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Improving Intermediate Mathematics Problem Solving Scores Through Specific Instruction And Self-Evaluative Techniques

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by

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Running head: INTERMEDIATE PROBLEM SOLVING

Authorship Statement

I hereby testify that this paper and the work it reports are entirely my own. Where it has been necessary to draw from the work of others, published or unpublished, I have acknowledged such work in accordance with accepted scholarly and editorial practice. I give this testimony freely, out of respect for the scholarship of other workers in the field and in the hope that my own work, presented here, will earn similar respect.

Charlotte K. Lilles

ABSTRACT

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Descriptors:Algorithims/BasicSkills/Computation/ Computational Linguistics/Elementary School Mathematics/Equations/Math Achievement/Mathematics Anxiety/Mathematical Application/Mathematical Instruction/Mathematical Vocabulary/Number Concepts/Problem Sets/Problem Solving/Self-Evaluation/Symbols

The author defined a deficiency in test scores in an a fifth grade setting that consisted of above-average intelligent students and devised a treatment to remediate the targeted students. The objectives were to improve test scores; improve affective behaviors; improve basic skills knowledge; improve the concept of word problems involving money; and to increase instruction in mathematical vocabulary.

The researcher defined a target group by using a pretest. The target group worked within the heterogeneous fifth grade classroom setting. Small discussion groups were defined within the setting for the purpose of peer interaction within the discipline of problem solving. Large and small group instructional techniques were employed. Instructional and oral discussion times were increased within the setting. Problem solving heuistics were introduced and practiced. Immediate feedback was given; problems were defined; and remediation was provided. A workbook was developed that incorporated: basic skills, logic, clue-word vocabulary, affective questioning techniques, evaluative tools, a basic instructional plan, and an answer key. The results were positive in four of the five objectives. Basic mathematics facts need to be mastered earlier in the adademic program to reduce common error. (Appendixes include the developed workbook with task sheets, instructional information evaluative materials, results of surveys, results of state achievement tests, mathematics vocabulary, and letters.)

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The school was formally located in an economically depressed area in the Southeastern part of the United States. The facility was closed by the local school board due to a lack of sufficient enrollment. It was moved to a portable classroom situation to await the opening of a new county location.

The new plant was spacious and versatile. Large classrooms provided ample closet and storage areas for both the students and the educators. The rooms were carpeted and contained a sink and cabinet area that was tiled. There were opportunities to provide group activities and learning stations. Large lighted boards provided visual stimulation and were available for instruction. The walls of the classrooms were cork, and the educator was able to arrange visual stimulation in a variety of patterns. Wide hallways were able to accommodate large groups of children that could have been engaged in an activity that required gross movement and verbal exchange.

In addition to the abovementioned learning facilities, there were various supplemental amenities. There were adequate restrooms and drinking fountains. The health room contained four sick beds, refrigerator, toilet, shower, washing machine, dryer, sinks, and a cabinet area. The office area contained the latest in computer equipment, duplicating machines, and a file room. The

computer room contained thirty computers, monitors, and printers. The special area rooms were complete with all of the necessary equipment to maintain the needs of the exceptional student.

Physical education activities were provided on the adequate grassy and asphalt grounds that surrounded the school. The appropriate equipment was found on the asphalt area, such as basketball nets and painted games for play. The grassy area contained the gross motor equipment designed for physical fitness and agility. If the weather did not permit outside participation, the students were accommodated in the large cafetorium complete with a stage and sound system. This room was the focus of school and community meetings. A fully appointed media center was located within the two main areas of the school plant.

During the transition of the moving period, many of the original faculty remained. Due to the increasing enrollment, this body was increased with additional faculty. These teachers were compatible with the original faculty and this produced, in the words of the principal, ... "an extremely competent, experienced, enthusiastic, child-oriented team of ecucators who provide a superlative learning environment for our students" (SACS, 1983).

The philosophy of this group of educators was essentially child-oriented, pragmatic, reconstructive, and humanistic (Doll, 1982). Politically, the community agreed with this philosophy and purpose of education. e members of the community were basically the "old left". Sc ling that provided for an educational

process that sought to "....develop individuals who were experienced in the values and ways of democratic living....take the child and encourage him to reach his full potential..." (SACS,1983), pleased this community. They [the community] were satisfied with the school and its eclectic curriculum (Progress Report, 1984).

Goals were set in terms of the learning needs of the student population. These included efforts to maintain and promulgate: harmony between the school and the home; positive attitudes; an attractive, relaxed, organized learning facility; insured community growth; a variety of activities that promoted citizenship, cultural awareness, and social interaction; physical and mental health; self-motivation; evaluative skills that promoted comprehensive judgment; an awareness of individual differences in learning; and educational skills that would enable children to pursue a career of their choice (SACS, 1983).

> Consideration of the philosophy and the goals produced a humanistic teaching style within the school. Humanists would attempt to form more meaningful relationships between students and teachers; they would foster student independence and self-direction and promote greater acceptance of self and others. The teacher's role would be to help learners cope with their psychological needs and problems, to facilitate self-understanding among students, and

to help them develop fully (Ornstein, 1982).

Instructional strategies were designed with the stated philosophies and goals clearly in mind. The prescribed teaching techniques utilized in most traditional classrooms were used. These included the use of the latest county and state adopted textbooks. In addition, there was small and large group instruction, creative and enrichment opportunities, learning centers, remedial help, discussion groups, role-playing, simulations, demonstrations, etc. These strategies were not only promulgated within the regular classroom, but they extended to the many special areas that were available within the school. These included: music, art, gifted, and physical educations; specific learning disabilities classes; an emotionally handicapped class; an educable mentally retarded class; speech therapy; compensatory reading and mathematics enrichment; and a fully equipped science labratory.

The school was, however, limited to basic instruction, due to the school day [300 contact minutes] and a policy set forth by the local school board. This policy required that certain standards be met and maintained in a uniform manner, and this made it difficult to deviate from the prescribed local plan. On occasion, material had to be skimmed or omitted from the curriculum.

In terms of pupil-teacher ratio, this school was 32:1 within the regular classroom situation. Of the 700 members of the student body, the majority were white non-hispanic (SACS, 1983).

Table 1

Cultural Background of the Student Body

Group	Percent of Student Body
White Non-Hispanic	92.5
Black Non-Hispanic	1.7
White Hispanic	5.1
Oriental	.4
Others	.3
TOTAL	100.0

There were no pupils at the school whose ages deviated drastically from the norm for their grade placement.

The Short Form Test of Academic Aptitude was administered on a yearly basis to the students during the month of May. The results of this test indicated that the average intelligence quotient [IQ] for the student body in the third through fifth grades was 110. The students who achieved lower than 30% were tested for placement in compensatory education programs. Those testing above expectancy were screened for the exceptional student program [gifted].

Reading, writing, and mathematic ability ranges were on grade level or above in the majority of cases. These statistics were based upon the results of the California Achievement Tests [CAT] (SACS, 1983).

Table 2

Percentile Range for Reading Ability for the Intermediate Student Population

Years + or -	Grade 3	Grade 4	Grade 5
4 and above	7.2%	14.6%	23.9%
3 and above	20.9%	10.5%	20.1%
2 and above	29.0%	26.3%	20.1%
1 year above	28.2%	28.0%	20.8%
At grade level	.8%	2.6%	
1 year below	12.0%	11.4%	12.0%
2 and below	1.6%	5.2%	2.6%
3 and below		.8%	
4 and below			

Table 3

Percentile Range of Mathematical Ability for the Intermediate Student Population

Years + or -	Grade 3	Grade 4	Grade 5
4 and above	4.8%	11.2%	18.6%
3 and above	10.4%	9.5%	30.8%
2 and above	45.6%	15.6%	24.8%
1 year above	32.8%	25.2%	22.1%
At grade level	3.2%	28.6%	.6%
1 year below	3.2%	8.6%	1.3%
2 and below		3.4%	1.3%
3 and below		1.7%	
4 and below			

Table 4

Percentile Range of Writing Ability for the Intermediate Student Population

Years + or -	Grade 3	Grade 4	Grade 5
4 and above	36.0%	39.7%	67.5%
3 and above	12.8%	15.6%	13.4%
2 and above	16.8%	10.4%	9.3%
1 year above	23.2%	13.9%	3.3%
At grade level	2.4%	4.3%	
1 year below	0.0%	9.5%	4.6%
2 and below	.8%	4.3%	1.3%
3 and below		1.7%	
4 and below			

In order for the researcher to highlight the parental background of the students, it was necessary to know that the majority [parents] were white and blue collar workers. They collectively averaged 95.4% in terms of finishing high school and furthering their education. The majority continued to be biological parents to their children (approximately 71.8%). The remaining percentages were: approximately 23.8% one biological parent due to separation or divorce; 1.9% one biological parent

due to death of the other parent; and approximately 2.5% of the children in the school lived with someone other than their biological parent(s) (SACS, 1983).

The students, parents, teachers, and members of the community were in agreement that the school was serving the educational and emotional needs of the population (SACS, 1983).

The percentile scores for the fifth grade students in the school was 75 when they were tested by the Statewide Assessment Program for the mastery of the skill that required a correct response to word problems involving making change from $1.00. The percentile scores for the fifth grade students should have been 90, when tested by the Statewide Assessment Program for mastery of solving word problems involving making change from $1.00. A discrepancy of 15 percentile points existed. There was a need to improve the abstract thinking skills involving money word problems so that the fifth grade students could raise their percentile scores 15 percentile points on the Statewide Assessment Program testing instrument.

In addition, the percentile scores for the fifth grade students in the school was 79 when tested by the Statewide Assessment Program for the mastery of word problems that involved subtraction using three digits. The percentile scores for the fifth grade students should have been 90% when tested by the Statewide Assessment Program for mastery of word problems that involved subtraction using three digits. A discrepancy of 11

percentile points existed. There was a need to improve the subtraction algorithim and the abstract thought process as they pertain to the solution of word problems involving subtraction with three digits. This needed to be implemented so that the fifth grade students in the school could raise their percentile scores 11 percentile points on the Statewide Assessment Program testing instrument.

Generally stated, the problem was the word story problem, both heuristically and algorithmically, within the confines subtraction. The problem had existed for a long time in the setting (see Appendix A). The problem existed in many settings across the country.

> In a recent address to the American Educational Research Association on crucial areas for future research in mathematics, Robert Gagne indicated that one of the wereas most in need of attention was "teaching...pertaining to the translation of concretely stated problems into mathematical form. Emphasiswas needs to be given to this phase as a separate kind of capability to be learned by students" (Gagne, 1983).

Futhermore, the results of testing by the National Assessment of Educational Progress (NAEP) concluded that serious problems in the teaching of mathematical problem solving continue to exist (Darch, Carnine, Gersten, 1984).

The main thrust of the mathematics program at the school was the county adopted textbook and its supplemental activity books. These supplemental books were issued one to a teacher, and many were copyrighted material. This limited the use of some of these books. A lack of county funds prohibited each child from having more than the prescribed textbook and, in some cases, a math workbook. Any special word problem solving books were not available in the setting.

A review of the current textbooks in mathematics revealed that word problems were reserved, in most cases, for the last several problems on the exercise page, and often times, they were starred (indicating that they were on an advanced level and were to be used for enrichment). Very few were for the average learner, and the problems were very few in number.

The researcher reviewed the current basal text and found there to be 14 chapters that averaged 25 pages per chapter. Two of the 25 pages in each chapter were devoted to problem solving; although there were several word problems found within the exercises. For an example, the researcher tabulated the total number of problems found within the first four chapters of the basal text. This tabulation showed that there were approximately 1,893 student problems contained within the first 97 pages of the textbook. Of these 1,893 problems, 171 were word problems designed for the average fifth grade student. An additional 51 word story problems were presented, and they were starred items

that reflected a higher level of mathematical competence (Abbott, Wells, 1985).

A survey was distributed to the members of the faculty that taught the intermediate grades, three through five. The results of the survey revealed that of the 16 teachers responding, the average teaching time spent on instruction of story problems per week [this included any mention of the discipline] was 4.56 minutes (see Appendixes B and C).

The target group was an average to above-average group of students, and their percentile performance on the Statewide Assessment Program should have been higher in the word problem section of the stated testing instrument.

Through the intervention of the researcher, it was desired that the following objectives would be obtained:

1. After ten weeks, 80% of the target group of fifth grade students, who had specific instruction in the identification of clue words, would score 90% or above on a teacher-made and administered posttest.
2. After ten weeks, 80% of the target group of fifth grade students, who had specific instruction in the heuristics of defining a problem statement, would score 90% or above on a teacher-made and administered posttest.
3. After ten weeks, 80% of the target group of fifth grade students, who had specific instruction and

practice involving the algorithms of addition and subtraction with emphasis on three-digit numerals and word problems, would score in the 90th percentile or above on a teacher-made and administered posttest.

4. After ten weeks, 80% of the target group of fifth grade students, who had instruction in the heuristics of problem solving strategies involving money and change with values of one to nine dollars, would score 90% or above on a teacher-made posttest.
5. After ten weeks, 80% of the target group of fifth grade students, who had instruction and affective reinforcement in the solving of word story problems, would demonstrate a positive attitude toward the discipline by answering a teacher-made and administered post-survey.

Research

After a review of the literature, the researcher concluded that the nature of mathematical problem solving appeares to be extremely complex, with varying schools of thought divided on solutions to effective instructional techniques. These schools purport strategies that range from advocation of extreme constraints upon the individualization of the instructional environment (Darch, 1984), and the open-ended creativity type of strategies that stress the process and not the solution (Von

Kuster, 1984). Somewhere in the scheme of these philosophies are those who would incorporate both teaching strategies.

The National Assessment of Educational Progress (NAEP), and the National Council of Teachers of Mathematics have found in recent years that problem solving is perhaps our most pressing issue in the discipline of mathematics. Problem solving should be the focus of the mathematics curriculum. According to the National Assessment of Mathematics, 58% of 17-year-olds were unable to find the area of a square when one side was given, and 82% could not find the area of a right triangle with all sides given.

The advent of Sputnik created public outcry. Change had to occur and promptly. Texts were created that were highly sophisticated and technical. They did enhance the terminology of math, and they did introduce college level concepts at an earlier age. They did not, however, stress repetition and review. this led us to a population that cannot deal with advanced concepts that are presented rapidly in sequential order. Without repetition and drill of previously taught and semi-mastered skills, the student is left unable to deal with the complexities of the next cognitive level. Proofs of Euclidian geometry come after Algebra I, and the student must plunge into this activity without the basic skills firmly internalized through repetition and drill. The textbooks remain status quo in their philosophies (Saxon,1984).

The classroom offers the student the opportunity to learn, process, encode, and retrieve information. The organization of this information is important in the problem solving process. The successful problem-slover has the following qualities: a grasp of structure; an ability to analyze relationships; a flexible mental process; an ability to generalize; and understanding of concepts and terms; an awareness of alternative solutions; and a knowledge of basic skills (Silver,1984).

Reasearch has been done to discover the thought processes of the successful problem-solver. There are four variables that affect the learner in the problem solving situation (task, subject, process, instructional). In terms of the task variable, it was interesting to study the mediational role of the student. this was also true of the instructional task. What are the inner-thoughts of the student as learning progresses? A method that stresses "inner speech" has been developed and is being tested. The study was based on the findings of Vygotsky in 1962. The process is being refined and tested in the present day. It is a method that incorporates sequential processes along with a questioning method that elicits the thought processes from the students as they perform the task. Groups of intermediate children are selected on the basis of a pretest, and skill groups are formed. The researcher investigates the variables that affect the situation, these are discussed, and results are recorded. The questioning is both affective and cognitive. When the problem

solving begins, specific questions are asked of the solver as the process proceeds. The results are recorded and analyzed. Many times the student would offer the response that the material had been forgotten. Responses would indicate that the material had been known but not internalized due to lack of review.

In her research involving "inner speech", Rohrkemper (1984) analyzed her findings into three areas: cognitive implications; affective implications; and attributional strategies. Of the 66 students participating in the study, all agreed that division is the most difficult task. Fifty-six attributed this to external factors such as problem length and instruction. The remainder cited such internal factors as lack of confidence, bias as to subject matter, and lack of positive attitude. The subjects would rather seek the answer from the teacher as opposed to finding the answer for themselves.

In general, awareness of an inner speech pattern when solving mathematics problems gives the student a reasoning tool. This tool works for them in both an affective and cognitive manner. The student develops a sequential thinking pattern. Eventually, with knowledge and practice, self-direction is increased. All of these give the learner a self-confidence and a positive feeling about the discipline of mathematics (Rohrkemper,1984).

Other research suggests the need for the development of an inner speech. It refers to the verbalization of young children as they manipulate concrete objects while solving situation problems.

Some suggest the need for a self-questioning process (Shumway, 1980).

Darch (1984) advocates explicit instruction in problem solving. This involves the use of a model that stresses: direct strategy teaching at each cognitive level; translating the concrete into the mathematical; immediate error diagnosis; and an eventual level of self-dependency. Subjects are selected through a screening process that relies on the use of test data. Instruction lasts 30 minutes and focuses on review, instruction, and seatwork, combined with immediate error correction. Some groups receive additional practice for purposes of data. ETS, or explicit translation strategy, concerns itself with the identification of the mathematical operation required to solve the problem. Specific questions were asked as the problems are sequentially presented. Problems to match the level of difficulty are carefully introduced, with much practice and review accompanying the lesson. Mastery is the goal.

The research on ETS yielded an internal coefficient alpha of (N=73) .80 posttest, .87 for maintence, correlation between the posttest and maintence was .70. All lessons were audio-taped. Compared with a control group that used the basal instruction from four approved sources, ETS scored in the 80-85% accuracy range as compared to 60-65% for the basal control group. Construct validity showed the ETS students enjoyed the tasks, felt they had learned "a lot", and felt they used the learned skills more than

the basal group. The basal group disliked the formulation of story problems, which is included in the basal method of instruction. The basal group had an average of 6.7 extra lessons, and they still scored behind the ETS students (Darch, 1984).

A similar approach to problem solving is mentioned in the Marion Indiana Study (Wheatley, 1984). This study reported a jump of 40 points in the elementary mathematics scores. Teacher strategies centered on four goals; meaning and understanding; problem solving; mastery of basic facts; and study of prescribed units at each grade level. The methods included the use of manipulative materials, pacing, and the introduction of basic problem solving heuristics.

The program was introduced at the beginning of the year and centered on problem solving. All disciplines of the mathematics review curriculum were incorporated into the selected problems. These were samples of all mathematical operations learned. The following heuristic strategies were taught: look-for-a-pattern; make-a-list; guess-and-test; draw-a-diagram; and break-into-parts. The unit was motivating and was paced.

Teacher attitudes towards problem solving reversed and the test scores rose. Before the introduction of the program, results of the Iowa Test of Basic Skills (ITBS) for grades 4 through 6 had been in the 32 to 50% range. After one year, the scores were in the 59 to 83%. Grade 5 went from 43% in 1980 to 73% in 1981.

Grade 6 went from 41% in 1979 to 82% in 1983. Overall averages were 82% in 1983.

After researching many designs to develop thinking strategies, Silver (1984) concluded that there were no "best" ways to teach problem solving. Five areas of research were mentioned as having significance. It was interesting to note that again, the importance of knowing the basic skills, and having a basic knowledge of problem solving heuristics, were some of the components discussed. This researcher stresses the importance of moving from a domain independence to a domain specific method of problem solving. Silver agrees that skills are necessary and abstract thinking should be the end result. The affective domain was hard to measure, but confidence was built using methods that incorporated the use of calculators, gearing problems to the specific level of the student, and offering praise. Difficulties in understanding were over-come by altering the problem statement and omitting extraneous material. Problems were geared to the interest of the students' real-life experiences. This increased motivation.

Saxon (1984) would have us combine the old and the new. He stresses drill and repetition. His book on the subject has been rejected by the "experts" as being too traditional. He feels, on the other hand, that current basal texts which were formulated on the work of Polya (Shumway, 1980) and others of his philosophy, do not offer the review and repetition necessary for basic

understanding. These basals stress discussion of the problem and possible strategies. Students were encouraged to look for different strategies. Activities were to be viewed in the light of the child's experience. Abstractions were often presented and not explained. He feels that concepts were introduced and then forgotten in the scheme of things. These concepts, if not repeated and reviewed, will be lost to the student in time.

There were those who were willing to accept the thoughts of Saxon (1984), and they adopted his teaching strategies.
The results of reasearch certified by the Oklahoma Federation of Teachers, and based on a pilot program involving 1,365 ninth grade students in 20 Oklahoma public schools, showed gains. The test group scored twice as high as the control group. Their California Achievement Scores were also higher. The study was retested with similar results in the Oklahoma City schools in 1981 and 1982. Amarillo, Texas, and Hillsboro, Ohio, also showed gains using this strategy of learning.

The results of word problem sloving in the area of percentage was interesting. The subjects in the test group were given three word problems involving percentage to solve each night. The average correct response was 1.09 for the test group as opposed to .32 for the control group which had no extra practice. The least "gifted" student out scored the "most" gifted student by 1.53 as opposed to .52.

In an opinion article, devoid of statistics or other facts, VonKuster (1984) advocates his problem solving methods. These are open-ended, and stress the solution, not the answer. If the solution was reasonable, the problem was counted correct, even if the answer was wrong.

The trend in problem solving for mathematics seems to be to take the basics of Polya, and combine them with specific task-specific heuristics. This, according to Putt seems to be effective (Shumway, 1980). He [Putt] claims that fifth-grade students can learn to solve problems in a relatively short time if they learn to ask themselves questions, and they have a basic knowledge of problem solving strategies and skills. The studies of Marcucci, mentioned in both the text of Shumway (1980), and the journal article of Darch (1984), suggest that guided "discovery" was rarely effective, yet, this method was the basis for the majority of basal texts. Discussion methods and "possible" solutions appear to be questionable with lower level students; to have them formulate problems on the basis of their experience seems to be ineffective. It limits the range of problem solving and does not teach the skills that are necessary for the student to translate the problem into a mathematical form.

Using this background of information, the researcher concluded that: skills need to be mastered; techniques need to be introduced in a sequential pattern; specific problem solving strategies need to be introduced in a logical format; and

repetition and drill need to be a part of the total strategy. All of these components contribute to the long-range success of the learner.

III. Method

After a review of the literature, the researcher came to a conclusion. Given the reading, mathematics, and writing capabilities of the student population within the setting, and considering the intelligence quotient of the average student, certain prescribed techniques should be developed and implemented over a period of time to determine if prescribed problem sloving strategies could remedy the problem. The researcher reviewed the goals: improve scores; improve identification of clue words as they pertain to problem solving in mathematics; improve the recognition of a problem statement in a word problem; improve the techniques of dealing with money problems; and improve the over-all attitude of students toward the solving of word problems.

The principal of the school was notified (see Appendix D), and an approval to proceed was granted.

A target group was identified, materials were developed, and strategies were implemented over a prescribed period of ten weeks.

Setting

The implementation plan was administered in a heterogeneous fifth grade classroom comprised of 30 students. It was a closed classroom situation with one teacher responsible for the majority

of instruction. No special teachers were involved in the remediation. It was a spacious classroom with ample area to hold discussion groups. The new facilities provided the latest in instructional board space, and every wall was made of a material that could accommodate bulletin boards. The room was acoustically sound, and any outside disturbance was minimal, if at all, during the period of the prescribed instruction.

Subjects

The entire group of 30 fifth grade students was given a pretest during the first week of the new school year. The test was not announced, and there had been no previous review. The test was administered to the entire group simultaneously, and no time limit was dictated. The students put their heads down and waited for the entire class to finish before they turned in their papers. This technique, in the opinion of the researcher, decreased the pressure to be the first person finished; minimizing errors due to carelessness. The researcher scored the pretest, and put them in rank order to determine the median scores. The upper ten scoring pretests were eliminated; as were the lower ten. This left a target group of ten students. Of the targeted subjects, six scored in the 60th percentile, and the remaining four scored in the 50th percentile on the pretest. The group had a combined average I.Q. of 113.4. Their average grade placement in math was 6.47, according to the California Achievement Test administered in

grade 4. According to this same testing instrument, the combined average grade placement in reading was 6.35 (see Table 5).

Table 5

Abilities-Relationship of Targeted Group and Pretest Scores

Subject	I.Q.(CAT)	CAT Math	CAT Reading	Pretest
A	120	7.8	6.7	60%
B	110	5.8	4.9	60%
C	98	5.9	6.1	60%
D	116	5.2	7.9	60%
E	113	6.7	7.4	60%
F	132	7.4	6.7	60%
G	123	7.4	6.7	50%
H	105	6.6	5.2	50%
I	107	6.4	5.8	50%
J	110	5.5	6.1	50%
Mean Total	113.4	6.47	6.35	56%

In general, the targeted group was above-average in terms of intelligence and ability as demonstrated on a nationally reliable

testing instrument. The pretest scores were low when the test results were compared.

Materials

In order to implement the proposed plan, it was necessary for the researcher to formulate a series of specific worksheets. These worksheets, or task sheets, stressed the algorithms of addition and subtraction (see Appendixes K to KK). They incorporated these algorithms as they related to money and word problems. Directions for each sheet were given first. Clue words and problem statements were well-defined. Space was provided, in the initial few sheets, for the subject to record any specific thoughts that led to the solution of the problem. As mastery of the skills progressed, this thought-process space was reduced, and finally eliminated. The purpose was to have the subject aware of the specific thoughts that enter the mind as one approaches problem solving techniques.

The task sheets were designed to deal with three-digit numerals. There was no regrouping in the beginning. Eventually, regrouping was introduced, and tested. Problems were presented that sought to be preposterous, realistic, amusing, and routine. This was done in order to keep the attention of the age level.

Throughout the plan, the students were made aware of the clue words and problem statements defined in the task sheets. They were required to circle and underline these.

The cost of duplicating the materials was minimal since they were original work, and the school had ample paper and duplicating facilities.

The researcher had to browse through available supplemental textbooks and other problem solving materials to gather ideas for use with the small group activity that was part of the plan. Eventually, the worksheets that accompanied the basal text provided ample stimulation. The teacher's manual with the basal text contained many problem solving situations, and the reseacher chose these at the rate of one per week (see Appendix MM).

Materials for the "Problem-of-the-Day" were chosen from the basal textbook.

Teacher-made fact review tapes were developed. The teacher said the fact; the children wrote the fact and provided the answer. The tape continued in this manner, and it was self-checking. An answer sheet accompanied the tape (see Appendix OO).

Flashcards and a chart were made. These contained the clue words for addition and subtraction word problems.

Design and Procedure

Week 1

The parents of the children in the class were informed of the intention by letter (see Appendix E).

The researcher informed the children of the problem and of the proposed plan. After a class discussion, they agreed that something should be done, and they were willing to try.

The pretest was administered to the entire group of fifth grade students during the first days of the first week of the new school year (see Appendix J). It was collected and evaluated by the researcher. The tests were placed in rank order and the researcher counted down the first ten; took the next ten as the target group; and eliminated the last ten scores. This gave a workable sampling of the class. The names were recorded, and letter names were assigned to assure anonymity.

Basic addition and subtraction facts were reviewed. A tape was played; the children wrote the fact and the answer in the appropriate space on the answer sheet. The tape related the answers; the children checked their own work. The missed facts were noted, and the children made flash cards to remediate their own personal problem facts.

The process of "inner thought" was introduced in a class discussion. The concept of "thought", in general, was reviewed. Attitudes were mentioned by the researcher, and the concept of attitude change was developed by class discussion of personal experience. The session narrowed to the topic of word problems. The class was told that there were specific questions they should ask themselves when confronted with a problem. They were informed that they would be working with various problem-solving

situations, and they needed to be aware of their thoughts as they attempted to solve problems. Clue words, they were told, would help them formulate thoughts that could lead to successful problem solving. Since thought process would be stressed during the entire implementation plan, the session ended here.

The attitude survey (see Appendix H) was distributed to the entire class. They were encouraged to be completely honest; as there were no right or wrong responses. They were told by the researcher that the survey would not be graded. The surveys were collected and reviewed by the researcher.

Task sheet 1 was introduced (see Appendix K) to the whole class. The first problem was read silently; then orally. The students were asked to relate some of there own experiences about animals and parks. They were encouraged to pattern a problem after the one they had just read. They were asked to state what the problem was asking them (problem statement). The clue words "how many" were discussed (see Appendix G). Questions were raised about "amount". "What was happening?" "Would there be more or less animals?" Discussion was encouraged about each of the problems on the task sheet. After an open-ended session, the students were encouraged to think about each situation in terms of the problem statement and the clue words, and solve the problem. They were asked to record the thoughts that led them to a particular algorithm and solution. Clue words were to be identified by circling. The problem statement was to be

identified by underlining. All work was to be shown on the task sheet, and the answer was recorded on the appropriate line.

When the students had completed the task sheet, the facilitator reviewed each problem, and solutions were discussed. The children graded their own work, and they received the benefit of immediate feedback. Specific praise was given that stressed the care taken in the thought process, the identification of problem statements, and clue words.

Each of the three sessions lasted approximately 25-30 minutes.

With the exception of solving money problems, all of the objectives were introduced.

Week 2

The class was divided into six groups of five members each. The purpose of the smaller groups was to introduce into the plan a weekly problem-solving activity. It was desired that this activity would promote lively discussion and the opportunity to practice the heuristics of problem solving in an interesting and stimulating environment. A leader was chosen from the target group to lead each small group discussion. The groups met in various areas around the room. They were presented with the problem, and they were encouraged to work together to arrive at a solution (see Appendix MM). After approximately ten minutes, the groups returned to their seats, and the problem was discussed with the class. Each group leader reported its solution, and gave

reasons for the solution. The correct response(s) was (were) given to the class by the facilitator and different methods of solving were discussed (heuristics). These were: look-for-a-pattern; make-a-list; guess-and-test; draw-a-diagram; break-into-parts; etc.

The "Problem-of-the-Day" was introduced. This consisted of the facilitator writing a word problem on the board each morning. The problem was used for the discipline of handwriting along with the problem-solving activity. Content for the word problem came from the creativity of the teacher or the basal text (see Appendix NN).

Basic facts continued to be reviewed. The tape was played at the faster speed. The children checked their own work. Flashcards that the children had made were used by pairs of children.

New clue word vocabulary was introduced that related to the task sheets of the week. The old vocabulary was reviewed, and problem statements were discussed.

Task sheets 2, 3, and 4 were completed (see Appendixes L, M, N); one per session. The same process as described in task sheet 1 was used to guide the students towards successful solutions. The thought process was stressed, and directed discussion focused on this process (see Appendix I). Immediate feedback was given and an opportunity to discuss difficulties followed (see Appendix F).

Each of the three sessions lasted approximately 25-30 minutes. With the exception of solving money problems, all of the objectives were reviewed and reinforced.

Week 3

The plan continued to be implemented in much the same manner as prescribed in Week 1 and 2. Task sheets 5, 6, and 7 were utilized (see Appendixes O, P, Q) One task sheet per session was introduced and presented according to the general plan as described in Appendix 1.

The daily problems were written on the board; written by the children; discussed and solved.

An oral quiz was given by the facilitator to provide a review. Results were teacher-observed, and no difficulties were encountered.

The small discussion groups met and followed the same pattern that had been set with the initial meeting.

A review of three-digit addition and subtraction was given. The algorithm was discussed, and the steps were explained by the facilitator. The students did ten examples of subtraction with three-digits using no regrouping, and they did ten three-digit additions using no regrouping. The teacher created the problems and wrote them on the board. The students copied the problems and solved them. The answers were provided, and the students graded their own papers. Difficulties were discussed.

Each session lasted approximately 25-30 minutes.

With the exception of solving money problems, all of the objectives were reviewed.

Week 4

The implementation of the Problem-of-the-Day and the small group discussions and problem solving continued according to the plan.

Clue word vocabulary was introduced according to the skills presented on the task sheets.

Problems with more than one algorithm were introduced and discussed. Task sheets 8, 9, and 10 were completed (see Appendixes R, S, T). One task sheet per session was utilized according to the general plan.

The children made their own problems and presented them in play form for their classmates. The children in the "audience" solved the problems. The first one finished got a point. Points were tabulated at the end of the simulation, and the winner got a badge that the teacher made.

The objectives were reviewed.

The researcher met with the practicum observer to discuss the progress of the research.

Week 5

This was the middle of the implementation. Several plans had to be revised.

The Problem-of-the-Day had to be less intensified. The students were becoming bored with it, and it was becoming

counter-productive in terms of the attitude objective. The children were doing an abundance of problem solving, and this was over-kill, so to speak. It was modified to become the Problem-of-the-Week. This was more palatable to the group. It continued to serve as a handwriting assignment.

Because of the intensity of the task sheets, quizzes were not necessary. Each sheet was really a quiz. They were graded each session, discussed, and remediated. There became no need to add an additional quiz. Again, this would have been counter-productive in terms of the attitude objective. The researcher was continually evaluating the situation and remediating the difficulties as they presented themselves. It became obvious that the difficulties were lessening, and the addition of more testing instruments would, in the opinion of the researcher, do more harm than good. The quiz planned for Week 7 was left in the general plan.

The children made paper money. They met in their small problem-solving groups and created problems. The problems were presented to the other groups to solve. They used their paper money to count change.

Task sheets 11, 12, and 13 were completed (see Appendixe U, V, W). The practicum observer visited the classroom to observe the small group activity.

All of the objectives were reviewed and reinforced.

Each of the three sessions lasted approximately 25-30 minutes.

Week 6

The children were given pre-cut manila tag cards. Each child wrote story problems. They were directed to write one addition problem and one subtraction problem. These were handed to the teacher for approval. A stack of problems was compiled. The teacher handed a story-problem card to each child in the room. They numbered their paper to thirty. They read the problem and classified it as to addition or subtraction.

Subtraction with zero was taught. It was related to money problems. Several examples were solved as a group. The children did more examples from the basal text.

The children gathered in small groups to solve money problems using the paper money. They recorded their answers. The teacher provided the immediate feedback. Difficulties were resolved.

Irrelevant statements were introduced into the task sheets.

Task sheets 14, 15, and 16 were discussed and completed (see Appendixes X, Y, Z). Clue words and problem statements were still stressed. The students were asked to think about each problem carefully and stress the thought process as the problems were worked. The sheets were checked according to the general plan.

Each of the three sessions lasted approximately 25-30 minutes.

All of the objectives were reviewed and reinforced.

Week 7

The "Word Problem Task Sheet Test" was administered (see Appendix AA). Of the target group, six of the subjects received a grade of 5 out of 5, or 100%. Subject D received 4 out of 5, or 80%. Subjects H and C received grades of 3 out of 5, or 60%. Of the five errors, one was due to regrouping; one was due to information transferrence; one was due to carelessness (the problem show and addition sign; yet the subject subtracted); and two were due to subtraction error.

Irrelevant statements within problems were reviewed along with a review of three-digit addition and subtraction with regrouping.

Problem-of-the-Week continued to be implemented.

The discussion groups met.

The class completed task sheets 17, 18, and 19 (see Appendixes BB, CC, DD). The general plan was followed.

The three sessions lasted approximately 25-30 minutes each.

All of the objectives were reviewed and reinforced.

Week 8

Number sentences and the unknown factor were introduced. Examples were done as a group. Problems were read from the basal text, and they were translated into formal mathematical statements. The students solved the equation for "x".

Problem-of-the-Week continued.

Problems containing insufficient information were discussed and identified. The teacher read problems and a lively discussion ensued. The children supplied the missing information, and the problems were solved.

The problem cards that the children had made were used to classify algorithms. Each child received a card and recorded the answer. The cards were circulated around the room. Each had a number, so that when the game was finished, thirty examples had been read, and classified. The students with the most correct were identified, and they recieved a certificate of praise.

Task sheets 20, 21, and 22 were completed according to the general plan see Appendixes EE, FF, GG). The small problem-solving groups met.

Each of the three sessions lasted approximately 25 to 30 minutes each.

All of the objectives were reviewed.

The observer visited the class.

Week 9

Discussion centered upon inner thought and the heuristics of problem solving. The children related the importance of the clue word vocabulary in deciding the correct algorithm that would lead to the problem solution.

More number sentences were introduced.

Small groups met to play with the paper money.

Task sheets 23, 24, and 25 were completed (see Appendixes HH, II, JJ).

Each of the three sessions lasted approximately 25-30 minutes.

All of the objectives were reviewed.

Week 10

This was the last week of the implementation.

The Problem-of-the-Week continued.

The small groups met to discuss the assigned problem situation.

Multiplication and addition were discussed and related. Examples were drawn from the basal textbook.

The attitude survey was given and reviewed (see Appendix H).

The posttest was administered and evaluated.

The observer visited the class.

Each of the objectives was evaluated.

The sessions lasted approximately 25-30 minutes each.

IV. Results

When the problem was identified within the setting, the intended over-all objective was for the students to improve performance in terms of nationally tested scores. Since this data could not be collected at the time of this study, the main objective was sub-divided into five outcome objectives. The researcher devised methods to deal with these desired improvements. In terms of the desired outcomes, four of the

five were achieved.

Objective 1

After ten weeks, 80% of the target group of fifth grade students, who had specific instruction in the identification of clue words, would score 90% or above on a teacher-made and administered posttest (see Appendix KK).

Table 6

Results of Specific Instruction in the Identification of Clue Words

Subject	Pretest	Posttest	% of Change
A	60%	90%	30%
B	40%	100%	60%
C	50%	100%	50%
D	0%	90%	90%
E	0%	90%	90%
F	40%	100%	60%
G	50%	100%	50%
H	0%	90%	90%
I	30%	100%	70%
J	40%	100%	60%
Mean Score	31%	96%	65%

This objective was achieved. Of the target group of fifth grade students, who had had specific instruction in the identification of clue words, 100% scored 90% or above on the posttest.

The researcher attributes these high scores to the repeated drill and practice that the targeted group received. The clue words were always stressed, and the subjects began to instantly identify these words. It became routine, and the researcher was concerned that the children were becoming bored with the drill and practice. The concrete activities that were provided did offer a challenge and a change of pace. The small group discussion activities were especially beneficial both educationally and attitudinally.

Objective 2

After ten weeks, 80% of the target group of fifth grade students, who had specific instruction in the heuristics of defining a problem statement, would score 70% or above on a teacher-made and administered posttest. The pretest scores varied substantially with the range being from 0-90 (see Table 7). However, when the mean was derived, 44% seemed reasonable to the researcher in terms of a starting point. It was surprising that three of the subjects had no idea of clue words. Again, the concrete activity of having to identify and circle the words seemed to be an attributing factor in the success of the objective. The children also benefitted from the repeated oral discussion that always stressed

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Objective 2

After ten weeks, 80% of the target group of fifth grade students, who had specific instruction in the heuristics of defining a problem statement, would score 90% or above on a teacher-made and administered posttest. The pretest scores varied substantially with the range being from 0-90 (see Table 7). However, when the mean was derived, 44% seemed reasonable to the researcher in terms of a starting point. It was surprising that three of the subjects had no idea of clue words. Again, the concrete activity of having to identify and circle the words seemed to be an attributing factor in the success of the objective. The children also benefitted from the repeated oral discussion that always stressed

identification of the problem statement. The children had to verbalize the statement in their own words. This required understanding and the concepts of "more", or "less".

Table 7

Results of Specific Instruction in the Identification of Problem Statements

Subject	Pretest	Posttest	% of Change
A	0%	100%	100%
B	90%	100%	10%
C	70%	100%	30%
D	70%	100%	30%
E	70%	100%	30%
F	0%	100%	100%
G	20%	100%	80%
H	40%	90%	50%
I	0%	100%	100%
J	80%	100%	20%
Total Mean Score	44%	99%	55%

Note. Subject H missed the 100% because the subject omitted the circle that was to be placed around the clue word. Whether or not the correct response was known, is only conjecture.

The results of the posttest showed that this objective was attained. All of the fifth grade students in the target group scored 90% or above on the posttest.

Objective 3

After ten weeks, 80% of the target group of fifth grade students, who had specific instruction and practice involving the algorithms of addition and subtraction with emphasis on three-digit numerals and word problems, would score in the 90th percentile or above on a teacher-made posttest. This objective was not attained. The skill was tested with six problems (numbers 1,2,4,5,7,9). The money problems were not included in the evaluation of the objective (see Table 8).

When the tests were reviewed, and the individual problems analyzed, the researcher came to several conclusions. Problem number 1 was missed with a frequency of 3, and problem 7 was missed with a frequency of 2. These problems, although stressing addition and subtraction, did contain added informantion. This may have been a factor in the failure of the subjects to reach a correct response. The fact that the first problem was missed, may have been due to apprehension; since this was a test. Problems 2 and 9 were each missed with a frequency of 2. These problems were

subtraction. Problem 9 dealt with regrouping, and this was the factor in the mistakes.

Even though the objective was not attained, the researcher was not discouraged because there was sufficient over-all gain achieved.

Table 8

Results of Specific Instruction in Three-Digit Addition and Subtraction Problems Involving Regrouping and Word Problems

Subject	Pretest	Posttest	% of Change (+ or -)
A	100%	100%	0%
B	67%	100%	+33%
C	67%	83%	+16%
D	50%	67%	+17%
E	83%	67%	-16%
F	33%	67%	+37%
G	33%	100%	+67%
H	67%	67%	0%
I	33%	100%	+67%
J	83%	100%	+17%
Total Mean Score	61.6%	85.1%	+23.8%

Objective 4

After ten weeks, 80% of the target group of fifth grade students, who had instruction in the heuristics of problem solving strategies involving money and change with the values of one to nine dollars, would score 90% or above on a teacher-made posttest.

Table 9

Results of Specific Instruction in the Solution of Money Word Problems With Values of One to Nine Dollars

Subject	Pretest	Posttest	% of Change
A	0%	100%	100%
B	50%	100%	50%
C	50%	100%	50%
D	50%	100%	50%
E	25%	100%	75%
F	100%	100%	0%
G	75%	100%	25%
H	25%	100%	75%
I	75%	100%	25%
J	0%	100%	100%
Total Mean Score	45%	100%	55%

Note. The problems intended to evaluate the objective were numbers 3, 6, 8, and 10 (see Appendix KK).

The objective was achieved. All of the target group of fifth grade students scored 90% or above on the posttest. The researcher attributes the success of this objective to the concrete activities of making the money, formulating experience problems and solving them in small groups, and the repeated drill and practice that was afforded the students. At the end of the treatment, the entire group was having little difficulty with the concept that the purchases had to be added and then subtracted from the amount of money available.

Objective 5

After ten weeks, 80% of the target group of fifth grade students, who had instruction and affective reinforcement in the solving of word story porblems, would demonstrate a positive attitude toward the discipline by answering a teacher-made pre and post-survey.

It is difficult to assess the progress in the affective domain. The children responded to the survey at the beginning of the year, and after 10 weeks there was positive change according to the survey results. The evaluation was based on a decreasing scale.

The most positive response was an "a"; the most negative response an "e". The evaluation was based on movement up or down the scale. A movement of more than two levels, plus or minus, was considered to be significant in terms of change (see Table 10).

For a tabulation of the pre and post-survey results, see Appendix LL.

Table 10

Results of the Attitude Survey in Terms of a Comparison Between the Pre-Survey and the Post-Survey (Ten Items)

Subject	Item(s) Positive Change	Item(s) Negative Change	Item(s) No Change	Item(s) +2 or more
A	10	0	0	5
B	4	0	6	2
C	5	0	5	0
D	4	0	6	1
E	8	0	2	3
F	7	0	3	2
G	0	8	2	0
H	3	3	4	0
I	1	0	9	0
J	8	1	1	6
Total Item Mean Score	5	1.2	3.8	1.9

The objective was achieved. Of the students participating in the surveys, 90% showed some positive gain. Of this same group, 60% reported changes of two or more levels. Perhaps the most significant inquiry was item five. On the post-survey, this item recorded eight "a" responses, and two "b" responses. This was an increase of five "a" responses.

In general, the implementation plan was a success.

V. Recommendations

Throughout the time-span of the implementation period, several recommendations were noted by the researcher.

First, there is the need to stress to previous grades the importance of drill and practice. Many of the problems missed in the study were missed because the subject did not have the mathematical facilities necessary to effortlessly solve the problems. In many instances, the process was known and identified, but the errors came in the mathematical process needed to arrive at a successful response. Fifth grade children are in a transition stage between the concrete and the abstract, but, in the opinion of this researcher, the capable students should have mastered the basic addition and subtraction facts by the entry of the fifth level. Games and worksheets that provided drill and practice could be developed, tested, and distributed. It is the recommendation of this reseacher that this be a priority that would preclude the more sophisticated skills that are required by the word problem solver.

Secondly, the researcher would like to continue the plan by developing task sheets that emphasize the algorithms of multiplication and division. The task sheets would become more complicated and eventually would be of longer duration. They would incorporate and intersperse all of the algorithms.

The amount of time spent on the algorithms of addition and subtraction might be lessened without harm to the general results; given the same set of circumstances. It appeared to the researcher that the target group was ready for more complicated task sheets.

With a less-capable target group, the amount of time spent on addition, subtraction, and money problems could be adjusted. Task sheets could be made that would reflect the reading and interest level of the targeted group. But in all instances, in the opinion of the researcher, drill and practice are a must. They cannot be over-looked in the general success that the learner can experience.

Then, it is believed, by the researcher, that the plan should be implemented in the other fifth grades within the school setting. The problem concerned itself with the entire fifth grade population, and they should benefit from the positive results of this research study.

The educators would need to be in-serviced. This would not require more than several sessions. It would include the method to follow when introducing the oral discussion period that

accompanies the task sheets. The questioning technique would be developed. The task sheets would be reviewed and distributed to the educators for duplication. Another session would be required to review the heuristics of problem solving. Material would be gathered and distributed to the educators that would aid in the teaching of problem solving.

Problem solving should then be introduced into the general curriculum of the fifth grade. Small group activities should be encouraged. These should extend into the science and social studies disciplines. This researcher found the subjects in the study asking for the small group activity to be done more than once during the week. They looked forward to this. If the fifth grade met with the same general success as this research study, then the plan should be implemented within the school. Every grade would need to become involved, as problem solving should concern itself with every aspect of the educational setting.

In the event of school-wide success, the program should be expanded into the county schools.

Next, if the need arose, the task sheets could be expanded, refined, and published. Revisions might include further extension of the concept of extra information. This is really a reading process skill. Problems of this type need to be practiced. When an abundance of information is presented, the subject tends to get confused in terms of concentrating on the problem statement. Task sheets of this type could be developed and introduced. The same

accompanies the task sheets. The questioning technique would be developed. The task sheets would be reviewed and distributed to the educators for duplication. Another session would be required to review the heuristics of problem solving. Material would be gathered and distributed to the educators that would aid in the teaching of problem solving.

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type of questioning could be followed as was followed with the other task sheets

Under normal circumstances, the cost of the duplication of the task sheets should be minimal. If finances are a problem, the problems could be written on the board and copied by the subjects. The materials to duplicate this study were not expensive. It involved student and teacher creativity. Other games and simulations could be developed as the interest levels of the target groups dictated.

Finally, other studies could be conducted as an extension of the research study mentioned within these pages. The facilitator recommends that further study be conducted in the area of student interest and carelessness. So many mathematical errors seem to be due to a lack of interest in the material thereby causing careless errors to be recorded. Is the process important, do we care? What is the purpose of correct thought process if the subject cannot produce a correct response to a problem?

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APPENDIX SECTION

APPENDIX A

Statewide Assessment Program

Percentile Results 1981-1984: Grade 5

Skill	A	B	C
1981	85%	72%	63%
1982	83%	62%	65%
1983	90%	72%	75%
1984	90%	79%	75%

Note. A = Solves word problems by adding 3-digit numbers. (4/5)

B = Solves word problems by subtracting two 3-digit numbers. (4/5)

C = Solves purchase problems involving change from $1.00. (4/5)

APPENDIX B

Subject: Information Survey

To: All 3rd, 4th, and 5th grade teachers

To fulfill a requirement for the degree of Master of Science, I am writing a Practicum Report. I need to know approximately how many minutes a week you devote to specific instruction in word problem solving. Please be as accurate as possible.

Please place the completed form in my mailbox. You do not have to sign the form.

Thank you for your cooperation.

Sincerely,

Specific instruction time devoted to word problem solving per week: _____ _____

APPENDIX C

Table 6

Survey of Minutes Devoted to the Specific Instruction of Story Problems Per Week

Teacher	Grade Level	Instructional Time
A	3	3 minutes
B	3	5 minutes
C	3	10 minutes
D	3	5 minutes
E	3	2 minutes
F	3/4	3 minutes
G	4	5 minutes
H	4	2 minutes
I	4	5 minutes
J	4	5 minutes
K	4	6 minutes
L	5	5 minutes
M	5	4 minutes
N	5	5 minutes
O	5	4 minutes
P	5	4 minutes
	TOTAL	73 minutes

APPENDIX D

Subject: Letter to Principal

Dear _____:

This is to acknowledge that I will be initiating the mathematics problem solving plan that we discussed in June. This project will satisfy the requirements for a Master of Science degree which I expect to complete in December, 1984.

I welcome your support and guidance.

Sincerely,

Teacher, grade 5

APPENDIX E

Subject: Letter to Parents

Dear Parents,

Reasearch has shown that the skill of problem solving offers some difficulty to the average student of the intermediate grades. Because of this, and because I want your children to have every opportunity to succeed, we will be concentrating our efforts on problem solving this first grading period. We will follow the prescribed textbook lessons, and the problem solving activities will be offered as an extension and enrichment of the basic math program.

The concept of making change from dollar amounts is of particular concern. Activities that involve real-life situations are always of value in the educational process. Any opportunity for children to "pay the bill" and see the exchange of real money would be helpful. Counting real money is also a valuable learning experience. If you have the opportunity to avail your child of these real-life situations, it would be of help.

Sincerely,

Teacher

Word Problem Solving Task Sheets to Accompany Intermediate Word Problem Solving

by

Charlotte K. Tilles

Nova University

APPENDIX F

Answer Key for Exercises and Tests

Pretest

1. 48 years
2. 413 marbles
3. $3.55
4. 136 miles
5. 861 feet
6. $.36
7. 126 plants
8. $1.55
9. 548 miles
10. $2.22

Task Sheet 1

1. How many
   add
   vary
   28 animals

2. altogether
   add
   vary
   789 sheets of paper

3. in all
   add
   vary
   499 sandwiches

Task Sheet 2

1. how many
   add
   vary
   599 frogs

2. in all
   add
   vary
   40 pounds

3. total
   add
   vary
   48 books

Task Sheet 3

1. how many,
   another
   add
   vary
   26 inches

2. altogether
   add
   vary
   57 miles

3. in all
   add
   vary
   6 hills

Task Sheet 4

1. altogether
   add
   vary
   99 windows

2. how many,
   more
   subtract
   vary
   2 cookies

3. total
   add
   vary
   99 shoes

Task Sheet 5

1. how much, less
   subtract
   vary
   551 pounds

2. difference
   subtract
   vary
   111

3. how many, gave away
   subtract
   vary
   214 hats

Task Sheet 6

1. how many more
   subtract
   vary
   253 students

2. how many more
   subtract
   vary
   3 teams

3. how many left
   subtract
   vary
   425 pieces of candy

Task Sheet 7

1. difference
   subtract
   vary
   12 desks

2. how many, miss
   subtract
   vary
   233 passes missed

3. how many left
   subtract
   vary
   11 cakes

Task Sheet 8

1. have left
   add, subtract
   vary
   254 cards

2. how many, gave
   add, subtract
   vary
   28 cookies

3. altogether
   add
   vary
   1134 stars

Task Sheet 9

1. more
   subtract
   vary
   391

2. gave, ate, left
   add, subtract
   vary
   218 pieces

3. how many more
   add, subtract
   vary
   155 miles

Task Sheet 10

1. 222 miles
2. 150 miles
3. 934 miles
4. 30 jogs

Task Sheet 11

1. 2
2. 4
3. 10
4. 20
5. 100

1. yes
2. yes
3. no
4. yes
5. no

Task Sheet 12

1. 2
2. 4
3. 10
4. 20
5. 100

1. subtract
   vary
   $.21

1 penny, 2 dimes
1 penny, 4 nickles
1 penny, 2 nickles, 1 dime

Task Sheet 13

1. $.62
2. $.77
3. $.50
4. $2.06

Task Sheet 14

1. 293 bottle caps
2. 207 miles
3. 44 miles
4. 14 more outfits

Task Sheet 15

1. 768 miles
2. 16 boys
3. 198 students
4. 1134 eggplants

Task Sheet 16

1. 484 hamsters
2. 145 miles
3. 222 heads of lettuce
4. 233 jars

Task Sheet TEST

1. $1.06
2. 123 swans
3. 222 ads
4. 223 miles
5. 1267 wags

Task Sheet 17

1. 14 feet
2. 845 rats
3. 155 rats
4. 314 witches

Task Sheet 18

1. $1.42
2. $.65
3. $1.22
4. 22 minutes

Task Sheet 19

1. sweet pickles and relish
2. $4.74
3. $3.11
4. $1.63

Task Sheet 20

7. subtract
1. 231 hats
2. 244 geese
3. 1554 pieces of pie

4. 1332 cars

Task Sheet 21

1. 752-435=X
   317 birds
2. 678-235=X
   443 alligators
3. 798-654=X
   144 ducks
4. 56+45=X
   101 concerts

Task Sheet 22

1. price of the jam
2. how far on Monday
3. how much money on Tuesday
4. how many for Karen

Task Sheet 23

1. $8.95
2. $.24
3. 22 cows
4. 577 pieces of peppermint

Task Sheet 24

1. add
2. subtract
3. subtract
4. subtract
5. subtract
6. add

8. add
9. add
10. add

Task Sheet 25

1. 312 hats
2. 1+9
   9+1
   2+8
   8+2
   etc.
3. 33 players
   923 pieces

Post-test

1. 37 friends
2. 133 shells
3. $1.77
4. 502 miles
5. 1023 feet
6. $.55
7. 309 cars
8. $1.51
9. 178 miles
10. $1.13

APPENDIX G

Suggested Vocabulary For Word Problem Solving Level 5

ADDITION

add
altogether
how many
in all
more
sum
total

SUBTRACTION

difference
left
less
many more
take away

MULTIPLICATION

altogether
each
in all
times

DIVISION

each
per

OTHER RELATED VOCABULARY

big number
change
estimate
number families
number sentence
operation
problem statement
small numbers
(any time or quantity related words)

APPENDIX H

Student Assessment

NAME_____DATE_____

Directions: Read the statement and circle the answer that tells the best about your own feelings. Do not think about the feelings of anyone else. Only tell how you feel!

1. Story problems are:
   a. Very easy
   b. Easy
   c. Sometimes easy
   d. Hard
   e. Very hard

2. I like story problems:
   a. Always
   b. Almost always
   c. Sometimes
   d. Once-in-awhile
   e. Never

3. Story problems make me feel:
   a. Great
   b. Good
   c. O.K.
   d. Scared
   e. Terrified

4. When the Teacher says that we will do story problems, I think:
   a. Great
   b. Good
   c. O.K.
   d. I guess I have to.
   e. Ugh! I hate this.

5. When it comes to story problems, I feel:
   a. Sure
   b. Not very sure
   c. Not sure at all

d. Scared
e. Terrible

6. When it comes to story problem, they are:
   a. Lots of fun
   b. Some fun
   c. A little fun
   d. No fun
   e. Horrible

7. Here is how I feel about story problems:

   a. They are great; I love to do them.
   b. They are fine; I can do them.
   c. They are so-so.
   d. I do them because I have to.
   e. They are "the pits"!

8. When it comes to story problems:

   a. I know what I'm doing.
   b. I know what I'm doing most of the time.
   c. I sometime know what to do.
   d. I guess a lot.
   e. I never know what to do.

9. Story problems are:
   a. Very interesting
   b. Interesting
   c. A little interesting
   d. Not interesting
   e. Awful

10. My advice to a friend about story problems is:

   a. Always do story problems.
   b. Sometimes do story problems.
   c. Try story problems.
   d. Do story problems only if you have to.
   e. Never do story problems!!

11. The hardest story problems are:
   a. addition
   b. subtraction
   c. multiplication
   d. division

12. The easiest story problems are:
   a. addition
   b. subtraction
   c. multiplication
   d. division

APPENDIX I

Sample Lesson Plan to be Used With Each Task Sheet

1. Conduct the oral discussion.

    a) Present the clue word vocabulary.
    b) Simulate real situations using the vocabulary.
    c) Emphasize concept words such as "gain", or "loses".

2. Discuss the problem statement, and have several children restate the sample problem statements in their own words.

3. Discuss questions that should be entering into the inner thought process of the problem solver.

    a) Have (I) ever seen this type of problem before?
    b) Is the "big number" there?
    c) What is the problem statement saying?
    d) What are the clue words telling me to do?
    e) Is there too much information?
    f) Is there enough information?
    g) What are some strategies I could use to solve the problem? (i.e. draw a picture, list possibilities, make a graph, estimate, look for a pattern)

4. Present the task sheet.

5. Give the students time to read and devise a plan.

6. The students complete the task sheet and accompanying questions.

7. Provide guidance for evaluation.

    a) Did the student verify the answer?
    b) Did the student check computation?

8. Provide the correct answers.

9. Discuss evaluations.

    a) Give help to those who require it.
    b) Discuss the possible solutions.
    c) Ask for student opinions:

        1) Difficulty levels
        2) Interest levels
        3) Frustration levels

10. Provide praise and encouragement to all.

APPENDIX J

Pre-test

NAME_____DATE_____

Directions: Read the problem carefully. Solve the problem using the space under the problem. Record your answer on the line that says "Answer". Underline the problem statement. Circle the clue words in the problem.

1. Jack, Mark, and Sam were all born on the same day of the week, but they were born in different years. Jack is now 25, Mark is 23, and Sam is 14. What are the ages of Jack and Mark altogether?

ANSWER_____

2. Joe found a bag of marbles. There were 648 marbles in the bag. The next day he found another bag of marbles. It had 235 marbles. If Joe wants to give the difference in the number of marbles to Sally, how many marbles will Sally have?

ANSWER_____

3. Mary walked to the store with a ten dollar bill in her purse. She needed paper that sold for $2.80, and a pencil case that sold for $3.65. After she bought the paper and the case, how

much money did she have in her purse?

ANSWER_____

4. The train went 567 miles on Monday, 678 miles on Tuesday, 345 miles on Wednesday, and 542 miles on Thursday. How many more miles did the train travel on Tuesday than on Thursday?

ANSWER_____

5. A hill in Ohio is 568 feet high. There is a hill in New York that is 293 feet high. If we put the hill in Ohio on top of the hill in New York, our new hill would be how many feet high?

ANSWER_____

6. Fred has $1.00. He buys candy for 39 cents, and gum for a quarter. How much change will he get back?

ANSWER_____

7. Alice loves plants. In fact, she has 89 plants on her porch. She has 478 plants in her yard. She wants to give some plants to older people in her neighborhood. She digs up 350 plants from the yard. How many plants are there in the yard now?

ANSWER_____

8. Elizabeth skated to the store with five dollars in her pocket.

She looked at a toy dog, and she bought it. The dog cost $3.45. How much change did she receive?

ANSWER_____

9. A family took a trip one summer. The summer trip was 987 miles long. The same family took a trip in the winter. The winter trip was 439 miles long. How many more miles did the family travel in the summer than in the winter?

ANSWER_____

10. If you have $5.00, and you spend $2.78, how much money should you get in change?

ANSWER_____

APPENDIX K

Word Problem Task Sheet 1

NAME:_____

DATE:_____

DIRECTIONS: Read each word problem carefully.
Circle the clue words.
Underline the problem statement.
Think about solutions.
Record your thoughts.
Solve the problems.

1. The children were running in the park. They saw 12 birds and 16 flying squirrels. How many animals did they see in the park?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

2. Mrs. John's class used 327 sheets of paper one week. The next week they used 462 sheets of paper. How much paper did they use altogether?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

3. At lunchtime, the fifth grade ate 125 sandwiches. The fourth grade ate 374 sandwiches. How many sandwiches were eaten in all?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

APPENDIX L

Word Problem Task Sheet 2

NAME:_____

DATE:_____

DIRECTIONS: Read each word problem carefully.
Circle the clue words.
Underline the problem statement.
Think about solutions.
Record your thoughts.
Solve the problems.

1. Jake had 378 frogs in his pond. He got 221 more frogs during the summer. Now how many frogs does he have in his pond?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

2. Mr. Smith is skinny. He gains 20 pounds in June and another 20 pounds in July. How many pounds has Mr. Smith gained in all?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

3. Sam bought 25 books at a garage sale. Mary bought 23 books at the same sale. What is the total number of books the children bought?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

APPENDIX M

Word Problem Task Sheet 3

NAME:_____

DATE:_____

DIRECTIONS: Read each word problem carefully.
Circle the clue words.
Underline the problem statement.
Think about solutions.
Record your thoughts.
Solve the problems.

1. Sue's hair grew 13 inches in a year. The next year it grew another 13 inches. How many inches did Sue's hair grow in the two years?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

2. Jay ran 36 miles in a race. His friend Bill ran 21 miles in another race. How many miles did the two friends race altogether?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

3. Five rabbits ran up three hills. Six more rabbits ran up another three hills. How many hills did the rabbits run up in all?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

APPENDIX N

Word Problem Task Sheet 4

NAME:_____

DATE:_____

DIRECTIONS: Read each word problem carefully.
Circle the clue words.
Underline the problem statement.
Think about solutions.
Record your thoughts.
Solve the problems.

1. There were 79 windows in a building. Another building has 20 windows. If you had to wash the windows, how many windows would you wash altogether?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

2. A puppy ate 14 doggie cookies in a week. The same puppy ate 12 chew bars in a week. How many more cookies did the puppy eat than chew bars?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

3. The puppy loves to eat shoes. It ate 65 shoes in one month, and 34 shoes the next month. What is the total amount of shoes the puppy has eaten?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

APPENDIX O

Word Problem Task Sheet 5

NAME:_____

DATE:_____

DIRECTIONS: Read each word problem carefully.
Circle the clue words.
Underline the problem statement.
Think about solutions.
Record your thoughts.
Solve the problems.

1. Mrs. Bonn weighs 685 pounds in January. In February, she stepped on the scale and was 134 pounds less. Now how much does Mrs. Bonn weigh?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

2. Find the difference between 234 and 123.

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

3. Mary had 435 hats in her collection. She gave away 221 to her best friend Shelly. How many hats does she now have in her collection?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

APPENDIX P

Word Problem Task Sheet 6

NAME:_____

DATE:_____

DIRECTIONS: Read each word problem carefully.
Circle the clue words.
Underline the problem statement.
Think about solutions.
Record your thoughts.
Solve the problems.

1. Smart Elementary School has 789 students. Smarter Elementary School has 536 students. How many more students does Smart Elementary School have?

Clues:_____

Operation:_____

Thoughts:_____

Answer: _____

2. The boys in Smart School love to play soccer. They have formed 18 teams. Smarter School has 15 teams. How many more teams will Smarther School have to form to have as many teams as Smart School?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

3. If I have 679 pieces of candy in a bag, and I take out 254 pieces, how many pieces of candy are left in the bag?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

APPENDIX Q

Word Problem Task Sheet 7

NAME:_____

DATE:_____

DIRECTIONS: Read each word problem carefully.
Circle the clue words.
Underline the problem statement.
Think about solutions.
Record your thoughts.
Solve the problems.

1. Smart School has 57 desks in a large room. One of the smaller rooms only has 45 desks. What is the difference in the amount of desks in the two rooms?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

2. Matt threw 467 football passes at a friend. The friend only caught 234 of the passes. How many passes did the friend miss?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

3. May baked 34 cakes for a party. The people at the party ate 23 of the cakes. How many cakes were left after the party?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

APPENDIX R

Word Problem Task Sheet 8

NAME:_____

DATE:_____

DIRECTIONS: Read each word problem carefully
Circle the clue words.
Underline the problem statement.
Think about solutions.
Record your thoughts.
Solve the problems.

1. Jim left home with 467 baseball cards in his pocket. He met Kelly, and he gave her 189 of the cards. At the ballpark, he met Tom and gave him 24 of the cards. How many cards did Jim have left at the end of the day?

Clues:_____

Operations:_____

Thoughts:_____

Answer:_____

2. Marcie had 45 cookies in a tin. She gave the teacher 12 cookies. Later she saw the principal, and he looked hungry. She gave him five cookies. How many cookies are in the tin?

Clues:_____

Operations:_____

Thoughts:_____

Answer:_____

3. If you could count the stars, and you counted 678 stars one night and another 456 stars the next night, how many stars have you counted altogether?

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

APPENDIX S

Word Problem Task Sheet 9

NAME:_____

DATE:_____

DIRECTIONS: Read each word problem carefully.
Circle the clue words.
Underline the problem statement.
Think about solutions.
Record your thoughts.
Solve the problems.

1. Prove that 625 is more than 234.

Clues:_____

Operation:_____

Thoughts:_____

Answer:_____

2. Mike had 678 pieces of gum. He ate 324 pieces and gave 134 pieces to Sam. Later in the day he ate another two pieces. How many pieces of gum are left for tomorrow?

Clues:_____

Operations:_____

Thoughts:_____

Answer:_____

3. The Smith family had to travel 987 miles to reach their vacation home. One day they went 400 miles. The next day they went 432 miles. How many more miles must they travel to reach the vacation home?

Clues:_____

Operations:_____

Thoughts:_____

Answer:_____

APPENDIX T

Word Problem Task Sheet 10

NAME:_____

DATE:_____

DIRECTIONS: Read each word problem carefully.
Circle the clue words.
Underline the problem statement.
Think about solutions.
Record your thoughts.
Solve the problems.

1. Birds can fly for a long time. One bird flew 345 miles to a new home. A friend flew 567 miles to a new home. What is the difference in miles flown?

Thoughts:_____

Answer:_____

2. Bill and Sally each walked 50 miles. How many miles did they walk altogether? If they walked the same number of miles each day, how many miles would they walk in three days?

Thoughts:_____

Answer:_____

3. Robbie has a motorcycle. Robbie rode it 678 miles to see Mike. Then he went to see Brian. That trip was 256 miles. How many miles did he travel on the two trips?

Thoughts:_____

Answer:_____

4. Jasper jogs and jumps a total of 45 miles a week. If he only jogs and jumps a total of 15 miles one week, how many more jogs and jumps will he have to do to equal 45 miles?

Thoughts:_____

Answer:_____

APPENDIX U

Word Problem Task Sheet 11

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully.
Use your paper money to solve the problem.
Record you change on the line.

1. How many 50 cents in $1.00? _____

2. How many quarters (25 cents) in $1.00?_____

3. How many dimes (10 cents) in $1.00?_____

4. How many nickels (5 cents) in $1.00?_____

5. How many pennies (1 cent) in $1.00?_____

THINK ABOUT THE FOLLOWING STATEMENTS. USE YOUR PAPER MONEY TO ANSWER THE QUESTIONS. ANSWER YES OR NO.

1. If you have $1.00, and somebody gives you $.50, will you have less money? _____

2. If you have $1.00 and you lose $.50, will you have less money? _____

3. If you have $1.00 and you spend $.35, will you have more money?_____

4. If you have $1.00 and you buy a bat for $.89, will you get some money back?_____

5. If you have $1.00 and you spend 23 cents, will you have more money?_____

APPENDIX V

Word Problem Task Sheet 12

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully. Use your paper money to solve the problem. Record you change on the line.

1. How many 50 cents in $1.00? _____

2. How many quarters (25 cents) in $1.00?_____

3. How many dimes (10 cents) in $1.00?_____

4. How many nickels (5 cents) in $1.00?_____

5. How many pennies (1 cent) in $1.00?_____

Now we will solve problems that require you to give change. Read the problem carefully. Decide how much money you have to spend. Pretend you are at the store. You buy some things. Remember that you give the items to the cashier. He or she adds up what you spent, and then he or she subtracts that from the amount of money you have in your hand. What you get back is called your change.

1. Susie has $1.00 in her hand. She walks into the store and buys some bread for $.79. How much change will she get back?

Operation:_____

Thoughts:_____

Answer:_____

If she is paid in pennies and dimes, she will get

____pennies and _____dimes. If she is paid in pennies and nickels, she will get ____pennies and _____nickels. If she is paid in pennies, nickels, and dimes, she will get

____pennies, ____nickels, and ____dime.

APPENDIX W

Word Problem Task Sheet 13

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully.
Think about what is happening.
Solve the problem.

1. Al bought a turtle for $2.49 and a fish for $1.89. He gave the clerk a five dollar bill. How much change should he get back?

Thoughts:_____

Answer:_____

2. Jean bought six tennis balls for $3.00 and a clip for her hair for $1.23. She gave the salesperson $5.00. How much money will she have left for ice cream?

Thoughts:_____

Answer:_____

3. Mary has $1.00. She plans to spend 35 cents on candy and 15 cents on baseball cards. How much money will she have after she buys the candy and the cards?

Thoughts:_____

Answer:_____

* Chris has $10.00. He will buy movie tickets for $6.49 and popcorn for $1.45. How much change will he get back?

Thoughts:_____

Answer:_____

APPENDIX X

Word Problem Task Sheet 14

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully.
Solve the problems using the information you have learned.
Remember the questions to ask yourself.
Underline the problem statement.
Circle clue words.

1. Juan has 607 bottle caps in his collection. How many more caps does he need if he plans on having 900 in his collection?

Answer:_____

2. The Keller family traveled 560 miles in a day. The next day they went 233 miles. If the whole trip is 1000 miles long, how much farther must they drive?

Answer:_____

3. An airline pilot travled 400 miles Monday and 456 miles the next day. If he traveled 900 miles on Wednesday, what is the difference between the miles traveled on Wednesday, and the miles traveled on both Monday and Tuesday?

Answer:_____

4. Patty made 40 toy outfits for a doll. Her sister made 26 outfits for the same doll. How many more outfits did Patty make than her sister?

Answer:_____

APPENDIX Y

Word Problem Task Sheet 15

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully.
Solve the problems using the information you have learned.
Remember the questions to ask yourself.
Underline the problem statement.
Circle clue words.
CROSS OUT UNNECESSARY INFORMATION.

1. A train traveled 400 miles along the track. The train is red and can reach speeds of 150 miles per hour. It traveled another 368 miles. How many miles did the train travel altogether?

Answer:_____

2. Seventy boys were playing in the schoolyard. They were playing soccer. Fifty-four of the boys went home. How many boys were left playing in the schoolyard?

Answer:_____

3. At the beginning of the school year a school has 578 students. At the middle of the year, the school has 654 students. At the end of the year, the school has 456 students. What is the difference in the number of students in the middle of the year and the end of the year?

Answer:_____

4. Eddie eats eggplant. He eats 567 eggplants every evening. Eddie ends exercises eating eggplants. If Eddie eats eggplant for 2 evenings, how many eggplants will he eat?

Answer:_____

APPENDIX Z

Word Problem Task Sheet 16

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully.
Solve the problems using the information you have learned.
Remember the questions to ask yourself.
Underline the problem statement.
Circle clue words.
CROSS OUT UNNECESSARY INFORMATION.

1. Harry Hambone has 500 hamsters in cages. If the hungry hamsters eat five bags of hamster food a day, and sixteen hamsters run away, how many hamsters are left?

Answer:_____

2. Quilly Quimby quickly runs 78 miles every morning. Most of the time, she runs in the quiet forest. If she quickly runs 67 more miles quietly in the evening, how many quick miles has she quietly run?

Answer:_____

3. Larry Larson loves lettuce. Larry lovingly grows 456 heads of lovely lettuce in the month of June. In July, Larry grows 678 lovely heads of lettuce. How much more lettuce does Larry grow in July than he does in June?

Answer:_____

4. Jill juggles 600 juice jars in January. In June, she juggles 367 juice jars. It is juniper juice. How many more jars does she juggle in January than in June?

Answer:_____

APPENDIX AA

Word Problem Task Sheet Test

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully. Work CAREFULLY.

1. Max has $5.00. He buys socks for $2.49, and a hat for $1.45. How much change will Max get back?

Answer:_____

2. Susan saw 56 swans in the swimming pool. Sixty-seven new swans arrived. How many swans are now swimming in the pool?

Answer:_____

3. The newspaper has 789 want-ads listed on Monday. On Tuesday it lists 567 ads. What is the difference in the number of ads on Monday and Tuesday?

Answer:_____

4. Jay went 790 miles by car to Canada. He went 567 miles to New York. How many more miles did he travel to Canada?

Answer:_____

5. A dog wags his tail 900 times when Mary walks into the room. It wags its tail 367 times when Milly walks into the room. How many wags in all?

Answer:_____

APPENDIX BB

Word Problem Task Sheet 17

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully.
Underline the problem statement.
Cross out any unnecessary statements.

1. Mary and Susan went 50 feet in a sack race on Thursday. On Friday, they went 36 feet. How many more feet did they go on Thursday than on Friday?

Answer:_____

2. The cat ate 500 rats in a week. The same cat ate 345 rats another week. The cat is green, because someone spilled paint on him. How many rats did the cat eat in all?

Answer: _____

3. The week the cat ate the 500 rats was in October. This cat loves Halloween. The week the cat ate the 345 rats was in May. How many more rats did the cat eat in October than in May?

Answer:_____

4. If you watched 670 witches on broomsticks fly over your house on Halloween night, and only 356 witches returned the next Halloween, how many witches left the witch business?

Answer:_____

APPENDIX CC

Word Problem Task Sheet 18

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully.
Underline the problem statement.
Cross out any unnecessary statements.

1. Ralph has $5.00. He wants to keep the money, but he is forced to spend it. He wants to go into the used car business someday. He has to buy a car catalog for $.68 and a used car poster for $2.90. How much change will Ralph get back?

Answer:_____

2. The toll on the bridge is $.50 on Friday and $.35 on Sunday. If Ted gives the man $1.00 on Sunday to cross the bridge, how much change will he get back?

Answer:_____

3. Glasses cost $5.00. Ginny is farsighted and needs to buy a pair of glasses. Ginny wants a pair of the glasses, but she only has $3.78. How much more money does Ginny need to save to buy the glasses?

Answer:_____

4. A turtle can crawl to the ocean in 67 minutes on a cold day. The same turtle takes 89 minutes to travel the same distance on a hot day. How much faster is the turtle on a cold day than on a hot day?

Answer:_____

APPENDIX DD

Word Problem Task Sheet 19

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully.
Underline the problem statement.
Cross out any unnecessary statements.

1. You're in a "pickle", so to speak!!! Dill pickles are on sale for $.47 a jar, sweet pickles are $1.89, gerkins are $.56, mustard pickles are $1.56, and relish is $.98. Someone has challenged you to a duel. You must spend as close to $3.00 as you can, without going over. Which pickles will you buy?

Answer:_____

2. Things are going badly. The bird is sick and will need an operation. The bird doctor is expensive, and you must pay the bill. You only have $3.24, and the operation was $7.98. How much money will you owe the bird doctor?

Answer:_____

3. Remember the pickles that were on sale in problem 1. Well, your aunt has heard about the sale and wants a jar of sweet pickles that sell for $1.89. She sends you to the store with $5.00. How much change will you get back?

Answer:_____

** Great!!! Auntie is letting you keep the change from the $5.00. You can give it to the bird doctor to help pay the cost of the operation. How much do you now owe the bird doctor? HINT - Look back at problems 2 and 3.

Answer:_____

APPENDIX EE

Word Problem Task Sheet 20

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully.
Underline the problem statement.
WRITE NUMBER SENTENCES USING "X".

1. Sam, the baseball player, hit 752 home runs in one season. This is an unbelieveable thing to happen!!! Anyway, 435 of the home runs hit birds flying over the stadium!! How many runs did not hit birds?

Number sentence:_____

Answer:_____

2. Alice, the alligator wrestler, wrestles 235 alligators on Mondays, and 678 alligators on Tuesdays. What is the difference in the number of alligators wrestled on the two days?

Number sentence:_____

Answer:_____

3. 798 ducks in a lake. 654 swim away. How many are left?

Number sentence:_____

Answer:_____

4. Pinky, the rock singer, will be giving some concerts. He will give 56 in May, and 45 in June. How many concerts will Pinky give in all?

Number sentence:_____

Answer:_____

APPENDIX FF

Word Problem Task Sheet 21

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully.
Underline the problem statement.
WRITE NUMBER SENTENCES USING "X".

1. Sam, the baseball player, hit 752 homeruns in one season. This is an unbelieveable thing to happen!!! Anyway, 435 of the homeruns hit birds flying over the stadium!! How many runs did not hit birds?

Number sentence:_____

Answer:_____

2. Alice, the alligator wrestler, wrestles 235 alligators on Mondays, and 678 alligators on Tuesdays. What is the difference in the number of alligators wrestled on the two days?

Number sentence:_____

Answer:_____

3. 798 ducks in a lake. 654 swim away. How many are left?

Number sentence:_____

Answer:_____

4. Pinky, the rock singer, will be giving some concerts. He will give 56 in May, and 45 in June. How many concerts will Pinky give in all?

Number sentence:_____

Answer:_____

APPENDIX GG

Word Problem Task Sheet 22

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully. Remember to ask yourself questions.

1. Martin weighs 600 pounds. He gains 567 pounds. How much does he weigh now? Don't worry, Martin is an elephant!

Answer:_____

2. Edgar has to lose 789 pounds. He now weighs 987 pounds. How much will Edgar have to lose to enter the Mr. Elephant contest?

Answer:_____

3. Milly must muster her courage to jump from a tall building. She will be in a movie, and she has to jump 45 feet onto the roof of another building. She jumps. The movie maker measures the jump at 89 feet. How much farther has Milly jumped than necessary?

Answer:_____

4. Rodney the Rodent will be starring in a new movie made for T.V. He must eat 78 pounds of cheese. He eats. Well, 56 pounds of the cheese disappeared in a minute. Rodney was full. He couldn't eat the rest of the cheese. He lost the starring role in the movie. How much more cheese should he have eaten to have kept the part?

Answer:_____

APPENDIX HH

Word Problem Task Sheet 23

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully. Remember to ask yourself questions.

1. Rodney went to the bank with his money. He deposited checks for $5.00, and $3.95. How much money did he deposit in all?

Answer:_____

2. Rodney kept $9.00 for himself. He went to the store and bought items that totaled $8.76. How much change did the clerk give him?

Answer:_____

3. Muffin manages to milk 65 cows every morning. One day she was in a hurry and only milked 43 cows. What was the difference in the number of cows milked?

Answer:_____

4. Alice always has candy in her purse. Today she had 786 pieces of peppermint. She gave 76 pieces to Henry. Next, she gave 43 pieces to Susan, and finally she gave 90 pieces to Marge. How many pieces of candy does she have now?

Answer:_____

APPENDIX II

Word Problem Task Sheet 24

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully.
Remember to ask yourself questions.
This is a test to see how well you understand the vocabulary we have learned.
Answer with "add" or "subtract".

1. The word "sum" tells me to _____.

2. The words "how many more" tell me to _____.

3. The word "difference" means I'll _____.

4. The words "take away" tell me I'll_____.

5. If the problem has been having things taken away, and the problem statement says, "How many are left in all?", I think I should _____.

6. If the problem has been adding things, and the problem statement says, "How many in all", then I'll _____.

7. If the word "less" is in the problem, I'll _____ when I see it.

8. If the problem says, "How many altogether?", I'll probably _____.

APPENDIX JJ

Word Problem Task Sheet 25

NAME:_____

DATE:_____

DIRECTIONS: Read each question and problem carefully. Remember to ask yourself questions.

1. Homer has 78 hats. He gets 234 more. How many hats does Homer have in all?

Answer:_____

2. There are some sticks on the ground. Some are 3 inches long, some are 5 inches long; in fact, there is every size. You need to have a total of 10 inches of sticks. You can only pick up 2 sticks. List the possible choices you have. HINT: There are five lines but more than five choices.

Possible choices: _____

_____

_____

_____

_____

3. Troy tackled 67 football players in his first game. In the second game he tackled 100 players. How many more players did Troy tackle in his second game than in the first game?

Answer:_____

4. 678 eggs. 245 pieces of bacon. How many total items of food?

Answer:_____

APPENDIX KK

Posttest

NAME_____ DATE_____

Directions: Read the problem carefully. Solve the problem using the space under the problem. Record your answer on the line that says "Answer". Underline the problem statement. Circle the clue words in the problem.

1. Alice, Mary, and Susan are having a party. Alice will invite 23 friends, Mary will invite 32 friends, and Susan will invite 14 friends. How many friends will Alice and Susan invite altogether?

ANSWER_____

2. Sam went to the beach to collect shells. He found 367 shells one day. The next day he found 234 shells. He decided to share the difference with Manny. How many shells will Manny have?

ANSWER_____

3. Jack went to the store with a ten dollar bill in his wallet. He needed to buy a new bat for the baseball season. It cost $6.98. He decided to buy a new baseball too. It cost $1.25. After he bought the bat and the ball, how much money did he

have left?

ANSWER_____

4. An airline pilot went 576 miles on Monday, 487 miles on Tuesday, 989 miles on Wednesday, and 765 miles on Thursday. How many more miles did the pilot travel on Wednesday than on Tuesday?

ANSWER_____

5. A building in New York is 567 feet high. If another building in New York is 456 feet high, what is the height of the two buildings altogether?

ANSWER_____

6. Milly has $1.00. She buys candy for 40 cents, and gum for a nickel. How much change will she get back?

ANSWER_____

7. Mark loves cars. In fact, he collects toy cars. He has a 546 toy car collection altogether. He decides that he will give 237 toy cars to the local museum for a display. He will keep 26 of his favorite cars on a shelf in his room. How many cars will Mark have after he gives the museum its cars?

ANSWER_____

8. Sally went to the store with five dollars in her purse. She

saw a doll that she wanted. The doll cost $3.49. How much change did she receive?

ANSWER_____

9. Some workers built a road in September. The road was 456 miles long. They did such a good job that they built another road in December. This road was 278 miles long. How much longer was the road that they built in September?

ANSWER_____

10. If you have $5.00, and you spend $3.87, how much money should you get in change?

ANSWER_____

APPENDIX LL

Attitude Survey Results

Attitude Survey Results as Evaluated on a Pre/Posttest

	Inquiry Number									
Subject	1	2	3	4	5	6	7	8	9	10
A	c/c	c/c	c/c	c/c	b/b	c/c	b/b	b/b	c/c	c/b
B	c/c	d/d	c/b	c/b	a/a	e/c	e/c	b/b	c/c	c/c
C	c/b	d/c	c/c	c/c	b/a	c/c	c/b	b/a	d/d	c/c
D	c/c	c/c	c/c	d/c	b/a	c/c	d/b	b/b	d/c	c/c
E	c/b	d/b	c/b	c/c	b/a	d/b	c/a	b/b	c/b	c/a
F	c/b	c/b	b/b	c/a	a/a	c/b	c/a	b/a	c/b	c/c
G	b/c	b/c	b/c	c/d	a/b	b/b	b/c	b/c	b/c	c/c
H	c/c	b/b	b/c	c/b	a/a	b/c	b/b	c/b	b/c	a/b
I	c/c	c/c	c/c	c/c	b/b	c/c	b/b	b/b	c/c	c/b
J	c/b	c/b	c/a	d/b	c/a	d/b	c/a	a/b	c/a	c/c

Note. The (/) separates the pre-test from the posttest. As was indicated within the text, an increase of one level was significant (see Table 10).

APPENDIX MM

Samples of Word Problems That Were Used for Small Group Discussion

The researcher used the basal text to aid in the selection of the problem used in the small group discussion problems. (Abbott, Wells 1985) Similar problems can be found in local libraries, school libraries, and in most instances, the current basal textbook; especially if the date is 1985 and later. They can be self-created.

Using Logical Reasoning
(Problem Solving Technique: Make a chart.)

"The Madison School had a pet show. There were 4 pets that won prizes. The pets were a dog, a cat, a bird, and a fish. The owners of the pets that won prizes were Tom, Mary, Sue, and Jack.

Use the clues below to figure out which child owned which pet.

Clue 1: Tom's pet can't meow and can't fly.
Clue 2: Sue is allergic to cats and dogs.
Clue 3: One of the girls owns a dog.

Complete the chart."

	Dog	Cat	Bird	Fish
Tom	X	X	X	*
Mary				
Sue				
Jack				

APPENDIX NN

Sample Problems Created by the Researcher to be Used For the Problem-Of-The-Week

Sarah wants to give the class cupcakes for her birthday. There are 32 students in her room. Sarah's mother has baked twelve cupcakes. How many more should she bake to give the class?

An eagle flies 24 miles one day and 35 miles the next day. How far has the bird flown?

Susan weighs 217 pounds. She gains 304 pounds. How much does she weigh now?

Susan has joined the circus. She is paid $425.00 for her first week. The second week she is paid the same amount. How much money has she been paid in all?

Sally had 425 hats. If she gives 216 hats to a friend, how many will she have left?

Hunter has 84 bones to eat. She usually eats 95 bones. How many less bones will she be eating?.

APPENDIX OO

Answer Sheet to Accompany Basic Skills Tape

2)	3)	4)	5)	6)	7)	8)
10)	11)	12)	13)	14)	15)	16)
18)	19)	20)	21)	22)	23)	24)
26)	27)	28)	29)	30)	31)	32)
34)	35)	36)	37)	38)	39)	40)
42)	43)	44)	45)	46)	47)	48)
50)	51)	52)	53)	54)	55)	56)
58)	59)	60)	61)	62)	63)	64)

Charlotte K. Tilles

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Signed: Charlotte K. Tilles
student's name

Date: 11/3/90