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AUTHOR Su, Hui Fang Huang
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ABSTRACT

The purpose of this practicum was to increase motivation and self-confidence of grade four students in mathematics achievement. Measured were the increase in the number of students displaying mastery of the times-tables, increase in the number of students making a gain on a math post-test, and increase in the number of students liking mathematics. Administered to the students were a math attitude questionnaire and a math pretest on basic math skills to determine the students' attitude toward math and to determine the students' performance level. Mental Math activities, math games design contests, in-class competitions, grade level competition, computer, calculators, systematic reviews, student-teacher interaction, and projects were used to help increase students' interest and to increase math achievement. This study includes the following chapters: (1) "Introduction"; (2) "Study of the Problem"; (3) "Anticipated Outcomes and Evaluation Instruments"; (4) "Solution Strategy"; and (5) "Results, Conclusions and Recommendations". Appended are copies of the math attitude questionnaire, the math pretest, the teacher evaluation instrument, and the student times-table performance record. (Author/KR)

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INCREASING FOURTH GRADE MATH ACHIEVEMENT WITH IMPROVED INSTRUCTIONAL STRATEGIES

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Cluster #30

A Practicum II Report presented to the Ed.D. Program in Early and Middle Childhood in Partial Fulfillment of the Requirements for the Degree of Doctor of Education

NOVA UNIVERSITY

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ABSTRACT

Increasing Fourth Grade Math Achievement with Improved Instructional Strategies. Su, Hui Fang Huang, 1990: Practicum Report, Nova University, Ed.D. Program in Early and Middle Childhood.
Descriptors: Mental Math/Problem Solving/Word Problems/Math Games/Competitions/Math Anxiety/Computers/Calculators/ Manipulatives/Projects/Systematic Review/Elementary Mathematics/Problems/Team Work/Multiplication/Patterns/ Self-confidence/Motivation/Surveys/Questionnaires/Activities/ Software/Community Resources/Basic Skills/Minority/Fourth Grade/Student-Teacher Communication/Student Attitude

The writer designed and implemented a math program to increase motivation and self-confidence of fourth grade students in math achievement. The writer's objectives were to increase the number of students displaying mastery of the times-tables, increase the number of students making a gain on a math post-test, and increase the number of students liking mathematics.

The writer administered math attitude questionnaires, and math pretests on basic math skills to determine the students' attitude toward math and to determine the students' performance level. Mental Math activities, math games design contests, in-class competitions, grade level competition, computers, calculators, systematic reviews, student-teacher interaction, and projects were used to help increase students' interest and to increase fourth grade math achievement.

The results of the practicum were positive. Analysis of the data revealed that with the appropriate teacher effort, students would be motivated and have confidence in mathematics. The results indicated that the use of Mental Math activities, competitions, calculators, computers, systematic review, math games, and game designs helped build students' self-confidence, motivate students to learn math, improve their test scores, and change the students' attitude toward mathematics.

PRACTICUM APPROVAL SHEET

This practicum took place as described.

Verifier: Judith Kurzawski

Ms. Judith Kurzawski

Principal
Title

400 S.W. 10th St., Delray Beach, FL. 33444
Address

June 11, 1990
Date

This practicum report was submitted by Hui Fang Huang Su under the direction of the advisor listed below. It was submitted to the Ed.D. Program in Early and Middle Childhood and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Nova University.

Approved:

July 9, 1990
Date of Final Approval of Report

Muriel L. Lundy
Dr. Muriel L. Lundy, Advisor

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CHAPTER I

INTRODUCTION

Description of Work Setting and Community

The setting for the writer's proposal was an inner-city school located in a low socio-economic neighborhood. The school had a professional staff of forty-four regular and support program teachers, twenty-four paraprofessionals, and two administrators. Seven hundred thirty students were enrolled in kindergarten through fifth grade. The entire student population of the school consisted of Black, Haitian, Hispanic, Asian, and White. However, Black Americans made up the major portion of the school's students.

On each grade level there were four to six different classes. Fourth grade was comprised of five separate self-contained classes. The District's Unified Curriculum served as the basis for instruction in communication skills, mathematics, science, art, music, physical education, and computer literacy. The school had programs that met the needs of exceptional students, such as: Speech Therapy, Specific Learning Disabilities, English For Speakers of Other Languages (ESOL), Potentially Gifted (SOI), and Chapter I All Day Basic Skills. The students in the school walked, were bused, or were driven to and from school each day. Students in one of the fourth grade classes (the special enrichment class) were bused from six of the school district's south area neighboring schools.

Based on the parent information sheet, the majority of the parents of the fourth grade students held non-professional jobs that paid minimum wages. At least 75% of the students were on the school's free or reduced lunch program. Many parents in the school depended on welfare for their daily survival. Many children also resided in a single parent environment.

There were 104 students enrolled in the fourth grade. The fourth grade was comprised of four regular fourth grade classes, with approximately twenty three students in each class, and one special enrichment class limited to sixteen children. These children had been recommended by their third grade teachers, and selected by the program teacher based on observation, their scores on the Structure of the Intellect Test of Learning Abilities, their group I.Q. test scores, and SAT results.

Writer's Work Setting and Role

The writer taught the Potentially Gifted Minority Student fourth grade special enrichment class. This program was for minority children with above average academic abilities. Upon the recommendations of the student's third grade teacher, based on previous academic performance, and teacher observation, a student was tested for this program by the writer, using The Structure of the Intellect Test of Learning Abilities. To qualify for the program, the student

needed to score above sixth grade level in five out of nine areas of the Learning Abilities Test. The class was limited to sixteen children who would enter fourth grade in the upcoming school year. The ratio of children per teacher in this special program was sixteen children to one teacher and one full-time aide.

The year of the practicum, the writer's class consisted of eight Hispanic children whose native language is Spanish, seven Black Americans whose native language is English, and one Asian whose native language is Vietnamese.

The major responsibilities of the writer for this class were: selecting candidates and providing regular fourth grade instruction as well as enrichment designed to further develop the students' creative talents and intellectual abilities and help them reach their true potential.

The writer managed the school's computer lab, serving as a resource person for the teachers and staff. At the time of the study, the computer lab housed fifteen IBM System 2 computers and one IBM AT computer that served as the master unit to the fifteen networked computers.

The writer also served as the school's math coordinator to help develop and reinforce creative math activities in order to improve the school's math curriculum.

CHAPTER II

STUDY OF THE PROBLEM

Problem Description

The writer believes that studying mathematics should be a happy experience. Every child has a natural ability to learn joyfully, and joyful learning creates confidence and self-respect.

The problem faced in the school was the lack of motivation and self-confidence of fourth grade students in math achievement. The writer wanted to change the attitude of students toward math, and improve it by constant teacher encouragement. The majority of students, as observed by the writer, were intimidated by the word 'math.' The following were just a few examples of students' lack of motivation and self-confidence in math achievement.

1. The majority of students in the fourth grade did not know and did not care if they did not know their times tables. Although teachers had tried different strategies in the past to increase fourth grade math achievement, no apparent results had been evidenced.

2. Students in the fourth grade, as observed by the writer, did not feel bad after failing a math pretest at the beginning of the school year. Not one student in the writer's school requested to have a second chance after doing poorly on the math pretest.

3. The majority of students indicated on an attitude

questionnaire at the beginning of the school year, that they did not like math.

The writer feels that one of the reasons why the problem of lack of motivation and self-confidence in math achievement has not been solved up to this point is that teachers give up too quickly. When the method employed fails they quickly switch to something else rather than revise the method. Maintaining the same strategy will not only reinforce concepts previously taught, but also will help the teacher to familiarize him/herself with math concepts.

Problem Documentation

Based on teacher observations, the math attitude questionnaire, and pretest scores on multiplication, division, and word problems, the writer concluded that the problem of lack of motivation and self-confidence of fourth grade students in math achievement did exist.

The students were given the attitude questionnaire (see Appendix A) at the beginning of this school year. Eighty-eight out of one hundred and four students identified math as a subject they 'dislike' or 'sometimes like.' When asked to answer "Math would be more fun for me if I could . . .," many wrote: "Do more of it," or "Do more fun games." The most interesting response to "What I like least about math . . ." was "the teacher." The students were also given a math pretest (see Appendix B) on third grade level skills. After

reviewing the pretest scores for the fourth grade, the writer noted that eighty-five out of one hundred and four students in the fourth grade scored forty percent or lower. Conferences with all the fourth grade teachers indicated that at least eight out of one hundred and four students did not know their times tables, therefore could not do the simplest multiplications, not to mention division.

Causative Analysis

The writer made every effort to find out why the problem of lack of motivation and self-confidence of fourth grade students in math achievement existed in the school. This was done by talking to the students in the writer's class during a morning discussion in our math period. Some of the questions asked were:

"What would happen if there were no math in the world?"

"If you were a teacher, how would you teach math?"

"If you got a low grade on a math test how would you feel? How would your parents feel?"

"When you need to ask questions during math, do you think that your questions might be dumb?"

"Do your parents or teachers help you with math when you need help?"

"How do you feel about a child who is good in math?"

The writer was pleasantly surprised by the eagerness of the students to respond to these questions. It would be

impossible for the writer to list all the responses. Instead, the writer selected some responses that assisted in determining the cause of the problem. The following is a list of some of the responses:

"My parents and teacher do not care what grades I get on math tests."

"Every time I ask a question in math, all my classmates laugh at me."

"If I were a math teacher, I would make sure that we have fun in math."

"If there were no math in the world, then we would never have to do those boring worksheets."

"The reason that anybody is good in math is because he/she is smart."

"My teacher never expected me to do well in math."

From the students' input, the writer concluded that the following were the contributing factors to the problem of lack of motivation and self-confidence of fourth grade students in math achievement:

1. Low teacher expectation - Teachers are easily satisfied with whatever progress is made by the students, especially by low-ability students. They tend to focus more on above average, gifted, and talented students. Teachers expect these students to perform better than the rest of the students.

2. Lack of assistance at home and at school - There are times when students are stumped by problems, the teacher in

the classroom is preoccupied, and the parents are not knowledgeable enough to assist them. In situations like these, the confusion will remain with the students and hamper the learning of any new math concepts

3. Math activities are not challenging or interesting to the students - So far, greater stress has been placed on practical experiences and thinking in concrete terms. However, all students at some time or other venture into the world of abstract thoughts, and when they do so they need help and support from teachers. There are times when activities are obviously inappropriate and teachers should find other ways to introduce the activities or express the math concepts in a challenging manner.

4. Improper teacher instruction - Often teachers do not have a clear understanding of the subject matter being presented. Learning cannot be achieved if "the blind are leading the blind". Teachers should be better prepared and trained. They should try to clarify math concepts with peers or do some research when in doubt. When starting a new lesson in math, it is highly desirable to develop meaning, understanding, and insight. When the new concept is understood, then try to develop more efficient and mature methods of math work through systematic practice.

5. Students are afraid to ask questions or clarify problems due to social pressure. Sometimes students are intimidated by brighter students and sometimes the teacher. They fear rejection from the class, and hence when in doubt,

they often shy away rather than "speaking up". There is always the fear of being "laughed at," "looked down on" or labeled "stupid". Teachers should recognize that these possible social problems exist among the students, encourage questions, and offer support to the students.

Relationship of the Problem to the Literature

According to the literature, our society is moving from an industrial society to an informational society. Areas of mathematics that have been given little attention in the past are becoming important today. For example, in addition to many traditional teaching methods, we are now placing a greater emphasis on using electronic assistance such as: computers, calculators, and other such devices. Many students have difficulty in really understanding mathematics. They have a fear of mathematics. Students learn mathematics because they 'have to' not because they like it.

The literature uses the findings of other math researchers and educators to emphasize the problem of math education in the United States. Copeland (1984), believes that children can develop mathematical concepts through the use of basic educational theories. He finds that for every stage of math concept development, a theory can be used to explain the cognitive behavior of a child. Copeland reinforces his concept of mathematics using Piaget and Skinner's views on child development and child behavior. Our

children have not been given opportunities to develop their own concepts of numbers. They are often "told" how to "do" mathematics. There have not been enough math laboratory facilities established to enable children to explore math with real-life objects and pursue their work at their own rate and level.

For Post (1988), the quality of math education is decreasing in the United States as compared to Japan, China, and Canada. Post says one of the reasons is the "back to the basics" movement in the United States, in which some educators and parents are not content with "the new mathematics" and want to stick to the traditional method of teaching math. They claim that the new mathematics was started by non-math professionals who do not have any link to the formal education of children. However, it is commonly agreed among math educators that the "back to the basics" movement has greatly slowed students' progress in learning math. Educators have lost too much valuable time arguing the appropriate method of teaching math. The time lost is irretrievable.

The government has funded many research projects on improving math education. Unfortunately many researches have encountered the problem of lack of cooperation from teachers, schools administrators, and federal agencies. The efforts put forth to revise the math curriculum in the schools will not have any positives results without external financial support from the federal government. Another problem, says

Post (1988), is that some research themes are poorly defined and research goals are difficult to pin-point.

Although elementary school teachers are teaching their students thinking skills, still not enough emphasis has been placed on the teaching of thinking skills. Bartalo (1983), says students are usually taught how to compute rather than knowing "why". Bartalo believes that the use of calculator instruction can foster the students' ability to think through problems before executing them. Presently, very few schools use the calculator in their math curriculum. According to Bartalo the following can help to reinforce students' ability to solve math problems.

1. Teachers need to spend more time teaching students how to analyze math problems.
2. Teach students how to think before computing math problems.
3. Math instruction should include a variety of activities.
4. Use calculators to help students to become better 'thinkers.'
5. Encourage teamwork.

Riedesel (1980), seems to share some of Bartalo's views. Riedesel feels that many teachers spend too much time on drills and practices or on correcting math work. They do not ask enough "whys" or "hows" during math lessons. Students are not given opportunities to report or explain approaches,

demonstrate ideas, work on manipulative materials, or research solutions to math problems. Although the number of math terms taught has increase, this improvement is not enough. Math vocabularies need to be introduced in the early grades, so that the students will not be intimidated by them later.

Another researcher, Driscoll (1986), shares the same views as the above researchers on why children are having problems in math and how it should be introduced. Driscoll feels that there is very little interaction between teachers and students in our nation's schools. Very few math teachers have been encouraging students to ask questions when they are having difficulty. Many math teachers fail to design math programs suitable for individual students in order to maximize flexibility in the classroom.

Due to the inconsistency in teacher expectation, students' performances often bounce back and forth between acceptable and unacceptable. Teachers should maintain a high expectation of their students' success in mathematics and in turn, students will have high expectations of their math teachers. The "Exemplary Mathematics Programs" described by Driscoll (1986), emphasize the above approach to teaching math. The method, according to Driscoll, will not only increase teacher-student interaction in the math class, but will also replace any materials which one might use for math.

Young children usually react positively toward math until they approach the latter part of elementary school.

Suydam (1984), says teachers, parents, classmates, and self-attitude are probably the causes of the change in children's attitude toward math. Suydam suggests that to improve students' attitude toward mathematics, teachers need to show enthusiasm and interest, make math learning activities enjoyable, relate math to real-life situations, accept input, suggestions on students' interests, give students opportunities to experience success in math, and make math easy to understand. All the above should be taken into consideration at the outset of math instruction.

Oberlin (1982), also feels that from the beginning children are taught to dislike mathematics by teachers who are not sensitive toward individual needs. They assign the same math problems to every child in the classroom, unaware of individual differences. They often repeat the same type of instruction day after day. There is very little variation in the teaching style or procedure, for example: assigning homework each day and insisting the work is to be turned in in a certain way, never tying math instruction in with real-life situations, and confining students to 'one way' of solving any kind of math problem. Due to teachers' rigid attitudes, repetitive teaching style, and expectations of repetitive feedback from students, the students are more likely to dislike math.

According to Riedesel (1985), the following are possible causes to the problem of why students are not proficient in the math curriculum.

1. Teachers do not use up-to date information to teach math content areas.
2. Very little effort has been made on the part of the teacher to use technological devices in math classes.
3. Math content has not been adjusted to meet the demands of our fast-changing society.
4. Some teachers are teaching the math curriculum with very little excitement and enthusiasm.
5. Emphasis is not placed upon emotional and intellectual interaction between students and teachers.

Riedesel feels that there are not perfect solutions to the above problems. Nevertheless, teachers remain the most crucial ingredient in teaching math content areas. They must be familiar with different ideas, so that they can introduce math lessons appropriately.

Tierney (1985), argues that students are not being trained to memorize math facts. The lack of memorization training decreases the students' ability to do well on math tests. Students without memorization practice tend to skip problems, compare progress with that of other students while taking a test, and some get frustrated easily and give up with many mistakes. Memorization of number facts works better with whole-number arithmetic. For fractions and other math areas such as problem-solving, memorization of facts is not enough. Students cannot relate number facts to number concepts. Teachers should teach number theory, and allow students to discover math rules by studying patterns such as

those evident in the multiplication tables.

Sherard (1981), in an article "Math Anxiety in the Classroom" points out that sex role stereotyping can cause math anxiety. While society sees math as a subject for boys, girls often feel that they can never be good in math, and hence shy away from math courses later in school. furthermore, teachers of mathematics tend to treat boys differently than girls. They expect boys to do better in math than girls, therefore students will perform accordingly. Teachers should make every effort to avoid such discrimination in order to increase positive attitude and math performance by all students. Students should be made aware of the usefulness of math in real-life situations. Sherard says many students' math anxiety is caused by the lack of self-confidence in their abilities to do mathematics. He feels that the students' attitude toward mathematics has a great deal to do with the math program, math activities, and the way the teacher teaches math. Teachers are often rigid in their teaching behavior. They should let the students know that math can be creative, rather than just having them follow that has been done previously in math and insisting on one 'right' way to do problems.

In contrast to Tierney (1985), Sherard (1981), states that many students have trouble in math because they have been taught to memorize number facts rather than understanding math concepts. Therefore math teachers should teach students to 'understand' math, rather than teaching

them to memorize and compute math problems.

Teachers have paid very little attention to math terms when in fact, math vocabulary plays a vital part in the math curriculum. Students will not be able to understand certain areas of math without knowing certain math terms, for example those concerned with spatial relations and problem solving. Teachers of mathematics need to show interest and enthusiasm while teaching math, since these feelings are contagious and can be passed on to the students quickly.

From the literature, the writer concludes that too many American students cannot do math. In a high-tech world, this does not work for the national interest. The books and articles published by the researches have been endorsed by leading professional groups in mathematics. Moreover, the math researchers' depiction of the problem is congruent with that of the writer's. It was found, for example, that only sixteen students out of one hundred and four, in fourth grade in the writer's school, scored higher than forty percent on a math pretest.

The experts seem to agree that there is a serious problem in math education. The books and articles propose a thorough overhaul of how math is thought of and taught. They recommend, for instance, that teachers minimize mindless repetition and the rote memorization of formulas. They also suggest that students should learn from first-hand experiences, using laboratory situations, and teachers must be aware of other innovative methods. Teachers should

encourage rather than discourage the use of computers and calculators for routine problem-solving.

Teaching students to think analytically about math problems, especially those with real-life applications, should be the teachers' main goal. The authors differentiated between "back to the basics" and "new math." The attempt made to reform the math curriculum has left many people wary. Many parents as a result of the attempted reform cannot solve their fourth-graders' math homework problems.

The lack of motivation and self-confidence of fourth grade students in math achievement remains a significant problem in the writer's school.

CHAPTER III

ANTICIPATED OUTCOMES AND EVALUATION INSTRUMENTS

Goals and Expectations

The most important goal parents and educators should share is educational achievement for the students. The writer feels that the most important need in educational achievement is to strengthen the curriculum in mathematics. Educators need to make mathematics more exciting. They need to increase motivation, incentives, and create opportunities for all students to excel in math education.

The writer's goal was to get fourth grade students involved in math activities, motivate them, and build self-confidence in math achievement. By doing so, we can discover the potential within each individual child, expand this potential to the fullest, and thereby foster the development of intellectually sound, responsible members of society.

Behavioral Objectives

With the conclusion of an eight-month implementation period, certain positive objectives have been achieved. These objectives are listed below:

1. Sixty out of one hundred and four students in the fourth grade mastered their times-tables as determined by the teacher evaluation instrument Student Times-

Table Performance Chart (see Appendix C).

2. Thirty out of one hundred and four students in the fourth grade made a gain of at least ten percent on a math post-test.
3. Fifty out of one hundred and four students in the fourth grade identified math as a subject they like on an attitude questionnaire.

Measurement of Objectives

During a math multiplication contest, the writer kept a record of the number of students who knew their times tables on the Students Times Table Performance Record Sheet (see Appendix D). The purpose of the record sheet was to keep track of the number of fourth grade students that had mastered the times tables. Before the contest, the writer conducted a practice contest with each individual class to familiarize students with the procedure, and to see how student attitudes and performance differed during in-class competitions, and fourth grade level competitions. There was a record sheet for each class.

The Student Times Table Performance Record Sheet had these items listed across the top of the paper: Student, Class, Does Know Times Tables, Does Not Know Times Tables, Knows Times Tables, But Not Proficient, Cannot Measure, In-Class Competition, and Fourth Grade Competition. To conceal the students' identity and class, each student was

represented by a number, and each class was also represented by a number. The writer marked the appropriate spaces for the corresponding responses on the record sheet. For example: if student #1 from class #2 knew his/her times tables during in-class competitions, then an 'X' was placed next to student 1, under the columns for In-Class Competition, and Knows Times Tables on the sheet for class #2. This record sheet helped the writer identify the status and the progress of a particular student in order to provide assistance if needed at a later date.

The Student Pretest and Post-test Record Sheet (see Appendix E), was utilized to keep records of students' pre- and post-test scores. There was a record sheet for each class. Four items were listed across the top of the record sheet. These included the Student, Class, pretest Score and Post-test Scores. The writer used the information collected from the tests and marked the appropriate space on the record sheet.

A Math Attitude Questionnaire (see Appendix A), was designed for the students of the fourth grade classes. The writer recorded the results of the math attitude surveys on a chart (see Appendices F & G). Information on fourth grade students' attitudes toward math at the beginning of the school year and at the end of the school year was recorded. Items on the questionnaire (see Appendix A) were listed in the leftmost column, while the responses: "Yes," "No," "Sometimes," and "Don't Know" were listed across the top of

the paper. The total number of students making the responses were recorded in the appropriate columns. The writer hoped to see fifty students indicating math as a subject they liked.

Unexpected results of this project might have included: no improvement in the number of students knowing their times tables over the school year, no one student in the fourth grade making a gain of at least 10% on a math post-test, more students identifying math as a subject they disliked than liked on the attitude questionnaire. The teacher evaluation instruments (see Appendices C, H, & I) recorded all information obtained during the experiment, therefore the unexpected incidents were also recorded on the chart. For example, if there were no improvement in the number of students who knew their times tables over the school year, the writer recorded the same number in the columns for the beginning of the school year and the end of the school year. If no one student in the fourth grade made a gain of at least 10% on the math post-test, then the numbers under the two columns for number of students who scored below 40% on a pretest and number of students who scored below 40% on a post-test were the same on the teacher evaluation instrument (Appendix H). Still, if more students identified math as a subject they disliked than liked, then by using the teacher evaluation instrument on Student Attitude (see Appendix I) one would be able to tell by comparing the first column with the second (i.e.: the numbers in the first column would be

larger than those in the second column).

After reviewing data recorded on the teacher evaluation instruments (see Appendices C, H, & I), the writer compiled and analyzed the data collected and determined whether the following objectives had been achieved:

1. On the Student Times Table Performance Record (see Appendix D), the writer took the tallies and transferred them onto the teacher evaluation instrument Student Times-Table Performance Chart (see Appendix C). To help identify classes, on top of the chart the classes were represented by numbers preceded by the letter 'C', and on the leftmost column there were four items, including the number of students knowing the times tables at the beginning of the school year and at the end of the school year. This condensed form enabled the reader to identify the number of students knowing their times tables at the beginning and end of the school year, compare the number of students' knowing their times tables at the beginning and end of the school year, identify the class that made the most gain, and the total number of students knowing their times tables at the end of school year. If sixty students knew their times tables at the end of the school year, then the objective of sixty out of 104 students in the fourth grade knowing their times tables had been achieved.

2. The teacher evaluation instrument for Math Pre- and Post-tests (see Appendix H), was a chart made up of three columns. Listed across the top of the chart were Class,

Pretest below 40%, Post-test below 40%, and students making a 10% gain. This chart showed the number of students from each class who scored below 40% on the math pretest and post-test respectively, and the total number of students making at least a 10% gain on the math post-test. This chart could also show which class made the most gain by comparing pretest and post-test records. The objective of thirty out of 104 students in the fourth grade making a gain of at least 10% on the math post-test was achieved if the column for the total number of students making a 10% gain totaled thirty or more.

3. The writer designed a teacher evaluation instrument to evaluate students' attitude toward math at the beginning and end of the school year. After tallying students' responses on the items on the Students' Math Attitude Survey Beginning of School (see Appendix F), and Students' Math Attitude Survey: End of School (see Appendix G), the writer transferred the information onto a condensed chart (see Appendix I) for the purpose of easy reading. The chart was made up of three columns. Listed across the top were Class, Number of Students Who Like Math at Start of School Year, and Number of Students Like Math at End of School Year. If the total number of students who liked math at the end of the school year was fifty or more, then the objective of fifty out of 104 students in the fourth grade identifying math as subject they liked was achieved.

CHAPTER IV

SOLUTION STRATEGY

Discussion and Evaluation of Possible Solutions

Mental computation has had its place in the elementary math curriculum since the early 1900'S. According to Reys (1985), although some students are able to adapt to mental computation quickly, others find it too difficult to handle. Mental computation can help students understand our number system, and teach students critical thinking skills. There are many benefits of mental computation such as:

1. Efficiency - Many real life situations can be easily handled using mental computation when paper and pencil or calculators are not available.

2. Enrichment - Mental computation is challenging for advanced math students and can be mastered by low-ability students when it is properly introduced. It also can help reinforce important concepts for all students.

3. Enhancement of Reasoning Ability - Mental computation can induce flexibility in thinking and thus, students can transfer learning to other areas of math.

According to Lenchner (1985), mathematics competitions should be increased at the elementary school level as well as the secondary and college levels. The reasons for the low number of competitions available at the elementary school level are: lack of experienced teachers, lack of competition materials, and lack of agreement on topics. "Math Olympiad"

is a contest originated in 1978 by students and teachers in Valley Stream Elementary School in New York. The purpose of the Math Olympiad is to develop students' enthusiasm for solving problems, to contribute to their knowledge, and to build an intellectually stimulating mental activity foundation. The success of the Math Olympiad program has drawn capable math participants from all over the world.

Yvon (1987), believes that calculators can do a great deal of good in the mathematics classroom. The use of calculators can: promote positive attitudes toward mathematics, increase self-confidence by acting as a tool to help students develop their ability to solve problems, reinforce speed and accuracy, allow individual growth, provide simplified checking of math work, and encourage cooperation between students.

Yvon (1987), also provides teachers with a four-point check list for calculator use. It includes:

1. Preliminaries - Physical setup of the calculators.
2. Provisions - Allocate time for students to familiarize themselves with the calculators.
3. Procedure - Allow students to discover answers to their questions. Ask open-ended questions.
4. Process - Encourage interaction, introduce methods, and point out relationships between calculators and the mind.

There are many math strategies that classroom teachers

can employ. Forseth (1984), suggests many creative math activities that are suitable for classroom use. The author believes that teachers should channel students' natural creativity into learning math. We need to reinforce students' thinking skills through concrete experiences. Many activities suggested by Forseth encourage the investigative approach in which the students use their own creative ideas to produce solutions.

Troutman and Lichtenberg (1982), introduce more strategies in teaching mathematics. Activities should be designed according to the way we think children should learn, how we think the concepts should be introduced, and the topics in which we think children might have difficulties. The teacher is one of the most important elements in math education. To be an effective teacher, one must learn the precise time at which a concept can be introduced, and the level at which a child may reach frustration. Math concepts should be presented from the concrete level to the pictorial level and finally at the symbolic level.

Troutman and Lichtenberg (1982), also suggest the use of calculators in the classroom. They argue that the use of calculators will enable the students to spend more time practicing ideas and concepts rather than carrying out tedious computational procedure work. The computer is another device mentioned by the authors that can be very helpful in the classroom. It has all the advantages of a calculator, plus many attributes that a calculator does not

have. It contains larger memory capacity and can perform more difficult tasks, for example.

Forte and Mackenzie (1983), believe that math should be introduced at an early age. According to them, teachers should provide appropriate situations for children to discover mathematics for themselves at their own rate. Concepts should be presented in the proper sequence at the correct time. Activities should be highly motivational ones. Teachers should use everyday tools to teach math, such as: measuring cups, calendars and clocks. Children should be in an environment surrounded by math opportunities so that they can transfer learning, and apply math to real-life situations, such as the use of numbers on houses, telephones, license plates and television sets, for example.

Kennedy and Tipps (1988), developed a program based on Piaget, Brownell, Deines, Skemp, and Gagne's learning theories. In their book, Guiding Children's Learning of Mathematics, they stressed the importance of sequencing mathematics activities. For example, they must learn the facts of addition before adding two-digit numbers. The authors suggested that the classroom should be structured to meet individualized instructional needs. Due to the recent emphasis on computer education, the authors believe that the use of calculators and computers should be integrated into the elementary math curriculum to enhance thinking skills. According to Kennedy and Tipps, the use of a variety of math manipulative materials is essential in the

development of mathematical concepts.

Lerch (1981), developed and implemented a laboratory approach to introduce and teach mathematics in the elementary school. According to Lerch, the advantages of a laboratory approach are many: it allows individual and small group work as a basis for learning, and it offers first-hand experience by individual students with objects in the physical world. In his book, Teaching Elementary School Mathematics: An Active Learning Approach, Lerch offered many valuable suggestions on how to use the laboratory approach to teach major content areas, and focused on selecting the most appropriate activities for the existing program.

According to Marks, Hiatt and Neufeld (1985), math content should be carefully selected because of its value in daily life. A set of aims for math education should be identified early, incorporating the input of teachers, administrators, and the public. Learning will be most effective if it is accomplished by doing, rather than having things done for the students. The authors suggested that learning can be most effective if the students explore and discover what they are learning. Therefore, participation plays a major role in the process of learning mathematics.

Mathematics is the subject most dreaded by students in general. This attitude is learned behavior. Therefore teachers can make a difference by carefully selecting and planning mathematics activities. Many different approaches have been suggested by math researchers. Some believe using

a laboratory approach to teach major content areas will increase motivation and can create student-student, student-material, or student-teacher interaction. Other researchers believe that at the outset, math instruction aims should be clearly identified. Thus, the teacher is in a position to encourage a positive attitude. Students should be encouraged to explore and discover mathematical concepts on their own, in order to enlist their total participation. Math strategies such as mental computation, math competitions, and real-life experiences should be employed in the classroom. Math manipulative materials, such as computers and calculators, also should be widely introduced into the classroom to foster learning.

Description of Selected Solution

Our technology is advancing rapidly, and in order to function in this society, the minimum competencies needed by individuals have been greatly increased. Students who will graduate from high school this year and many years in the future will face a computation-dominated society.

The writer believed that educators must develop positive, caring strategies to make the benefits of math learning available to all children. Appropriate math learning opportunities play a key role in how students' math concepts develop and how well they are used in their daily life activities.

Mathematical learning techniques, caringly and appropriately used, can increase the students' motivation in math learning. Simultaneously, a variety of strategies should be developed to make it easier for students to learn math.

It is obvious to the writer that the six solutions listed below worked to solve the problem of lack of motivation and self-confidence of fourth grade students in math achievement.

First, daily Mental Math activities were practiced in the classroom. Students were not limited to written computations. Systematic Mental Math computation improved students' performance in math as well as their thinking processes in general. For example, "What is the cost of one candy bar if the cost for a box of six is $6.98?" The main goal here is to enhance the mathematical sense needed to comprehend division. Students need to see the relationship of one candy bar to the box of six candy bars, then decide which mathematical operation to use.

Obviously, high level Mental Math computation is not to be expected of all students. Therefore Mental Math activities were introduced in the most simple mode and gradually moved into a complex mode of solving problems using more than one operation or step. For example, systematic mental drills in addition of numbers up to ten cannot only greatly improve speed and concentration, but will help build students' self-confidence and help them gain proficiency in

more difficult Mental Math computations.

Second, teachers should provide systematic review and daily math drill. The writer believed that "practice makes perfect". For example, at the beginning of the school year, students often performed at a level considerably below that evidenced at the end of the previous school year. This can be attributed to the lack of practice during the vacation period. Therefore it is important to continuously provide review and practice in order to keep the students' minds alert and "up to date".

Third, math competitions can promote interest and enthusiasm in students. Therefore they were widely used. Math competitions also provided the initial foundation for Mental Math activities.

In-class competitions were held often. For example: divide the class into two teams, then ask "How many students are there in the fourth grade if there are five classes and each class has twenty-three students?" One student from each team must compute mentally, then go to the chalkboard to write the answer. The first person to write the correct answer wins a point. Such activity also can be used to build up speed. For example, the teacher can give the students a time limit in which to complete the problem.

Competition between classes was encouraged. For example, "Multiplication Champions" for a specific grade can be determined by competing with other classes in the same grade. This greatly increased motivation, and promoted

enthusiasm for learning. Math competitions also teach teamwork, respect for others, and sportsmanship. Experiences gained from math competitions encouraged teachers to design their own open-ended challenges. Students also were encouraged to design their own tasks. Those who do gain valuable experiences in problem solving, through math competitions often produce excellent challenge projects.

Fourth, math projects were designed and utilized by students and teachers as often as possible. Up to this point, emphasis had been placed upon gifted, talented and capable students when it comes to creative math activities or competitions. The writer believes that is all children are given the same opportunities and expectations, they can and will produce work that is often surprising. For example, if after reading a story the teacher asks: "Who can come up with questions that will stump other students?" All the students respond enthusiastically. If we take the same techniques and apply it to math, the same enthusiasm will likely be evident.

Math projects also promoted creativity, interest, enthusiasm for problem solving, self-confidence, teamwork and many other undoubted advantages for students.

Fifth, student-teacher interactions were increased by encouraging students to ask questions when in doubt Special incentives were made available to entice students to participate.

In math class the teacher observed and listened to the students, and picked up clues to topics that interest them.

Experiences then were provided that allow the students to develop concepts and make discoveries about math.

The teacher can set a positive social/emotional climate in the math class by understanding that all students are individuals at different stages on the developmental continuum, and use a positive approach in dealing with slower students, by speaking in an enthusiastic voice when instructing.

The writer believed that it was important to interact frequently with students during math lessons. The teacher created a climate for positive interaction and mutual trust. The teacher also observed the students, listened to them, and attempted to meet their needs by providing many opportunities for them to experience success. He or she respected students and valued their suggestions in relation to the math curriculum and teaching methods.

Sixth, computers, calculators and other devices were used as aids to math instruction. The writer firmly believed that computers and calculators, when properly used, help improve the math curriculum. More affordable calculators, computers, and related technologies have greatly changed our society. Computers are being used everywhere in offices, factories, schools, and homes. Therefore, we need to train our students to familiarize themselves with the use of these popular technological devices. Also, students find it more fascinating when a math lesson is taught using computers and calculators than using the traditional pencils and paper

method.

The writer also believed that when learning becomes 'fun,' students are more likely to learn faster and thus become motivated in the learning process.

There are many ways to utilize technological devices. For example, use calculators to help memorize several digit numbers, check math work, and estimate sums. Use computers to introduce a new math concept, review math lessons, create word problems, and perform math computations without paper and pencil.

The writer developed the above solutions for all fourth grade teachers in the writer's school, and involved all the fourth grade students in the process.

The steps that the writer took were (a) conferred with school administrators in setting up guidelines for implementation of the math program, (b) conferred with fourth grade teachers to enlist their cooperation in administering attitude questionnaires and the math pretest, (c) conferred with fourth grade teachers to gather information on their students' times-tables performance, (d) administered the beginning of the year attitude questionnaire to all fourth grade students regarding their views about math, (e) administered the pretest to fourth grade students on basic math facts, (f) designed and disseminated Mental Math activities in the fourth grade, (g) set up math competitions, (h) demonstrated the use of computers, calculators, and other devices, (i) kept a log recording feedback on students' math

progress based on teacher observation, (j) had students work on math projects and design math games, (k) designed Mental Math Grand Championship Competition, (l) designed and administered Mental Math Teacher Attitude Survey, and (m) administered the end of the school year attitude questionnaire and math post-test.

Report of Action Taken

The implementation of the project was eight months. Based on the Math Attitude Questionnaire (see Appendix A), the writer knew that the fourth grade students in our school felt intimidated by math. As part of the preliminary ground work before the implementation phase, the writer invited some of the writer's former fourth grade students to talk to the fourth grade classes about their experiences with math. The former students came on different days and held question and answer sessions. Each session lasted about an hour. Most students were receptive, because these former students had similar problems in the fourth grade. Therefore, their opinions were greatly accepted and valued by the fourth grade students. They learned that math can be fun or that M=F (Math equals fun).

During the first four weeks of the implementation phase, students and teachers in each fourth grade class were invited (one class at a time) to the writer's class to observe and participate in Mental Math activities. Simultaneously,

students were told what they would accomplish, and the purpose of the eight-month math program. The writer told the students that the new classroom rule was "I Can Do It!" She also reviewed the goals and objectives with the students. Furthermore, the students were told what kind of prizes they would receive for participating and winning in the contests.

The writer provided the fourth grade teachers with teacher-made materials, so that they may continue to work with their students in their classrooms. The self-made materials included multiplication cards, basic skills worksheets, and word problem homework activities (see Appendix J).

In the next four weeks, the writer met with each five fourth grade classes four times as shown below:

	Week 1	Week 2	Week 3	Week 4
Monday	Class 1	Class 1	Class 1	Class 1
Tuesday	Class 2	Class 2	Class 2	Class 2
Wednesday	Class 3	Class 3	Class 3	Class 3
Thursday	Class 4	Class 4	Class 4	Class 4
Friday	Class 5	Class 5	Class 5	Class 5

The purpose of the meetings was to make sure that the students were properly instructed in the Mental Math activities. Since the same teaching techniques were employed, the students' performances were expected to be the same.

During Mental Math activities (see Appendix K), the students formed teams of two. The writer used teacher-made flash cards with two-digit multiplications. The teacher held the cards in front of the students. The students, one from each team, came up and solved the problems. To increase excitement, the teacher told the students that they only had five seconds to solve each problem. If the two students up could not solve the problem, the next two students would attempt to solve the next problem, and so forth. Already, the students seemed more interested. The writer redivided the teams. This time, boys competed against girls. The students were more motivated by this situation. They were told that the teacher would select eight winners, who would then work with the intermediate set of cards (two-digit numbers multiplying one-digit number). This time both groups of students became very excited. Boys claimed they were better than the girls, and vise-versa. With practice, students were able to solve problems quickly and accurately.

Two winners were chosen to compete in three-digit multiplication. Similar procedures were employed. Students were not allowed to use paper, pencil, or any other means to obtain answers. They needed to visualize the equations in their heads. A grand champion was chosen. Certificates were given to eight intermediate level and two advanced level champions.

Each time the writer met with a class, she kept a record of the number of students who knew their times tables on the

Students Times Table Performance Record Sheet (see Appendix D). The purpose of the record sheet was to keep track of the number of fourth grade students that had mastered the times tables.

In the next four weeks, Mental Math competition continued with high interest from all students. The competition consisted of three different levels: simple (i.e., 23 x 3), intermediate (i.e., 98 x 8), and advanced (i.e., 356 x 7). The teacher from Class 2 did not attend the competition, but sent a student teacher. The students showed high competitiveness and interest. The writer's class usually took the title for championship. This result could have been attributed to the amount of practice the students received in the classroom. Also, the writer felt that the teachers' enthusiasm played an important role in the competition. The students in the writer's class were highly motivated because of the math activities. For example, the teacher's aide observed that when the teacher took most of the class to lunch, the remaining children stayed in the room and played "Mental Math." When the class returned from the lunch room, these children said to them, "You've missed all the fun!"

Before each math lesson, the teachers were informed of the type of math activity. The teacher of Class 3 had led practice and prepared her students well before each meeting. The results were obvious. This class of students listened intently, and paid close attention to the math lessons.

Competition with Class 3 was tough. The teacher from Class 3 was present each time the writer met with her class. She was constantly encouraging and talking to the students. This teacher also made her own math competition materials for classroom use. Due to frequent exposure to a variety of math activities, students no longer felt intimidated. Most students not only demonstrated an "I Can Do It" attitude, but wanted to win in competitions. Most students were able to solve two-digit multiplication problems spontaneously after seeing the flash cards.

The students from Class 4 appeared to be intimidated by the writer's class. However, they participated eagerly, and were able to defeat some students from the writer's class. it was obvious to the writer that the students' math skills had improved with the increased practice. One child from Class 4, as observed by the writer, lacked confidence in her ability, but was able to defeat many students in a row in the math competitions. She seemed highly motivated to try even harder next time. The writer told the students that the next time they met, there would be a competition in two-digit multiplication without flash cards. Everything would be done mentally. The immediate responses from the students included: "We'd better practice," "I'm gonna ask my mom to help me," and "I'm going to work on my multiplication." This showed that most fourth grade students were enthusiastic about math competitions, and were motivated to compete.

At the first meeting after the winter holidays, students

seemed rusty. The attempt to do Mental Math without multiplication cards was little difficult.

Systematic reviews were employed throughout the competition. The competition developed into a math lesson. The students from Class 1 seemed anxious to start the competition. Before the competition, the writer introduced basic concepts and tricks which students could use to solve problems mentally. For example: 49 x 7, students were told to round the number 49 up to 50, multiply 5 x 7, add the zero, then subtract 7. The writer explained why the method worked, step by step. In a situation such as 46 x 2, they were told it would be easier to add. (46 x 2 is actually 46 + 46.) Each time a problem was given the students were reminded of what would be the easiest process to solve the problem. The writer guided the students step by step mentally using the techniques taught. Students were not aware that they were actually having a math lesson. They thought that they were just having "fun," and wanted to come up with the right answer first. Even the children that were not up were doing the problem in their heads.

After a round of mental drill without the cards, the writer felt the students had grasped the idea of choosing the easiest methods for themselves. They moved on to the competition. The students requested that the cards be used during the competitions. The writer mixed beginning level and intermediate level cards together. Students were able to respond quickly and accurately without any difficulty. To

avoid disappointment, the writer asked two students from Class 2 who seemed very good at Mental Math to come up to compete against each other. This time, Class 2 were actually cheering for their classmates. Six intermediate winners were selected, including two from Class 2. The spectators looked on with excitement as the six intermediate champions fought for the grand champion title. The remaining students were encouraged to solve the problems. If the champs could not solve a problem, the other students would try to get the answer and win a treat. The attentiveness of the students was to be commended. They not only stayed quiet for the competitors, they also were listening and solving the problems.

The teacher of Class 4 had recently returned from leave of absence. The writer was pleasantly surprised by the students' performance. Apparently, the substitute had drilled the students well. She had duplicated the writer's Mental Math techniques and materials and systematically reviewed them with the class.

A slight variation was made with Class 4. Since five of the children in Class 4 appeared to have the same ability, the writer asked these children to compete against each other for the champion title. The competitors as well as the spectators were very excited. Ten bright eyes lit up, while their brains searched for the product. All five students wanted to be the champion.

The writer was intrigued by the students' enthusiasm.

Taking into account that Class 4 had less practice than the writer's class, they were given preferential treatment by being arbitrary chosen as intermediate champions. When a few of the students in the writer's class objected, they were persuaded privately that it was to make the competitions more equal.

Class 3 was a well-behaved class. When the writer introduced the methods, they all listened intently. Most children understood the concepts immediately, and some even employed the techniques in their problem-solving. Throughout the competition, the writer prompted the competitors with the easiest method to use in solving the problem. Some children were apprehensive about solving math problems in their heads.

Due to the constant encouragement of the teachers, the students slowly built up enough confidence to go up against each other. One child, who was especially slow in solving problems at the very beginning, ultimately became the Grand Champion. While she was competing with a student from the writer's class for the Grand Champion title, all the classmates cheered for her.

The excitement was contagious. The teachers as well as the students were involved in the solving of problems mentally. In all, it was a great and fruitful competition. The purpose was to get the students to think logically, and to build their self-confidence. With the help of systematic reviews and rewards, the results were overwhelmingly positive.

During week 17 of the implementation, the writer thought it would be helpful if she could obtain teacher input for a comparison to her observation. The writer designed and administered a teacher survey form (see Appendix L). The results were impressive. The teachers in the fourth grade indicated, on the teacher survey, that students were showing more interest in math, there was an improvement in the students' test scores, and the students' motivation in math had increased due to exposure to Mental Math activities. Most teachers enlisted the students' opinion. According to the students, Mental Math activities were (a) challenging to them, (b) training their thinking skills, (c) providing good education, (d) preparing them for upper grades, (e) helping them to learn a great deal in math, (f) getting them to compete and discover their strengths in math, and (g) the most fun thing they did.

During our grade level meeting, one teacher commented that, "When the students saw your class (super stars of the school), they came back and worked hard. They had never worked so hard. Now they do everything with enthusiasm, because they come back feeling 'high'." The teacher from Class 1 said, "Sharing ideas are very important. The team planning provided opportunities for each teacher to contribute his/her special talents. We were glad to have this opportunity to learn from the math whiz." Another teacher commented, "We were not taught to do math with our minds. We were taught to use machines. It is very

unfortunate." The teacher from Class 4 said, "I am also learning. When I was in school, no one ever taught me how to use different ways or strategies to solve math problems. With this kind of work, the children's creativity spills over into other areas as well. They began to think more in general. It develops them more as a whole person."

During week 17 to 20 of the implementation phase, the writer sent home with the fourth grade students a parent letter regarding the up-coming Mathematics Game Design Contest (see Appendix M). All students were encouraged to participate. The purpose of the contest was to promote creativity, interest in math, enthusiasm for problem solving, self-confidence, and teamwork. The contest attracted 40% participation from fourth grade students. Because this contest was a "first" in our school district it generated positive press and enthusiasm throughout our school, community, and district (see Appendix N).

Due to the teachers' cooperation and the students' enthusiasm, math activities initiated by the writer continue to be employed in the fourth grade classrooms. The teachers held math competitions frequently in their classroom. They used systematic review as part of the math instructional strategy.

During the next four weeks, the fourth grade students were exposed to computers. The writer took one class at a time to the school's computer lab to introduce them to math games. The math games used included Adventures in Math

(IBM), Math Concept Level II (IBM), and the students' own math game designs. The students first used the IBM math softwares to practice solving math problems. Afterward, they were taught how to create their own math problems using BASIC programming skills. The students were thrilled to have the opportunity to stump their classmates. They created their own math problems eagerly. The same degree of enthusiasm for the Mental Math competitions was observed during computer math competition. The writer did not expect the overwhelming student enthusiasm for any math competitions. Often, students have stopped the writer in the hall and requested more computer time. If the response was "next week," the students then asked, "Then, could we have a Mental Math competition with your class?"

During week 28 to 30 of the implementation phase, the writer introduced the use of calculators. The first time the writer introduced the use of calculators, students were highly curious. They wanted to know what else a calculator could do other than its basic functions. As time went on, students were amazed at many innovative activities that were created by themselves. They were given (extra credit) assignments to research on the history of computational machines. In addition, the students had to identify the number system used by these machines and the origin of them. More than 40% of the students did the assignments. When the assignment of creating a calculator game was first assigned, students responded enthusiastically. Some designed word

games on the calculator, while other designed number search games. To this day, students are still coming up with new ideas for the calculator.

Calculators can be used to generate many fun mathematical activities. The writer has tried many activities with the calculator, and it has helped increase the students' interest in math. The calculator can be used as a tool for teaching accuracy, estimation, problem solving, creativity, and much more.

The writer thinks calculators are good for promoting enthusiasm, improving test scores, increasing interest in math, developing more confidence in problem solving, assisting in understanding basic concepts of math, and promoting creativity.

Our First Annual Mental Math Grand Championship Competition was held on April 27, 1990. Twenty-five students (five students from each five fourth grade classes) participated in the Mental Math Grand Championship. It was the culmination of a year of practice in Mental Math techniques, both within individual classrooms and on an inter-classroom level. Before the competition, the writer distributed rules and sample problems to the teachers (see Appendix O).

The purpose of this competition was to increase interest in math, develop self-confidence, reinforce problem solving skills as well as basic math skills, promote abstract thinking and concepts, and promote teamwork and harmony

between classes.

The Championship was organized by the writer, who had spent the year fostering Mental Math competition in the school. Invitations (see Appendix P) were sent to the associate superintendent of curriculum, area administrator, director of potentially gifted minority program, and the principal of the school to serve as judges for the event. The judges reviewed the rules for judging (see Appendix Q), and the answer/score sheets (see Appendix R) prior to the competition.

The four events making up the championship were (a) multiplication using flash-cards, (b) word problems, (c) multiplication without flash-cards, and (d) equations (strings of arithmetic computations to be carried out in sequence to obtain a numerical answer).

Each event consisted of five rounds with students wearing identification tags as follows:

	Class 1	Class 2	Class 3	Class 4	Class 5
Round 1	A	B	C	D	E
2	F	G	H	I	J
3	K	L	M	N	O
4	P	Q	R	S	T
5	U	V	W	X	Y

The first student to respond to three problems correctly was the intermediate champion. One intermediate champion was

chosen for each round in each of the four events. The five intermediate champions then competed for the grand championship title using more difficult math problems. The winners of the competition were published in the local newspapers (see Appendix S).

The competition was broadcasted by channel 5 news, and it has attracted the attention of our school board. Presently, they are working to disseminate the project throughout our school district.

During the final phase of the implementation, the writer administered math post-tests and student attitude questionnaires. Some students were not longer at this school. We also received some new students. Yet, all students were included in the final phase of the implementation.

CHAPTER V

RESULTS, CONCLUSIONS AND RECOMMENDATIONS

Results

Through Mental Math competitions, daily improved math instructions, systematic review, projects, increased student/teacher interaction, and the use of computers and calculators, the writer has increased fourth grade math achievement.

The writer successfully:

1. Increased the number of students who mastered their times tables.
2. Increased the number of students who made a gain on a math post-test.
3. Increased the number of students who identified math as a subject they like.

The writer's plan and goal to have at least sixty out of 104 students in the fourth grade master their times tables were definitely and successfully achieved, since all 104 students mastered their times tables. The students were considered as knowing, or mastering, the times-tables if they could respond with 100% accuracy to ten flash-card multiplication problems within ten seconds. However, twenty students out of 104 knew their times tables, but were not proficient. Although These twenty students were not able to respond to the ten flash-card multiplication problems within

ten seconds, they eventually came up with the correct answer.

The table below shows the number of students mastering times tables at the beginning and end of school year. It also shows the total for both categories. The total is useful for comparative purposes.

Table 1 Summary of Student Times-Table Performance

C=Class

	C1	C2	C3	C4	C5	Total
Number of Students Displaying 100% Mastery in the Times-Tables at the Beginning of School Year	5	3	4	7	5	24
Number of Students Displaying 100% Mastery in the Times-Tables at the End of School Year	23	23	22	22	14	104

The writer tabulated the check marks on the students Times-Table Performance Record (see Appendix D). To receive a check mark, each student had to answer ten flash-card multiplication problems correctly. These students then were considered having 100% mastery in the times-tables. The check marks were converted into numbers. The numbers for "Number of Students displaying mastery of the Times Tables at the End of School Year" add up to 104.

The Student Times-Table Performance Record was a teacher observation check list. It also contained precise information regarding individual student's times table

performance during in-class competition and fourth grade competition. It served to help the teacher in identifying students who needed additional help in times-tables.

The Teacher Evaluation Instrument (see Appendix C) was used to record student times-table performance. After tallying the teacher's check marks on the Student Times-Table Performance Record Sheet, the check marks were converted into numbers for ease of understanding. The total was derived by adding up five numbers, one from each fourth grade class. While all 104 students know their times-tables, twenty students did not appear to know the times-tables fluently during in-class competitions. Only thirty-eight students responded quickly to multiplication problems during fourth grade competition. The writer feels that there are factors that could affect the student's times-table performance such as competitions. According to the Teacher Evaluation Instrument (see Appendix C), students did extremely well under no pressure. Besides, students' performance decreased during intense competition such as a grade-level competition.

The second objective was to have thirty out of 104 students in the fourth grade make a gain of at least 10% on a math post-test.

This objective was achieved easily. The number of students attaining a 10% gain exceeded the original plan. After the writer administered the math post-test, the number of students scored below 40% were tabulated and recorded on

the Pretest and Post-test Record Chart (see Appendix H). The number for each class was recorded separately. For comparison purposes, the post-test results were listed next to the pretest results. The difference between the pretest and post-test helped the writer determine the number of students making a gain. Table 2 summarizes the comparison of the two tests.

Table 2 Summary of Math Pretest and Post-test

C=Class

	C1	C2	C3	C4	C5	Total
Pretest Below 40%	17	20	21	18	9	85
Post-test Below 40%	0	1	1	1	0	3
Number of Students Scoring 50% or Higher	23	22	21	21	14	101

Although most students scored 64% or higher, to accommodate the objective, the writer compiled the number of students scored 50% or higher. These students were considered making a 10% gain. The writer was elated to see all students in the writer's class scoring 88% or higher. Three students from Class 1 and 3 scored 100%.

The writer's third objective was to have fifty out of 104 students in the fourth grade identify math as a subject they like on the Student Math Attitude Survey (see Appendix G). For "I like math," 101 students checked "Yes" to this item. After compiling students' responses, the raw data was

converted into numbers for ease of understanding. Each check mark represented one student. The total for each class was recorded using a Teacher Evaluation Instrument (see Appendix I). For comparison purposes, both beginning and end of school year survey results were recorded next to each other. The writer was surprised by the number of students who "liked" math at the end of school year. The results of the third objective are illustrated by the following table:

Table 3 Summary of Student Attitude Survey

C=Class

	C1	C2	C3	C4	C5	Total
Number of Students like math at the Beginning of School Year	5	3	2	2	4	16
Number of Students like math at the End of School Year	23	21	21	22	14	101

The result of the student attitude survey was significant. The items on the attitude survey helped teachers in deciding which math activities teachers should continue to have, and what type of activities to center upon to increase motivation and self-confidence of their students in math achievement. The third objective could be identified as very successful as 101 students in the fourth grade identified math as a subject they "like".

The writer was proud of the success of her mathematics

program. It changed whatever negative attitudes toward math students might have had, enhanced their math skills such as in problem solving, basic skills, and mental computation. Furthermore, the fourth grade students now have a positive attitude toward learning. Their school work, in general, showed a gainful improvement.

Conclusion

Based on the results gathered, the writer concluded that with the appropriate teacher effort, students would be motivated and have self-confidence in mathematics. The key, the writer found, was (a) providing daily, improved math instructions such as Mental Math and creative math assignments, (b) providing systematic review such as basic math drills and abstract recalls, (c) designing math projects such as math games and problem solving with real-life situations, (d) increasing student/teacher interaction by constant teacher encouragement and incentives, (e) providing discussion sessions to get the students' feedback on math instructions, (f) offering special tutoring sessions for needed students, (g) having competitions, and (h) utilizing technology such as computers and calculators.

The writer was very fortunate to be assigned to teach a special class in an inner-city school. The writer had the flexibility to provide enrichment activities to fourth grade students in the mathematics program that resulted in

phenomenal improvements in students' math abilities. The principal of our school was very supportive, as she often invited school district personnel, school board members, and others to observe the method that the writer used to teach mathematics. Teachers at the fourth grade level have become proficient in using the method and find the method excellent. By observing the math activities in practice, many teachers, even the school's principal, were familiar with the method, and could demonstrate it comfortably.

The fourth grade students in our school have experienced challenging enrichment activities in math. They were involved in activities that have helped build their confidence, such as constant Mental Math practice. Individual and group games and competitions made math fun. Students were motivated through practical applications of word problems and everyday examples. For example, the students were given an assignment to go grocery shopping with their parents. They were to help purchase $5.00 worth of groceries. The food or items purchased were to be considered the best buy, healthy, useful, and appealing. This activity helped the students learn the value of money. It helped them make judgements on what was considered healthy, useful, and appealing. Most important, it required the students to make cost estimates and cost comparisons. The students learned that there were different approaches to solve math problems. Over an eight month period, the writer was able to get 104 out of 104 students to know their times tables, 101

out of 104 student to make a 10% gain on the math post-test, and 101 out of 104 students to like math.

After the demonstration of a Mental Math activity, one fourth grade teacher said, "I am also learning. When I was in school, no-one ever taught me how to use different ways or strategies to solve math problems". Another fourth grade teacher commented, "With this kind of work, their creativity spills over into other areas as well. They began to think more in general. It develops them more as a whole person".

The writer has used Mental Math techniques, competitions, calculators, computers, systematic review, math games, and game designs to build up students' self-confidence, motivate students to learn math, improve their test scores, and change the students' attitude toward mathematics.

Recommendations

It is this writer's opinion that a similar math program should be used in any classroom where lack of motivation and self-confidence is the issue.

Children at the fourth grade level are special because they have jest advanced from the primary grades to the intermediate grades. By now, they should have a good understanding of the number system, including place value, inequalities, telling time, counting money, and the relationship among basic operations. In the fourth grade,

the emphasis is placed upon the mastery of basic operations in addition, subtraction, multiplication and division. They also are introduced to concepts of computation involving fractions, mixed numbers, and decimals.

The writer feels that fourth grade is a crucial grade in which a teacher can make a significant impact on a child's competence in mathematics. Often children are exposed to math topics slowly over years and in pieces. With addition and subtraction at the early years, and geometry and algebra years later, they wind up being intimidated by mathematics. The students in the fourth grade should learn math facts, math applications, the importance of accuracy in computation, and the importance of math in their lives. Educators should design math programs to help students understand fundamental mathematical concepts, and develop the students' ability to apply their knowledge in problem solving.

Often teachers were competitive among themselves. One major factor to the success of the writer's implementation was being able to foresee teacher competitiveness as a problem, and making every effort to avoid conflict situations. For example, class against class competition should be avoided. It was perfectly acceptable to the teachers if the children went into competition against each other without an obvious division between classes. During the competitions, students from both classes should be mixed on the two teams. In this fashion, possible hostility that may have existed between classes would be eliminated. This

strategy also could help the students feel "right at home," and comfortable in unfamiliar situations.

The writer recommends that teacher training sessions be provided to a grade level representative from every school. After the representatives are trained, they could teach their classes, and use their classes as models to demonstrate mathematics techniques to the other classes in their schools. Often teachers do not have a clear understanding of the subject-matter being presented. Teachers could be better prepared and trained at very little cost.

The writer also would recommend that math textbooks should only be used as a reference or guidance to the math curriculum. Teachers should try every effort to provide a specially tailored mathematics curriculum for their students. Before and after school math tutoring also should be provided to students who are having difficulties. Schools can use volunteers or capable math students to serve in the capacity of math tutors.

Computers and calculators should be used to help promote enthusiasm and creativity, increase interest in math, develop confidence in problem solving, and help understanding basic concepts of math. Computers and calculators have acted as motivational tools for the fourth grade students. The writer is certain that they also will act as motivational tools for many other students.

A strong mathematical foundation, even if begun at the fourth grade, would serve students very well. If all the

above recommendations could be implemented through out our nations' schools, ten our national educational goal of becoming the best in mathematics could be achieved before the year 2000.

Dissemination

The First Annual Mental Math Grand Championship Competition, which was held on April 27, 1990, attracted the attention of our school board. They have sent representatives to attend the competition, and may disseminate the project throughout the schools in our county. The writer's ultimate goal is to see improved math techniques such as Mental Math and Math Games implemented throughout our county's schools, in our state, and in the United States. The improved techniques do not require much funding. All it takes is teachers' willingness to try, and carry out the project faithfully. Any publicity regarding this project through the media or newsletters will help boost its widespread use in the schools.

Plans have already been made to implement the writer's mathematics program for all grade levels in her school for the up-coming school year. Many teachers, kindergarten through fifth, have already supplemented their math curriculum with Mental Math techniques.

The writer's immediate plan is to present a session at our county's Council of Teachers of Mathematics

Conference on August 23, 1990. The writer will present the Practicum results and her mathematics program at the conference.

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APPENDIX A

MATH ATTITUDE QUESTIONNAIRE

APPENDIX A

MATH ATTITUDE QUESTIONNAIRE

1.	I like math.	Yes	No	Sometimes
2.	I feel I learned a lot in last year.	Yes	No	Don't Know
3.	The math homework was. . .	Hard	Easy	Just Right
4.	My teacher checked my homework and explained my errors.	Yes	No	Sometimes
5.	We participated in math competitions in class last year.	Yes	No	Don't Know
6.	We participated in math competitions with other classes or schools.	Yes	No	Don't Know
7.	Competitions are fun for students.	Yes	No	No Opinion
8.	We designed and played special math games in class last year.	Yes	No	Don't Know
9.	We did special math projects in class last year.	Yes	No	Don't Know
10.	I feel math is an important part of school.	Yes	No	No Opinion

Comments:

Math would be more fun for me if I could_____

_____

_____

My favorite part of math is_____

_____

My least favorite part of math is_____

_____

APPENDIX B

MATH PRETEST

APPENDIX B

MATH PRETEST

Round to the nearest 10

1. 526
2. 9,121
3. 451
4. 70
5. 8,249

Add

1. 5 + 4 + 6 =
2. 6 + _____ + 2 = 16
3. 7 + 2 + 0 + 5 =
4. 3 + 7 + _____ = 11
5. 23 + 35 =

Subtract

1. 16 - _____ = 7
2. 24 - 8 =
3. 300 - 19 =
4. 109 - 100 =
5. 41 - 9 - 8 =

Multiply

1. 23 x 4
2. 29 x 4
3. 313 x 5
4. 105 x 9
5. $5.46 x 8

Divide

1. 22 / 2 =
2. 488 / 4 =
3. 693 / 3 =
4. 2468 / 2 =
5. 567 / 7 =

Problems Solving

1. The camp has 62 cabins. Each cabin has 8 beds. How many beds are in all the cabins?

2. Ann learned to identify 12 plants each day for 8 days. Roberto learned to identify 19 fewer plants than Ann. How many plants could Roberto identify?

3. Mrs. Su has 92 flowers planted in her garden. If 68 are roses, how many are marigolds?

4. There are 108 passengers on the plane traveling to England. 39 are children. How many are adults?

5. Daniel sent away for some stunt motorcycle models. He ordered a stunt cycle for $9.99, a jet cycle for $12.33, and a chopper for $10.99. How much did he pay in all?

6. There are 45 goldfish and 5 goldfish bowls. How many goldfish in each bowl?

7. Each balloon ride costs $81.00 and $7.00 for fuel. What is the cost per person if 4 people share the ride?

APPENDIX C

TEACHER EVALUATION INSTRUMENT

STUDENT TIMES-TABLE PERFORMANCE CHART

APPENDIX C

TEACHER EVALUATION INSTRUMENT

STUDENT TIMES-TABLE PERFORMANCE CHART

C=CLASS

Activity	C1	C2	C3	C4	C5
Number of Students Knowing Times Tables At the Beginning of School Year					
Number of Students Knowing Times Tables At the End of School Year					
Number of Students Knowing Times Tables During In-Class Competitions					
Number of Students Knowing Times Tables During Fourth Grade Competition					

APPENDIX D

STUDENT TIMES TABLE PERFORMANCE RECORD

APPENDIX D

STUDENT TIMES-TABLE PERFORMANCE RECORD

S=Student C=Class

A=Knows Times Tables B=Does Not Knows Times Tables

D=Know Times Tables, But Not Proficient E=Cannot Measure

F=In Class Competition G=Fourth Grade Competition

S	C	A	B	D	E	F	G
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							

APPENDIX E

STUDENT PRETEST AND POST-TEST SCORE RECORD

APPENDIX E
STUDENT PRETEST AND POST-TEST SCORE RECORD

Student	Class	Pretest Score	Post-test Score
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			

APPENDIX F

STUDENT MATH ATTITUDE SURVEY

BEGINNING OF SCHOOL YEAR

APPENDIX F

STUDENT MATH ATTITUDE SURVEY
BEGINNING OF SCHOOL YEAR

Items	Yes	No	Sometimes	Don't Know
I like Math.				
I feel I learned a lot in math last year.				
The math work was easy.				
My teacher checked my work and explained my errors.				
We participated in math competitions in class last year.				
We participated in math competitions with other classes or schools.				
Competitions are fun for students.				
We designed and played special math games in class last year.				
We did special math projects in class last year.				
I feel math is an important part of school.				

APPENDIX G

STUDENT MATH ATTITUDE SURVEY

END OF SCHOOL YEAR

APPENDIX G

STUDENT MATH ATTITUDE SURVEY
END OF SCHOOL YEAR

Items	Yes	No	Sometimes	Don't Know
I like Math.				
I feel I learned a lot in math this year.				
The math work was easy.				
My teacher checked my work and explained my errors.				
We participated in math competitions in class this year.				
We participated in math competitions with other classes or schools.				
Competitions are fun for students.				
We designed and played special math games in class this year.				
We did special math projects in class this year.				
I feel math is an important part of school.				

APPENDIX H

TEACHER EVALUATION INSTRUMENT

PRETEST AND POST-TEST RECORD CHART

APPENDIX H

TEACHER EVALUATION INSTRUMENT

PRETEST AND POST-TEST RECORD CHART

C=CLASS PT=PRETEST PST=POST-TEST

#=TOTAL NUMBER OF STUDENTS MAKING 10% GAIN

Class	PT Below 40%	PST Below 40%	#
C1			
C2			
C3			
C4			
C5			

APPENDIX I

TEACHER EVALUATION INSTRUMENT

STUDENT ATTITUDE RECORD CHART

APPENDIX I

TEACHER EVALUATION INSTRUMENT

STUDENT ATTITUDE CHART

A=NUMBER OF STUDENTS LIKE MATH AT START OF SCHOOL YEAR
B=NUMBER OF STUDENTS LIKE MATH AT THE END OF SCHOOL YEAR
C=CLASS

Class	A	B
C1		
C2		
C3		
C4		
C5		

APPENDIX J

MATH SHOPPING ACTIVITY

APPENDIX J
SHOPPING ACTIVITY

The students were given an assignment to go grocery shopping with their parents. They were to help purchase $5.00 worth of groceries. The food or items purchased should be considered the best buy, healthy, useful, and appealing. The students compared their lists and presented their findings in an oral report format. This activity helped the students learn the value of money. It helped them make judgements on what were considered healthy, useful and appealing. Most important, it required the students to make cost estimates and cost comparisons. The students learned that there are different approaches to solve math problems.

APPENDIX K

MENTAL MATH ACTIVITIES

APPENDIX K
MENTAL MATH ACTIVITIES

Divide the class into two teams. Teams can be divided into:

1. boys against girls
2. class against class
3. mixed teams with alternating students from different classes.

The teacher stands in front of the two students, holding teacher-made multiplication flash cards in front of them. The students are first given as much time as they need to compute the problem in their heads. Then they are given five seconds to respond.

The second round, the student who can defeat his/her opponent gets to stay to compete with a new opponent while the "loser" moves to the end of the line.

In the third round, eight champions are selected. Each competitor needs to defeat five opponents in a row in order to be one of the champions. The students compete in this second level using intermediate difficulty cards.

Two champions are selected from the eight intermediate champions to compete to choose two "Grand Champions." Each champion needs to defeat his/her opponent twice in a row to be the grand champion. The grand champions compete with the advanced level cards (three-digit multiplication). They must solve the problem within five seconds. Certificates are given to eight intermediate champions and special certificates given to the grand champions, first and second place.

APPENDIX L

TEACHER SURVEY ON MENTAL MATH ACTIVITIES

APPENDIX L

TEACHER SURVEY ON MENTAL MATH ACTIVITIES

1.	Do your students enjoy Mental Math activities?	Yes	No
2.	Do your students feel Mental Math is too difficult for them?	Yes	No
3.	Are your students showing more interest in math because of exposure to Mental Math activities?	Yes	No
4.	Do you see an improvement in your students' math skills?	Yes	No
5.	Is there an improvement in the students' test scores?	Yes	No
6.	Do you feel Mental Math has motivated your students in math?	Yes	No
7.	Do you do Mental Math practice in your class?	Yes	No
8.	Do you try to incorporate Mental Math into your math curriculum?	Yes	No
9.	Do any of your students initiate Mental Math activities in your class?	Yes	No
10.	Do you feel Mental Math is too difficult for your students?	Yes	No

Comments:

Mental Math is fun because_____

_____

_____

_____

It would be better if the following improvements could be made:

(Use back of the paper if necessary.)

APPENDIX M

PARENT LETTER - MATH GAME DESIGN CONTEST

APPENDIX M
PARENT LETTER - MATH GAME DESIGN CONTEST

January 9, 1990

Dear Parents:

The first annual Mathematics Game Design Contest for P G fourth grade students will take place on Wednesday, February 28, 1990.

The purpose of the contest is to promote creativity, interest in math, enthusiasm for problem solving, self-confidence, and teamwork by having students design their own games based on mathematics and enter them in competition. Examples might include board games, calculator games, and computer games. All students are encouraged to participate.

The individual math games should be original in idea and strategy, but parents are encouraged to assist and guide their children in their designs.

There will be one first place winner, two second place winners and two third place winners. Awards will be given. Please feel free to call me at . - should you have any questions or concerns regarding this contest. Good luck!

Sincerely,

Hui Fang Hsiang Su

Mrs. Hui Fang H. Su
Fourth Grade Teacher
Math Coordinator

APPENDIX N

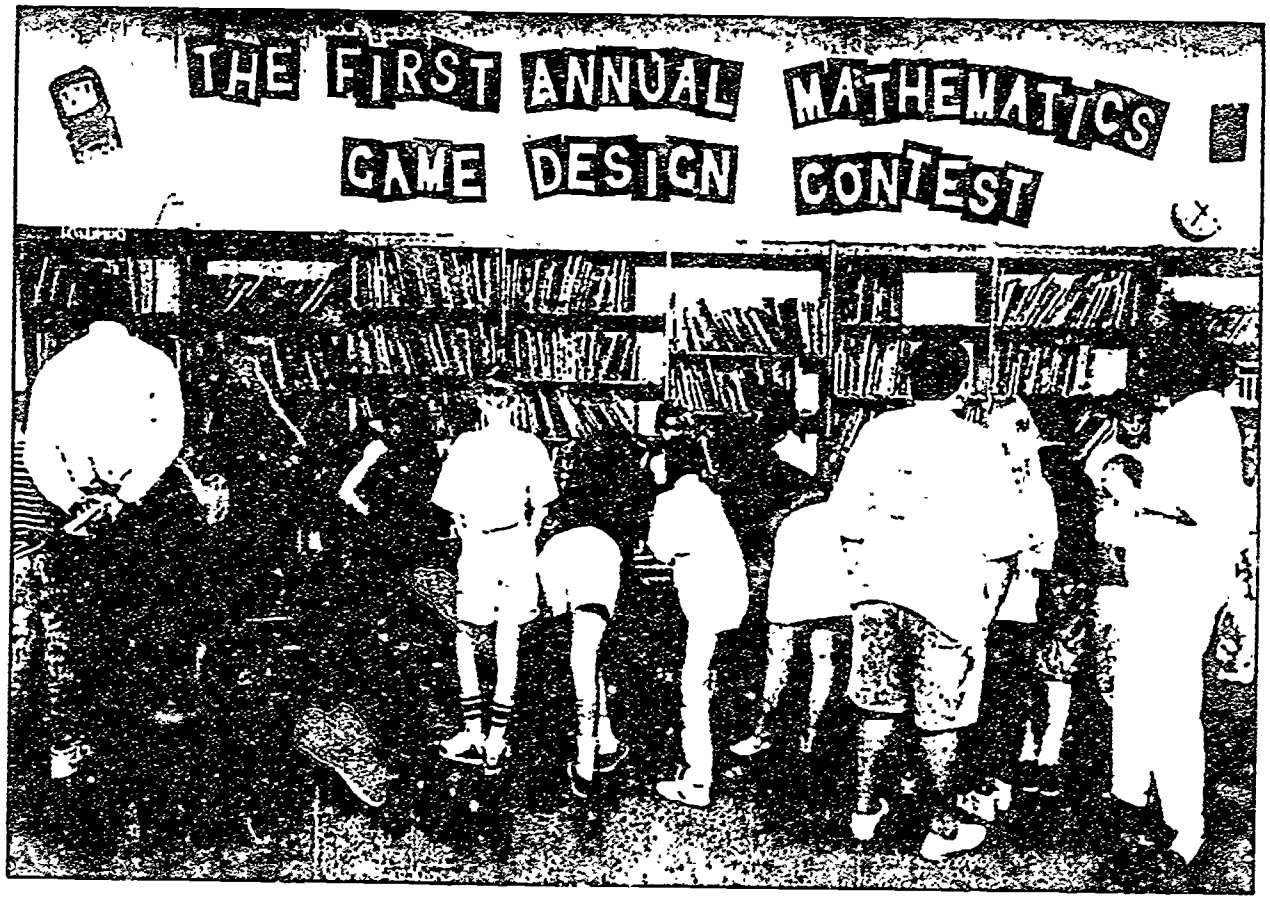
NEWS ARTICLES - MATH GAME DESIGN CONTEST

Staff photo/SEAN DOUGHERTY

THE SUM IS FUN

N S and D W listen as their fourth-grade classmates at P G Elementary School describe math games they have designed. The assignment was intended to make math fun.

R C 's Monopomath won first place.



Staff photos/SEAN DOUGHERTY

P G Elementary School fourth-graders gather around a table to try out some of the math games.

NUMBER GAMES

Creative competition motivates elementary students to learn math — and even to like it.

By WENDY CULBREATH
Staff Writer

When teacher Hui Fang H. Su conducted a poll on math last September, 90 percent of the fourth-graders at P G Elementary School said they hated it.

Now, at least as many say they like the subject, thanks to new games that make learning fun.

Out of 110 fourth graders at the school in D B , 40 percent became inventors in the school's first-ever Mathematics Game Design Contest.

"I noticed that students were not well motivated in the math area. so I came up with some various activities," Su said. "I didn't expect so many kids to turn out for this. They're all feeling very good about themselves."

There were no losers in the contest, which taught children pply what they are learning in school to something they use with friends and family.

put lots of work into this," said R C , 10, the first-place winner of a 35-mm camera. "If I didn't win, I could still play with my cousins and get practice out of it."

His game called "Monopomath" was set up like the popular board game Monopoly. To move forward, players must give correct answers to multiplication problems on flash cards.

"When I was playing against my parents, I found that I learned a little bit more," he said.

While judges made their choices for first prize and two second and third prizes, the children were allowed to play with their peers' inventions.

C V , 10, won second place for her "Beauty Math" game for girls. The object of her board game is to acquire as many cosmetics as possible by correctly answering multiplication problems.

"It's interesting that kids can come up with stuff like this," said J H , 10. "Multiplication for children should help them when they grow up to get jobs ... with money you have to know how much to take in and give out."

Judges included four math teachers, principal J K , and Dr. L , a mathematics professor at F A U in B R .

L said a creative approach like a math game is often what s needed in education. The basics are important. Looking at what you already know about and changing them around a bit — that's how you get things done."

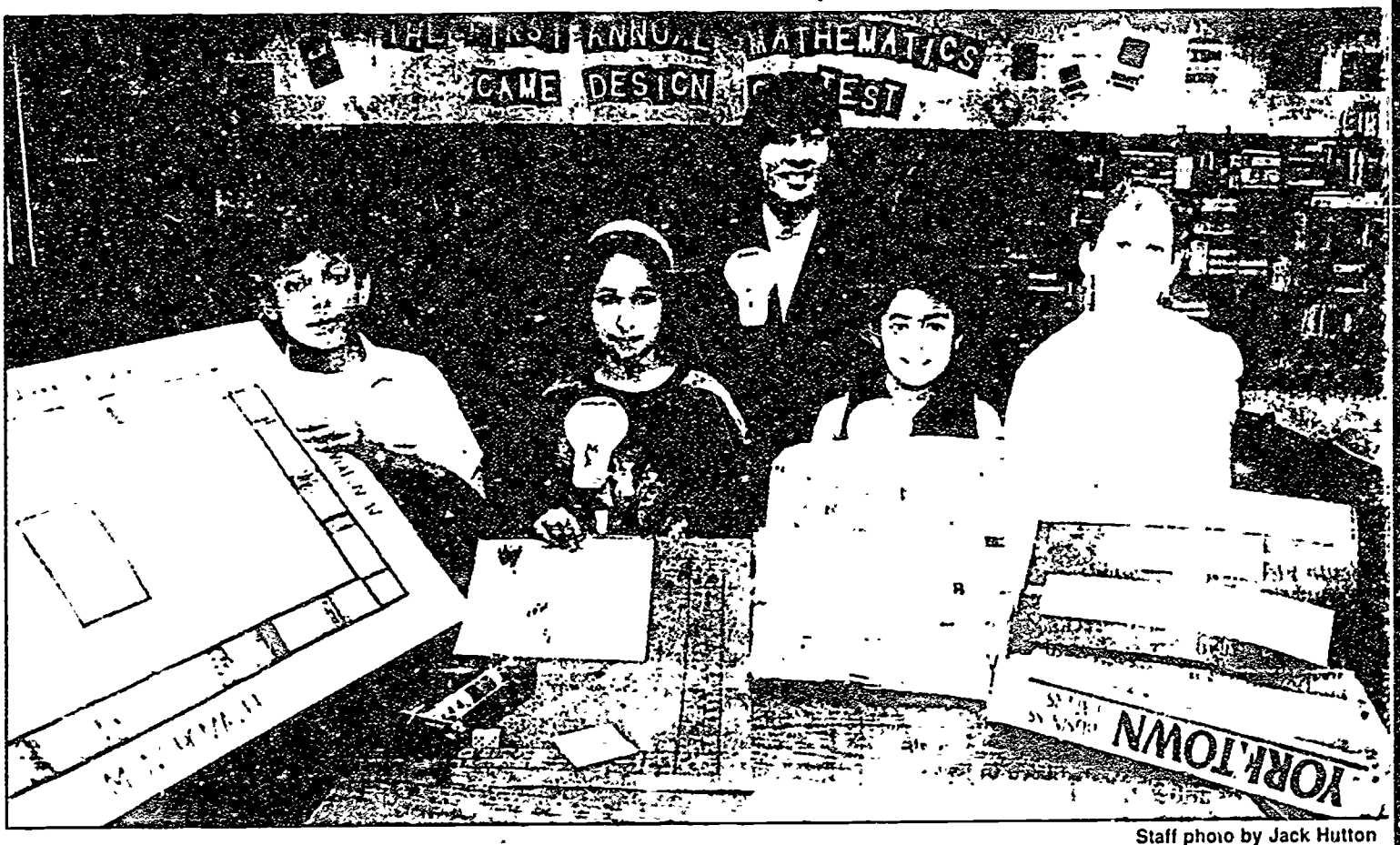
Next year Su hopes to get city officials and other members of the community involved in the judging process.

"With this kind of work, their creativity spills over into other areas as well," said teacher S R "They began to think more in general — it develops them more as a whole person."

ERIC

93

The people page



Staff photo by Jack Hutton

Winners of mathematics game creations at P G Elementary School in D B are. (from left) R C , first place; C V , second place; A P . second place; and S P , third place. With the winning students is Hui Fang Su, the math coordinator and fourth-grade student

Pupils add to their achievements

Fourth-grade students at P G Elementary School in D B recently were challenged to design math games.

The first annual Mathematics Game Design Contest was created to promote creativity, interest in math, enthusiasm for problem solving, self confidence and team work, according to Hui Fang Su, math coordinator and fourth grade teacher.

Winners of the contest are R C , first; C V and A P , second; and S P and D T , third.

101

APPENDIX O

SAMPLE PROBLEMS AND RULES FOR TEACHERS

APPENDIX O

SAMPLE PROBLEMS AND RULES FOR TEACHERS

Dear Fourth Grade Teachers:

The First Annual Mental Math Grand Championship Competition will be held on Friday, April 27, 1990 from 10:00 A.M. to 11:00 A.M.

The purpose of this competition is to increase interest in math, develop self-confidence, reinforce problem solving skills as well as basic math skills, promote abstract thinking and concepts, and promote teamwork and harmony between classes.

The rules for the competition are as follows:

1. Choose a team from each fourth grade class to compete in each of the 4 events. Each team should have 5 members.
2. Each team member must compete in all 4 events.

Events:

1. Word Problems

   A word problem will be read only once. Each student will solve the problem in his/her head without paper or pencil.

   Sample:

   Joe bought 2 packages of flower seeds for .50¢ each. He also bought some pots that cost $2.00 each. The clerk gave Joe $1.00 change from a ten dollar bill. How many pots did Joe buy? (Ans. 4)

The first student to come up with the answer stays in the competition until he/she has defeated all opponents.

2. Mental Math Multiplication with flash cards as visual aids

   a. Two-digit

      Students will compete in two-digit mulitiplication problems.

Sample:

26 x 8

b. Three-digit

Students will compete in three-digit multiplication problems.

Sample:

318 x 9

All problems will be computed mentally, using only visual aids.

3. Mental Math Multiplication

Students will compete in two-digit multiplication problems mentally, without using aids.

Sample:

89 x 7

4. Mental Math Equations

Students will mentally solve math equations composed of different operations.

Sample:

What is 3 x 60 / 5 / 6 x 9 - 5 = ?

One winner will be chosen in each of first, second, and third place categories. Awards certificates will be given.

Please feel free to talk to me should you have any questions, concerns, or suggestions regarding this competition. I will be more than happy to provide you with a set of self made Mental Math flash cards for your classroom use, if you have not already had a set made up. Please lead your own in-class Mental Math competitions prior to selecting your 5 class representatives.

Thank you for your cooperation.

Sincerely,

Hui Fang H. Angie Su
Fourth Grade Teacher
Math Coordinator

APPENDIX P

INVITATION

APPENDIX P

INVITATION

March 9, 1990

Dear

You are cordially invited to attend our in-school First Annual Mental Math Grand Championship Competition.

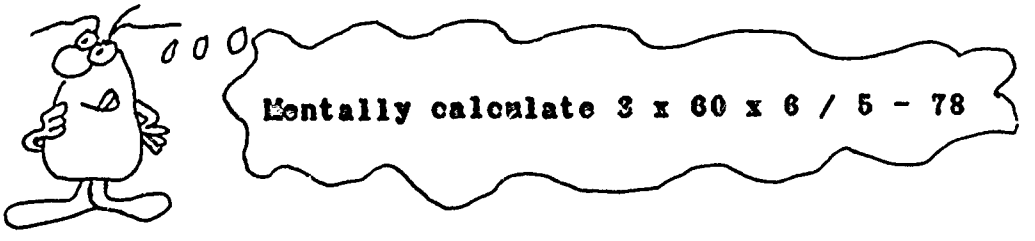
Date: Friday, April 27, 1990

Time: 10:00 A.M. to 11:00 A.M.

Refreshments will be served.

Sincerely,

Hui Fang H. Angie Su
Fourth Grade Teacher
Math Coordinator



APPENDIX Q

RULES FOR JUDGING MENTAL MATH COMPETITION

APPENDIX Q
Rules for Judging The First Annual Mental Math Grand Championship Competition

Five fourth grade classes will each be represented by five class representatives for a total of 25 contestants. There will be four events in the competition: Word Problems, Mental Math Multiplication with Flash Cards, Mental Math Multiplication without Cards, and Mental Math Equations. There will be five rounds and a grand championship for each of the four events. For each round, five contestants (one from each class by lot) will compete against each other. The first student to respond to five problems correctly will be the intermediate champion of each round in each of the four events. One intermediate champion will be chosen in each round. The five intermediate champions will then compete for the grand championship title for that particular event using the same procedure.

The contestants will face the audience, and the judges will be seated in front of the stage with their backs to the audience. Questions will be projected on the stage wall behind the contestants for the benefit of the judges and the audience.

The judges will mark on the answer sheet (in the appropriate box) the letter of the student who is first to answer each question correctly. Four different answer keys/scoring sheets will be provided for each of the four events. The judges will tally and compare their score sheets

to select five intermediate champions in each round for each of the four events. Then they will also tally and compare their score sheets to select one grand champion for each of the four events Awards will be given to first, second, and third place champions for each of the four events according to the number of tallies received in the grand championship round.

I will be available to assist should you have any questions regarding judging procedures. Thank you.

Hui Fang Huang Angie Su
Fourth Grade Teacher
Math Coordinator

APPENDIX R

MENTAL MATH COMPETITION

ANSWER KEY/SCORE SHEETS

Event I - Multiplication
Answer Key/Scoring Sheet

1. 7 2 x 6 = 432	2. 4 1 x 7 = 287	3. 3 0 x 8 = 240	4. 4 0 x 9 = 360
5. 1 3 x 6 = 78	6. 1 8 x 7 = 126	7. 2 2 x 8 = 176	8. 2 6 x 6 = 156
9. 1 1 x 9 = 99	10. 1 5 x 7 = 105	11. 7 8 x 7 = 546	12. 9 1 x 6 = 546
13. 3 9 x 9 = 351	14. 8 4 x 8 = 672	15. 7 9 x 6 = 474	16. 6 7 x 7 = 469
17. 8 4 x 8 = 672	18. 7 7 x 9 = 693	19. 9 8 x 6 = 588	20. 9 1 x 8 = 728
21. 9 6 x 9 = 864	22. 5 4 x 6 = 324	23. 9 4 x 8 = 752	24. 6 4 x 7 = 448
25. 6 3 x 8 = 504	26. 3 9 x 9 = 351	27. 3 8 x 8 = 304	28. 5 6 x 7 = 392
29. 7 9 x 9 = 711	30. 6 6 x 8 = 528	31. 8 6 x 9 = 774	32. 6 7 x 6 = 402
33. 7 0 x 7 = 490	34. 5 9 x 8 = 472	35. 7 5 x 6 = 450	36. 9 5 x 9 = 855
37. 9 7 x 7 = 679	38. 9 7 x 8 = 776	39. 7 3 x 9 = 657	40. 5 4 x 9 = 486
41. 2 8 x 8 = 224	42. 7 2 x 7 = 504	43. 5 8 x 6 = 348	44. 7 5 x 8 = 600
45. 6 2 x 9 = 558	46. 4 9 x 7 = 343	47.4 4 x 6 = 264	48. 5 6 x 4 = 224

Event I Three-digit Multiplication
Answer Key/Scoring Sheet

1. 568 x 2 = 1136	2. 326 x 3 = 978	3. 636 x 5 = 3180	4. 515 x 4 = 2060
5. 352 x 2 = 704	6. 541 x 3 = 1623	7. 419 x 4 = 1676	8. 291 x 5 = 1455
9. 437 x 7 = 3059	10. 205 x 7 = 1435	11. 706 x 6 = 4236	12. 181 x 6 = 1086
13. 815 x 9 = 7335	14. 361 x 9 = 3248	15. 407 x 9 = 3663	16. 309 x 8 = 2472
17. 462 x 3 = 1386	18. 563 x 2 = 1126	19. 419 x 2 = 838	20. 208 x 3 = 624
21. 217 x 4 = 868	22. 614 x 5 = 3070	23. 730 x 5 = 3650	24. 352 x 4 = 1408
25. 121 x 6 = 726	26. 102 x 7 = 714	27. 203 x 6 = 1218	28. 341 x 7 = 2387
29. 205 x 8 = 1640	30. 240 x 9 = 2160	31. 431 x 8 = 3448	32. 503 x 9 = 4527
33. 938 x 2 = 1876	34. 129 x 3 = 387	35. 615 x 3 = 1845	36. 694 x 2 = 1388
37. 421 x 5 = 2105	38. 731 x 4 = 2924	39. 908 x 4 = 3632	40. 817 x 5 = 4085
41. 915 x 6 = 5490	42. 581 x 7 = 4067	43. 360 x 6 = 2160	44. 714 x 7 = 4998
45. 591 x 8 = 4728	46. 908 x 9 = 8172	47. 604 x 8 = 4832	48. 651 x 9 = 5859

Event II - Word Problems
Answer Key/Scoring Sheet

1. 21 miles	2. 302 miles	3. 142 miles	4. 52 appendages
5. 8 rat.sna.	6. 277 times	7. 260 squares	8. 550 pages
9. 58 cents	10. 62 yards	11. 72	12. 70
13. 156 runs	14. 71	15. $50.00	16. $90.00
17. 18 t.	18. 2544	19 1920 cans	20. 50
21. $14.00	22. 6 cars	23. $1.01	24. $2.05
25. 192	26. 675 m	27. $1.56	28. 11 oranges
29. 1920 h	30. 212 p	31. 72	32. 335
33. $15,900.	34. $27.00	35. 1260 b	36. 744 liters
37. 478	38. 208	39. $140.00	40. 281

Event III- Multiplication
Answer Key/Scoring Sheet

1. 7 2 x 6 = 432	2. 4 1 x 7 = 287	3. 3 0 x 8 = 240	4. 4 0 x 9 = 360
5. 1 3 x 6 = 78	6. 1 8 x 7 = 126	7. 2 2 x 8 = 176	8. 2 6 x 6 = 156
9. 1 1 x 9 = 99	10. 1 5 x 7 = 105	11. 7 8 x 7 = 546	12. 9 1 x 6 = 546
13. 3 9 x 9 = 351	14. 8 4 x 8 = 672	15. 7 9 x 6 = 474	16. 6 7 x 7 = 469
17. 8 4 x 8 = 672	18. 7 7 x 9 = 693	19. 9 8 x 6 = 588	20. 9 1 x 8 = 728
21. 9 6 x 9 = 864	22. 5 4 x 6 = 324	23. 9 4 x 8 = 752	24. 6 4 x 7 = 448
25. 6 3 x 8 = 504	26. 3 9 x 9 = 351	27. 3 8 x 8 = 304	28. 5 6 x 7 = 392
29. 7 9 x 9 = 711	30. 6 6 x 8 = 528	31. 8 6 x 9 = 774	32. 6 7 x 6 = 402
33. 7 0 x 7 = 490	34. 5 9 x 8 = 472	35. 7 5 x 6 = 450	36. 9 5 x 9 = 855
37. 9 7 x 7 = 679	38. 9 7 x 8 = 776	39. 7 3 x 9 = 657	40. 5 4 x 9 = 486
41. 2 8 x 8 = 224	42. 7 2 x 7 = 504	43. 5 8 x 6 = 348	44. 7 5 x 8 = 600
45. 6 2 x 9 = 558	46. 4 9 x 7 = 343	47.4 4 x 6 = 264	48. 5 6 x 4 = 224

Event III Three-digit Multiplication
Answer Key/Scoring Sheet

1. 568 x 2 = 1136	2. 326 x 3 = 978	3. 636 x 5 = 3180	4. 515 x 4 = 2060
5. 352 x 2 = 704	6. 541 x 3 = 1623	7. 419 x 4 = 1676	8. 291 x 5 = 1455
9. 437 x 7 = 3059	10. 205 x 7 = 1435	11. 706 x 6 = 4236	12. 181 x 6 = 1086
13. 815 x 9 = 7335	14. 361 x 9 = 3248	15. 407 x 9 = 3663	16. 309 x 8 = 2472
17. 462 x 3 = 1386	18. 563 x 2 = 1126	19. 419 x 2 = 838	20. 208 x 3 = 624
21. 217 x 4 = 868	22. 614 x 5 = 3070	23. 730 x 5 = 3650	24. 352 x 4 = 1408
25. 121 x 6 = 726	26. 102 x 7 = 714	27. 203 x 6 = 1218	28. 341 x 7 = 2387
29. 205 x 8 = 1640	30. 240 x 9 = 2160	31. 431 x 8 = 3448	32. 503 x 9 = 4527
33. 938 x 2 = 1876	34. 129 x 3 = 387	35. 615 x 3 = 1845	36. 694 x 2 = 1388
37. 421 x 5 = 2105	38. 731 x 4 = 2924	39. 908 x 4 = 3632	40. 817 x 5 = 4085
41. 915 x 6 = 5490	42. 581 x 7 = 4067	43. 360 x 6 = 2160	44. 714 x 7 = 4998
45. 591 x 8 = 4728	46. 908 x 9 = 8172	47. 604 x 8 = 4832	48. 651 x 9 = 5859

Event IV - Equations
Answer Key/Scoring Sheet

1. 23	2. 4	3. 76	4. 6	5. 104	6. 9
7. 9	8. 12	9. 11	10. 54	11. 4	12. 100
13. 106	14. 54	15. 33	16. 5	17. 36	18. 0
19. 4	20. 81	21. 52	22. 40	23. 0	24. 61
25. 100	26. 32	27. 7	28. 4	29. 99	30. 500
31. 13	32. 50	33. 72	34. 1	35. 20	36. 21
37. 20	38. 66	39. 96	40. 39		

APPENDIX S

MENTAL MATH COMPETITION NEWS ARTICLES

Serving Boca Raton, Delray Beach, Highland Beach and surrounding areas

PALM BEACH Plus

Sun-Sentinel, Wednesday, May 16, 1990

At P G Elementary School in D B a mental math challenge drew 25 fourth-grade students in the school's first grand championship.

The competition was designed by teacher Hui Fang H. Su to increase interest in math and reinforce problem solving skills.

The events included word problems, multiplication with and without flash cards and math equations. The results:

- Event I — D T , grand champion. Intermediate champions were J A , L B , C B , J E and K T .
- Event II — D T , grand champion. Intermediate champions were R B , E L , M M and K S .
- Event III — J E , grand champion. Intermediate champions were J A , R B , D T and K T .
- Event IV — D T , grand champion. Intermediate champions were R B , R H , A M , and K T .

Page 2C — THE NEWS — Thursday, May 10, 1990

The people page

Math grand champs

Twenty-five fourth-graders at P G Elementary School in D B competed in the school's Mental Math Grand Championship recently.

The championship was made up of four events organized by Hui Fang H. Su, a fourth-grade teacher and math coordinator. The events were: multiplication using flash cards; word problems; multiplication without flash cards; and equations.

Winners in the four contests:

- In multiplication using flashcards: D T grand champion: and J. A. L. B. C. B. J. E. and K T , intermediate champions.
- In word problems: Daniel Torres, grand champion; and R. B. E. M. M. and K. ., intermediate champions.
- In multiplication without flash cards: J E , grand champion; and J A. , R B. , D. T and K. T , intermediate champions.
- In equations: D. T , grand champion; R E , R H. A. M. M. and K. T ., intermediate champions.

Judges for the contest were Dr. J. O , associate superintendent of curriculum for P B C ; Board of Education; E. D , area administrator; Dr. R. K , director of potentially gifted minority programs; and J. K , principal of P G Elementary.

END

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