell time (she believes) from using Clockworks.

3. She rated herself a 3 at the beginning and now is a 5. She enjoys using the computers and wishes the project had more programs in other content areas - especially science.

4. She feels that she will use the program including the computers in much the same way next year as she has this year.

5. Positive event: The students want to use computers to learn rather than just to play games. She overheard a student say to another student, "We come here (the lab) to learn, not just to play games." She also mentioned that students do see the correlation between the work they do in the class and on the computer.

"B"

1. Teacher "B" has used the computer more.

2. "Yes, students have benefitted and learned more. They have also become computer literate." She alluded to something about the SPED kids not being able to use computers in high school because they don't know how to operate them. "Their math has improved and they have been forced by the computer to memorize their multiplication facts."

3. Her comfort level went from a level 1 to a 5 and she said she wants more computers and wants to have one in her classroom.

4. In the coming year, she sees herself continuing to use the math. She would like to expand to another subject area and also to have her students learn word processing so they could use the computer to write reports.

5. One positive event: "The students have gained self

confidence in using the computer and their math knowledge has increased."

"C"

1. Teacher "C" said that the project has made her aware of the sequence one has to follow in teaching math. The software forces the student to do a problem in a particular way so you can let the students know that there are other ways of getting an answer. They understand that when working on the computer, they must do it the way the computer is programmed.

2. The students have benefited from the project. "The computer gives them a different avenue for doing math. Most kids enjoy math or want to enjoy it and they do enjoy it with the computer."

3. Level of computer comfort before the project, was a 1. After the project, a 3. Teacher "C" responded that she is no longer afraid of the computer. When something goes wrong, she realizes it is not necessarily because she did something wrong. It may be that the disk is not working.

4. She will use the computers with students next year if the time can be allotted.

5. One positive event: The children look forward to the computer lab for math - not just for games. They also can see a correlation when using other math software with programs they the project and they will tell her that "we could have used this disk when we were doing such and such."

"D"

1. The dominant change that occurred in her was the knowledge that she can "use the computer room for practical application and math practice." Also knowing that she had some other option for teaching made a difference.

2. Yes the students have benefitted from this project. If nothing else, they saw that what was on the blackboard and paper in class is also in computer technology. For some reason that amazed them. Perhaps they are so used to arcade type games that "educational" games were not in their expectations.

3. "D" rated her level of comfort with using computers since becoming a part of our project at 3. She is now very comfortable with using computers and sees the potential for it's uses.

4. Next year she would like to have the same schedule as this year if time allows. At least twice a week.

5. One positive event: "Students have become more interested in

math and look forward to using the computers."

"E"

1. "E" said that she has not done anything different except incorporate the materials into what she usually does.

2. She believes the students have benefited and learned more.

3. Level of comfort with using computers before the math project was a 1. "E" is now comfortable with using computers in teaching and plans to use them in other subject areas in the future.

4. In the coming school year "E" will try to use the computers same as this year if time allows.

5. Positive event: The computers helped a borderline student "like" math more.

Information on Teacher "F" not available.

"G"

1. "G" reported no changes in methods and approaches toward teaching mat .

2. She said yes the students benefitted from this project, because of the "motivational, one-on-one, step by step approach" it uses.

3. Her level of comfort with computers before the project was a 4 and it has remained as such.

4. Information not available.

5. Information not available.

"H"

1. "H" said that it was unusual for him to have a group of students such as the class he had this year. He spent all year on three domains due to their level of ability and attitudes. He altered his method and approaches but these changes were not related to the project.

2. "H" reported that students have benefited and learned more as a result of this project.

3. He rated his level of comfort with computers before becoming a part of this project at a 1. His attitude toward using computers changed greatly. He said he "loves them" and he's looking forward to branching into English and Reading next year.

4. He intends to use the computers as much as possible in all areas next year.

5. "H" said the positive thing that has happened as a result of this model is that the students are more enthusiastic on "lab" days then when they are in class.

Information on Teacher "I" not available.

"J"

1. Teacher "J" doesn't teach math. She works with a co-teacher's students only when they use the computers.

2. Her response was "yes absolutely", the students benefited from using this project.

3. "J" gave herself a comfort rating of 3 since becoming a part of this project. She reported no changes in her attitude toward using computers.

4. Next year she hopes to bring the students in the lab three times a week. She hopes to use the computers for reading and if she teaches math, she plans to use the entire model.

5. Positive Events: "J" had a student from Cambodia who had no skills in early math, he was excited and motivated to learn on the computer. She had two non-readers in her group and they loved Oregon Trails, there's a lot of reading in that program and the non-readers allowed the others to help them with the text on the screen without feeling embarrassed

"K"

1. Teacher "K" said he was able to individualize more, since the project required computer use and their school had such a small computer lab. He was forced to put his students in smaller groups and spent more time on specific skills than usual. He was more independent [than when he stayed in the classroom with the math teacher] and able to stay with a concept for longer periods of time.

2. He said his students benefited from this project. His students were highly motivated and because of the computers, the incentive for them to be in math was there. The math teacher believes that students showed for class on days that they were scheduled to use the lab.

3. "K" gave himself a high rating because he was always comfortable with computers. He has one at home that he uses

quite a bit. He hasn't had the opportunity to use computers with students until this project. He said he is now more familiar with how they are used during instruction. He has more ideas for integrating now.

4. He plans to use the computer in the same way next year if possible. He feels it's important to be consistent, and hopes to use them three times a week.

5. Positive Event: He noticed that his special education students had a positive attitude towards learning math.

"L"

1. Teacher "L" reported that using the computers <u>is</u> the change in her approach.

2. She feels the students have "definitely" benefited from this project, "it enhances their math skills using a different medium. The skills are presented in a different way and the students are forced to follow directions."

3. Her level of comfort with using computers has always been very comfortable. She also said that no changes occurred in her attitude toward using computers in teaching because she always felt positive about them.

4. Teacher "L" said that she perceived herself using the computers and the model next year. She would like to individualize her students program more and most of that depends on re-arranging the schedule. She said she had too many students this year at one time and at the very last mod of the day.

5. Positive event: Her students are computer literate now, they "process information better, their skills have improved, and they transfer skills more easily."

"M"

1. Teacher "M" reported " I individualize more and have become more aware of specific skills and concepts that kids lack." She said that she had a better idea of "the way students process information"--learning styles.

2. She responded "yes, the students have benefited." They have gained self esteem and confidence in being able to learn. They teach each other. They have not necessarily learned more math but they have learned more about themselves. "They are not as afraid to learn new things because they are not afraid of making mistakes. Therefore there is less fear in learning new concepts."

3. Teacher "M" has gone from a 2 to a 5 in computer comfort level. She said she has become more fluent in using the computer.

4. She used the computers this past year in spurts as the need arose, especially in the beginning for basic skills. Then when they were covering fractions, she took the students everyday even for as short a time as fifteen minutes on certain days.

5. The one positive event that has happened to her students is that they have increased in maturation of social skills. They help each other. She feels this has been extremely important for her students since they need these social skills in high school very badly in order to "make it" in the high school system.

"N"

1. Teacher "N" has become more individualized in his instruction, more systematic by using the pretests and diagnostic tests. He uses his instructional time better because he knows what skills have been mastered.

2. He believes the students have benefited. He doesn't feel they have learned more since he is sure that everything he taught them has been given to them before. However, he does feel that they have "retained" more.

3. He says he has gone from a 3 to a 4 in comfort level with the computer. He would, however, like to have the time to do more with the computer and be able to go in and change options for the students.

4. His students used the computers for two mods at a time (84 minutes) twice a week on a regular basis all year. He would like to continue this type of schedule.

5. One positive event from this is that the skill level for each student has become more concrete. "At the beginning of the year, when you read student records, it is very difficult to determine where they really are." He has used the task analysis to write skill levels for his students' IEPs.

"O"

1. Teacher "O" said that the computer has been incorporated into the curriculum. It has become part of the weekly lesson. It is also used as a motivator often to get the students to behave. She said the students really like the computers.

2. The students have certainly benefited from using the computers. She sees a marked improvement in the math area on the Woodcock Johnson. The students are more independent in doing

classwork because they have learned the step-by-step procedure and it has carried over into the classroom. She uses the same approach in teaching as is used in a particular computer program.

3. Teacher "O" has gone from a "0" to a "5". She always liked the idea of computers and her experience has reinforced this. She has a very positive attitude towards computers.

4. This past year her students have been divided into four groups and one group goes to the computer lab everyday for two mods (84 minutes).

5. She has seen growth in the math area as indicated on tests and through observations. The students have incentive to do well in class.

"P"

1. Teacher "P" said she's more "analytical", due to the task analysis provided in the model. She said "the computers helped me to see exactly where the students were having a problem because of the immediate feedback [of the software]. During paper and pencil classwork, teachers often miss the errors."

2. She believes the students have benefitted and are much more motivated to get it right when problems are presented on the computer, "something about them being up on the screen vs. the paper."

3. Her comfort level rating was a 1. She said she was fearful, and uncomfortable, but now after being trained by the project and taught how to "teach" with computers she said she learned a great deal about teaching even without computers. Based on the training on using computers, and how to use the materials and software, (especially on how to modify software with the teachers options) teacher "P" became so comfortable with them. The teacher management is easy to use and she said she would modify the software right with the students at the computer. For the students, she said "they feel special." Teacher "P" would tell them "Special just for you" when she modified the disks. The software responds right to the students individual needs. Some students figured out her set up and commented on the difficulty levels she set for them, for ex. "You didn't set this up right, this is too easy."

4. Teacher "P" will be teaching a self contained class next year and plans to use the model as her math curriculum.

5. Positive Event: Kids have a "hands on" to math and it is excitable and enjoyable for them.

"Q"

1. Math has always been her favorite subject and she sets out to convince her students that it will be their favorite subject too! Teacher "Q" said by the end of the year it does become their favorite. This year she used software to help with a concept when she ran into difficult times. Technology helps. Instead of doing things manually, she uses technology for "remediation."

2. She said yes, the students have benefited. They are enthusiastic, motivated and they ask for software when running into problems in other classes.

3. Teacher "Q" was always comfortable with computers but not so much so in math until the project. She became aware of the materials available for Math and then for other areas as a result of the project. She gave herself a comfort rating of 3.

4. In the coming year, "Q" plans to continue using the materials as she has this year.

5. Positive Event: Students are asking for help! "Kids are more aware of when they need help. Before they didn't even know where they were lacking. Now they say `I'm having problems in this, can I work on the computer and get some practice?'"

"R"

1. Teacher "R" said that this program is so new and different.

2. He said he believed that the students benefited, "absolutely".

3. His level of comfort before this project was a 1. He was completely new to computers. He said he feels very comfortable with them now and sees the potential for their use in all areas of the curriculum.

4. He sees them being used as much as physically possible with all the kids in the school next year.

5. Positive event: Generally the teachers have become more computer literate and so the entire school has benefited by integration of computers into the math curriculum.