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A study of the effects of first year implementation of the Everyday Mathematics Program in a second grade classroom

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of the
Everyday Mathematics Program in a Second Grade Classroom

by
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ABSTRACT

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A Study of the Effects of First Year Implementation
of the Everyday Mathematics Program in a Second Grade Classroom
Dr. Stanley Urban, Thesis Advisor
Learning Disabilities

The effects of the first year of the Everyday Mathematics Program for a group of 21 second graders was evaluated through a pre and post-test study during the 2000-2001 school year. The students in the study had not experienced the program in kindergarten and grade one. Math achievement was evaluated using the individually administered KeyMath Diagnostic Inventory of Essential Math Skills. Scores reflected progress in the areas of Basic Concepts, Operations and Applications. Student perceptions about math were measured using an Interest Inventory fall / spring. In addition, teacher perceptions and parent reflections were gathered to assessment adaptability reactions. Standard scores, scaled scores and percentile ranks demonstrated growth in all areas. The largest area of growth was in basic concepts, specifically, numeration. Advances in multiplication and division concepts increased raw scores in the area of operations. All students did not demonstrate mastery of basic addition and subtraction facts to 18 even though percentile scores in these areas increased. The smallest area of growth was in measurement. Home Links did not directly correlate with level of achievement. Teachers acknowledged overall acceptance of the program and praise for instructional design however, they felt assessment and level of adaptability were weak. Teachers of students with special needs noted level of compactness and complexity as an area of concern for students with special needs. Limitations of the study include the lack of a control group and the duration of the study. Implications for future research include a longitudinal study of this same group over several years in the program.

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Mini- Abstract

Achievement effects for first year implementation of the Everyday Mathematics Program for twenty-one second grader were evaluated using a pre and post-test design for the 2000-2001 school year. Teacher and parent reactions were evaluated. Students demonstrated growth in Basic Concepts, Operations and Applications. The largest area of growth was in basic concepts, specifically in the area of numeration. The smallest area of growth was in measurement. Teachers were concerned about assessment and adaptability. Parents were pleased with the results.

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Chapter I

In spite of the multitude of factors contributing to the poor academic achievement of American students, politicians and parents continually blame the state of affairs in American education on schools. One of the factors easiest to change is curriculum. Professionals in the field of education attempt to rectify inadequacies through curriculum reform. Curriculum reform initiatives and the resulting tests of accountability that accompany them are currently found in every state. Current reform initiatives are observed in national and state standards, standardized testing, and the promises of politicians who propose channeling more federal aid to education while demanding higher standards for all students.

Results of international studies paint a dismal picture for American students when they are compared to their global counterparts. The Third International Mathematics and Science Study (TIMSS, 1996)[i] compared the math and science achievement of students in 4th, 8th and 12th grades of forty-one nations. Twenty of those nations scored higher than United States 8th graders in mathematics. The TIMSS video study compared teaching practices of 8th grade mathematics in Germany, Japan and the United States through observations of classroom teaching in each of these countries. In American classrooms math content was found to lag about one year behind other countries and was presented in a "piecemeal and prescriptive way" (Stigler & Hiebert, 1999). The United States covers a great variety of topics but covers them less deeply than European and Asian counterparts.

James W. Stigler and James Hiebert refer to the cultural differences in mathematics teaching methods as The Teaching Gap. They characterize German teaching practices as "developing advanced procedures"; Japanese teaching practices as engaging in "structured problem solving" and American teaching as "learning terms and practicing procedures". Their central thesis is that teaching is a cultural activity and that very real differences exist among nations. They maintain this component is the easiest to change and is the critical factor in the level of mathematical understandings students develop.

The National Council of Teachers of Mathematics has provided recommendations for substantial changes in the way math is taught in American classrooms through the Professional Standards for Teaching Mathematics. The New Jersey State Board of Education adopted Mathematics Standards as part of the Core Curriculum Content Standards on May 1, 1996. These standards and their corresponding progress indicators describe what all students should be able to accomplish by 4th, 8th, and 12th grades. The core curriculum standards were intended to be common goals for math instruction to enable students to compete for jobs in a global economy where deeper understandings and problem solving will be more valued than rote knowledge and superficial learning. The first four standards describe enabling objectives in problem solving, reasoning, making mathematical connections and communicating mathematically. These are pervasive in the remaining 12 core content standards that delineate achievement goals in mathematical sub-topics (NJ Mathematics Curriculum Frameworks). The fifth standard specifically addresses the use of calculators, computers and manipulatives to enhance understanding and not to replace the ability to do paper and pencil computation or mental math. Curriculum developers are marketing current math programs designed to address these national and state standards. Everyday Mathematics is one of the programs designed to meet those needs.

The Everyday Mathematics program is a comprehensive K-6 curriculum currently in its second edition (2001, copyright). It was developed by the University of Chicago School Mathematics Project in response to results of international studies that indicated a paucity of effective mathematics instruction. The Everyday Mathematics curriculum seeks to capitalize on the intuitive understandings of young children through interactive discovery, exploration and student generated problem solving approaches. Each grade level took three years to develop. The principles behind this research-based curriculum are:

> Knowledge evolves from everyday experience.
>
> The curriculum in Kindergarten through 3rd is a gradual transition from concrete experiences to more abstract symbols. This foundation provides for future extensions into more complex math.
>
> Instruction needs to be rich and developmentally appropriate.
>
> Automaticity develops through routines.
>
> Curriculum needs to be workable.
>
> Math needs to be integrated into other curriculum areas such as science, social studies and art. The connections made promote the ability to think mathematically.
>
> Partner and small group activities provide for cooperative learning experiences.
>
> (Everyday Mathematics Teacher's Teacher's Reference Manual)

Theory

The Everyday Mathematics curriculum orchestrates a learning environment through which children use their intuitive understandings to make sense of mathematical situations and work through explorations that are based on cognitive discovery. In this sense this program stands on the shoulders of cognitive theorists such as Jean Piaget, Jerome Bruner and Lev Vygotsky. The cognitive view of learning states that children actively construct knowledge through experiential, hands-on, goal-oriented play. Through everyday experiences children are constantly seeking to make sense of their world. New learning leads to a reorganization of knowledge structures and problem solving. What the learner brings to the learning is as important as the experience itself (Woolfolk, 1993).

According to Piaget's stages of cognitive development children are constantly interacting with their environment in an effort to make sense of their world. "Maturation, activity and social transmission all work together to influence cognitive development" (Woolfolk, 1993). Children organize their thinking as they interact with the world and construct schemes of experiential knowledge. Children adapt through assimilation or accommodation when new data does not fit their existing scheme. Disequilibrium occurs when existing schemes do not fit the given situation and in that case children seek a balance or equilibration between their cognitive schemes and the new information. Children are at work making sense of their environment from birth and pass through a series of overlapping developmental stages where concrete experiences pave the way for more abstract connections and symbolic representations.

Everyday Mathematics seeks to maximize the enormous bank of background knowledge children internalize even before formal mathematics instruction begins. The program provides the scaffold or seeks to work within what Lev Vygotsky called their "zone of proximal development". Lessons within the program provide the scaffold through which with teacher support and social interaction the child solves problems and works through high level thinking processes that they may not be able to do independently. Small group and partner interactions provide the kind of learning environment in which the teacher can orchestrate experiences and games where a more proficient learner can help a struggling learner make sense of those connections. The semi-structured explorations maximize that zone of proximal development through inductive reasoning.

Jerome Bruner stressed inductive reasoning through active exploration in which students discover relationships and patterns that lead to deeper understanding (Woolfolk, 1993). General principles are formulated after working through the relationships among various examples. The exploration activities in the Everyday Mathematics Program are guided discovery lessons in which the teacher provides the environment through planned activities with specific directions toward working with manipulatives. For example, while working with geoboards and rubber bands students are directed to create various triangles. The teacher asks them to note similarities and differences among their constructions. This activity leads to some general principles about the properties of a triangle. Discovery learning has been criticized as being too difficult for cognitively challenged learners because they lack the background knowledge and problem solving skills to maximize their discovery experiences (Woolfolk, 1993).

Purpose and Significance of the Study

The primary purpose of this study was to investigate the effects of initial implementation of the Everyday Mathematics Program for a class of twenty-three second grader students in a suburban New Jersey school district. In adding, the significance of a study such as this lies in the fact that the school district introduced the program in Kindergarten through second grade with two pilot classes in third grade for the 2000-2001 school year. The children in second grade experienced the program without having experienced the spiraling curriculum in kindergarten and first. Actual achievement growth in mathematical areas and implementation perceptions can be shared with other districts considering such first year K-2 implementation of this innovative approach to mathematics instruction. Combining objective standardized test results with subjective personal interpretation, this study also surveyed regular and special education teachers using the program for the first time. The parents of children tested in this study responded to questions concerning effectiveness after seven months in the program. Results of this study are not filtered through the publisher of the curriculum materials and such bias can be avoided.

The need for curriculum reform to improve mathematics achievement has been cited time and again and changes are being implemented across the board for regular education classes as well as those with special education needs. The effects of instructional changes need to be examined in a realistic setting to study the connections between educational theory and practical application. The effects of the pace of curricular changes can be investigated as well. At what point should reforms be introduced and are they applicable to all learners? Are we frustrating or enabling in our national efforts to compete with Asian and European students? Should implementation be more gradual –starting in Kindergarten and then progressing through the grades? Can curricular reforms be effective without more drastic changes in the American educational system?

Research Questions

What are the achievement effects for a class of second grade students experiencing the Everyday Mathematics curriculum for the first time in the areas of basic concepts, operations and applications as measured by the Key Math Diagnostic Inventory of Essential Math Skills- NU ?

Do these same students achieve a proficient level of mastery with basic addition and subtraction facts in second grade as measured by a commercially prepared number fact test?

What are the teachers' perceptions and attitudes towards the program after K-2 first-year implementation with two pilot programs starting in third as measured by teacher survey (Appendix I)?

Does the degree of participation in Home Link activities correlate with greater achievement gains as measured by a teacher rating scale correlated with percentile and standard score gains on the Key Math -NU ?

Does the Everyday Mathematics Program increase feelings of self-efficacy in problem solving and positive attitudes towards math in general as measured by The Everyday Mathematics Student Interest Inventory?

Definitions

The following list of terms have specialized definitions within the context of this study.

constructivism- a framework for instruction that assumes children actively construct their own knowledge through experience "The learner selects and transforms information, constructs hypotheses, and makes decisions, relying on cognitive structure to do so. Cognitive structure (schema, mental models) provides meaning and organization to experiences and allows the individual to go beyond the information given" (Bruner, 1973)

discovery learning- an instructional approach in which learners have opportunities to discover interrelationships and understand concepts through inductive reasoning - In discovery learning the teacher provides stimulating problems and encourages students to generate their own solution methods through trial and error. Children actively construct schema as they work with manipulatives and problem solving (Woolfolk, 1993).

Everyday Mathematics- Components (Everyday Learning Corporation, 1998)

Journal 1 & 2: A student record of mathematical discoveries and experiences. Journal pages provide visual models for conceptual understanding; problem material; and activities for individual and small-group settings.

Math Boxes: Cell format worksheet used for review problems and skills practice

Math Messages: Brief activities before lessons that act as advanced organizers

Home Links: Suggested activities intended for homework follow up.

Tool Kit: A bag containing a calculator, measuring tools, and manipulatives such as real coins that are used throughout the program.

Limitations

The researcher was the teacher implementing this program for the first time realizing unfamiliarity with methods and activities. Certain modifications in the lessons were necessary to provide background because the children did not have this program in Kindergarten & 1st grade and were not familiar with games, terms and prerequisite skills for the second grade curriculum of the Everyday Mathematics program.

Children were pre-tested during two weeks in October 2000 and post-tested throughout March 2001. Those tested at the end of the testing sessions learned more math in the interim than those tested first. Also, the majority of the children were tested after school hours and fatigue may have effect test scores. The class was dealing with chicken pox during the March post-test and scores may have been affected by long absences for five of those tested. Children moved throughout the year and one student was not available for spring post-testing so the spring post-test results may not include the same number of test instruments used in the fall pre-test.

Teachers and parents may misrepresent their feelings about the program because they do not want to be perceived as negative.

The Key Math test, although standardized, may not be aligned with the New Jersey Core Content Standards or the curriculum of Everyday Mathematics. In addition, test administration may have been modified due to time available for testing and student fatigue level. Certain subtests were not administered in order during spring post-testing and may have been administered on separate occasions. Such modifications in administration may effect validity of standard scores. In addition, basal levels in individual sub tests were not always achieved because of the age of the participants and this may have inflated raw scores.

The population was limited to one class of twenty-three second graders and a control group was not used.

The study only investigated first year implementation and better results are expected after three years of implementation. A longitudinal study with the same group over the next four years would demonstrate actual achievement gains when compared to similar students who have had the program since kindergarten.

Chapter 2

Review of the Literature

Research and Development of the Everyday Mathematics Program

The University of Chicago School Mathematics Project (UCSMP) combined the talents of the mathematics and education departments at the University of Chicago and began working to reform mathematics curriculum in grades K-12 with a six year grant from the Amoco Foundation in 1983. They based their work on established research and examined curriculum and teaching methods from other countries. They began developing the Everyday Mathematics Program (EMP) elementary component in 1985-86 with the Kindergarten Everyday Mathematics Program which was field tested 1986-87. With a grant from GTE Corporation, UCSMP group began developing First Grade Everyday Mathematics in 1987-88 and field tested it the following year 1988-89. Kindergarten EMP was published in 1988-89. At this juncture, they began developing Second and Third Grade EMP.

In 1989-90 Everyday MathTools Publishing Company and UCSMP signed a contract to publish the elementary component curriculum and teacher development materials. Subsequently, this company became Everyday Learning Corporation in 1991. First Grade EM was published in 1989-90 and the Second Grade EM was field tested. Second Grade was published in 1991-92 and the Third Grade component the following year. In 1992-93, EM continued work on the curriculum with additional grant money for grades 4-6. By the year 2000 both the elementary and secondary components are recognized as "Promising" by the U.S. Department of Education. While "exemplary" programs demonstrate effectiveness in multiple sites and with multiple populations, "promising" programs were chosen based on "preliminary evidence of effectiveness in one or more sites"(http://www.enc.org/ed/exemplary/). To date approximately 3 million students throughout the United States are using materials developed by the University of Chicago School Mathematics Project. (Usiskin, 2000-2001). The program is currently in its second edition (2001).

The Everyday Learning Corporation publishes two volumes of Student Achievement Studies which contain standardized testing results from districts that have adopted the Everyday Mathematics. They also provide literature on "Everyday Mathematics Success Stories". *TeacherLink* is a newsletter published by Everyday Learning that offers support and a forum for idea exchanges for teachers using the program. Publications designed to market the program cite improved test scores and enthusiasm from students as affirmation of the success in implementing this standards based curriculum.

In a 1994-95 study involving 496 first graders using the Everyday Mathematics program the students demonstrated stronger performance than students in traditional math programs and matched or exceeded East Asians on a broad range of questions (Drueck, Fuson & Carroll, 1999). Karen Fuson, Professor of Education at Northwestern University, (Carroll and Drueck) followed this group of first graders as they moved through the program in 2nd and 3rd grade. The authors of the study used existing studies for comparison and questions from the National Assessment of Educational Progress (NAEP).

In Study 1 conducted by Fuson (2000), 392 second graders were tested at the end of the year (343 were in the original grade one group) to investigate the longitudinal effect of the curriculum. The group represented 11 schools with a heterogeneous mix of SES and demographic characteristics. The tests were administered to whole classes. These children were compared to students in another study from both U.S. and Japan on number sense and mathematics achievement measured by computation. In the area of number sense, students using the EM curriculum had a mean of 54% correct compared to 52% for U.S. and 50% for Japanese students. On the mathematics achievement test the mean percentages correct were: EM curriculum- 70%, U.S. - 55% and Japan- 92%. EM students outperformed their U. S. counterparts but not the Japanese. The authors of this study compared performance on 2-digit computation to national norms on the Stanford Achievement Test because they felt SES was not comparable in the Japanese and US. studies that were used for comparison. The students in the Everyday Math group were at 65% compared to the national norm of 50% and they were at the norm or at 38% on multi-digit subtraction (Fuson, 2000). EM students did not outperform traditional US counterparts on context free symbolic computations (56 -34=__). In Everyday Mathematics computation is always done within a context and numbers are given a label through a unit box or a story problem. Computation is not taught in isolation so the authors feel the performance of the EM group was underestimated.

In Study 2 (Fuson, et. al, 2000), of the 620 third graders in 29 classes tested, 236 were in the original grade one group. Those 236 were the focus of the study. The performance of students new to the program in both the second and third grade groups were not included in the study. Again, the test was whole class administration. Compared to performance on the NAEP: EM 3rd graders had a mean of 65% correct compared to 52% for the comparison group. EM students did better with place value and number stories (problem solving). They were also compared on a cognitively based math test (Wood,T. and Cobb, 1989). EM students scored 20% higher on problem solving using addition, subtraction, multiplication and division. In geometry, data and reasoning, EM had a subtest mean of 56%correct as compared to 35% for NAEP counterparts. Strengths for EM students include geometry concepts and reasoning items. These are underrepresented areas in traditional math programs (Fuson, et. al., 2000).

Results from these two studies indicated the EM student in Grades 2 and 3 were at normative US levels on multi-digit addition/subtraction and symbolic computation. On number sense, EM second graders scored higher than US counterparts but not the Japanese. They were still outperformed on the most difficult items by their Japanese counterparts. EM third graders scored higher on place value, numeration, reasoning, geometry, data and solving number stories. The results of following this cohort group in both 2nd and 3rd grades supports the EM curriculum as effective in helping students learn more advanced topics at a younger age.

This study also noted that teacher interactions were not always able to maximize extensions and deep math discussions. Teachers remarked about difficulty concerning when to expect mastery within the spiral design of the curriculum. Some teacher felt they had to cover the lessons and it was sometimes impossible to do this in a given year.

The teacher, although more of a facilitator in a discovery oriented classroom is pivotal to the success of the Everyday Mathematics curriculum. No matter how well designed the lessons, games and explorations, the students will not reap the full benefit of the program without an enthusiastic, knowledgeable teacher to navigate the curriculum for them. Another component of the five-year study following first graders that Karen

Fuson was involved in is a study in which she, Judith L. Fraivillig and Lauren A. Murphy investigated teacher interactions in advancing children's mathematical thinking in the Everyday Mathematics classrooms. As a result of their investigation they describe the kind of student-teacher interactions that facilitate success of an inquiry -based constructivist curriculum.

To implement effective teaching strategies learned through classroom based observations, they organized successful strategies into a framework. This framework constitutes a new way of teaching that supports a constructivist approach. Eighteen first grade teachers with 1 to 4 years experience teaching Everyday Mathematics from 10 schools in Chicago were observed. Through formal observation instruments, summaries based on social climate, teacher interactions, and teacher interviews, six were identified as skillful teachers. One teacher, Mrs. Smith, stood out as advancing student thinking. The ACT framework (Advancing Children's Thinking) became the lense through which teachers were observed. This framework classifies teacher-student interactions on three levels: Eliciting Children's Solution Methods (Eliciting); Supporting Children's Conceptual Understanding (Supporting); and Extending Children's Mathematical Thinking (Extending).

When eliciting children's solution methods teachers find out what their students know. They facilitate student responses by providing a safe place to risk making a mistake and understanding that there are many ways to find solutions. They allow "wait time" and encourage elaboration and collaborative problem solving. Effective teachers orchestrate class discussions and monitor the level of student engagement keeping all students involved.

Teachers support children's conceptual understanding through linking describer's (child explaining solution strategies) thinking to similar situations, providing background and encouraging group support. Teachers support through "instant replays", recording solution methods on the board and asking a different student to explain the thinking. Supportive teachers add a secure level of support to both describer's and listener's thinking in class discussion and in private.

Teaching in the mode of Extending Children's Thinking is working in their "zone of proximal development" (Vygotsky), setting high standards for all learners and encouraging reflection. This kind of teaching goes beyond initial solution methods and uses student- generated problems. Teachers who extend children's mathematical thinking cultivate a love of challenge and model enthusiasm for mathematics (Fraivillig, 1999).

Using this framework as a gauge to compare teaching practices of five teachers, the study revealed that most teachers used supportive teaching. Elicitation was not as frequently observed even though it is one of the more important components of the program. Supportive strategies observed were: whole class discussion of one child's solution, teacher demonstrated teacher-selected solution methods and teacher prompted students to rethink incorrect responses. The authors of this study concluded most teachers observed supported the thinking of their students rather than eliciting student explanations or extending student's thinking. The supportive role of the teacher is more closely aligned with traditional didactic teaching methods. Eliciting requires more time and more knowledge about children's thinking and math ideas and also requires a change in teaching habits.

Even though teachers were not using all strategies efficiently they were enjoying math and making progress in meeting the NCTM standards using the Everyday Mathematics curriculum. The ACT Framework can be used to train teachers to effectively use the materials in the EM curriculum. This kind of teaching is very time consuming, requires patience, sensitivity and a knowledgeable, skillful teacher (Fraivillig, 1999).

Differences of Opinion: California

The Everyday Mathematics curriculum was noted as "Promising" according to the US. Department of Education but not all have greeted it with enthusiasm and for some very valid reasons. According to their Final Adoption Report (1997 Follow-Up Adoption of Basic Instructional Resources in Math), the California Department of Education adopted four math programs (six were submitted). Everyday mathematics was adopted along with Encyclopaedia Britannica's Mathematics in Context (Gr. 5-7); Everyday Mathematics (Gr. 1, 2, 4, 5); Kendall/Hunt Math Trailblazers: A Math Journey Using Science and Language Arts (K-3); and Prentice Hall Middle School Tools for Success Gr. 6-8. The State Board of Education adopted Everyday Mathematics however the Instructional Resources Evaluation Panel members and Curriculum commission did not recommend it for adoption.

The Final Adoption Report describes the format of the EM program. Number sense dominates grades 1 and 2 and more strands are involved in grades 4 and 5. They felt the program focuses on fundamental skills and includes games that are not language dependent. However, they felt the program relies heavily on student's oral and written language abilities. The report noted a need for more ESL activities and that standards of performance were not clear.

In a report submitted to the California State Board of Education July 5, 1999, David Klein, Professor of Mathematics at California State University, Northridge recommended that the K-6 Everyday Math Curriculum be rejected based on "missing or drastically abridged presentations of the standard algorithms of arithmetic at all grade levels". He wrote that the program promotes calculator use contrary to state standards and does not include materials for independent study.

California standards state that technology should not replace mastery of basic skills. Professor Klein argued that Everyday Math clearly sends the message that they are opposed to standard algorithm proficiency and support reliance on calculators. Everyday Math lacks a textbook therefore the materials cannot be used for independent study. Students in the Everyday Mathematics curriculum are not required to learn standard algorithms and proficiency in standard algorithms is part of the state standards. Professor Klein also sees the fact that students never use the standard long division algorithm as a major problem because understanding that algorithm is important for success in later mathematics. He stated that Everyday Mathematics proposes that because of the availability of calculators students do not need to learn long division. Professor Klein noted some of the activities are "a waste of time" and he stressed the importance of standard algorithms citing a 1998 report from the American Mathematical Society that stressed the value of standard algorithms relating them to spelling as a mutual communication everyone should learn (Klein, 1999).

However Professor Klein's critique ignores the Teacher's Reference Manual supplied with teaching materials for the Everyday Math curriculum. In this manual the authors address their position on mathematical themes taught in the program. (See Chapter 3). This manual is necessary reading for anyone involved in teaching Everyday Mathematics. Perhaps the danger lies in concepts being misrepresented because of the teacher's insufficient background in math. In Everyday math students use some computational methods that are given to them and some they "invent" on their own. It is the intention of the program that students understand the "idea of an algorithm" as a method to solve problems and not ends in themselves. They don't want children to substitute algorithms for thinking processes. They want them to rely more on number sense based on a firm understanding of our number system. The program does not call for abandoning standard algorithms, it merely suggests being open to more than one way of doing it.

"Algorithm invention" requires time, real life contexts, and discussion of strategies. It requires teacher support and a firm foundation in number sense. This can occur more easily if a student starts the program in Kindergarten and builds these understandings. For example, a student with a firm grasp of numeration should be able to do 300-1 in their head without relying on regrouping 300 (Teacher's Reference Manual). Addition algorithms suggested by the program include: Left- to- Right (adjusting requires knowledge of place value); Partial -Sums and Renamed Addends. Subtraction algorithms also appear to be unconventional and some are more labor intensive than the traditional ones. They include: Add-Up Algorithm; Left-to -Right Algorithm; Rename -Subtrahend Algorithm.

Even though some algorithms seem more complicated than standard U.S. algorithms, they give students more options. Students still need to arrive at the correct solution and this is where teacher support and eliciting responses come in to play. Algorithms are taught as a means to an end and calculators are intended to free up time once facts are mastered. The goal of Everyday mathematics is to get students thinking about developing algorithms as they solve problems. Once they understand them they can use a calculator (K-3 Teacher's Reference Manual, 1998).

Authors of the program cite improved test results time and time again as proven success of the program. In 1993, a study conducted by William M.Carroll from the University of Chicago School Math Project compared the achievement results of 26 schools in 9 districts using the Everyday math program in Illinois to student in Chicago and Cook County who were not using the program (14 of the 26 had been using the program since Kindergarten). He used the math portion of the Illinois Goal Assessment Program (IGAP) given in grades 3-6-8 and 11. There was no performance- based assessment in this instrument and no calculators were used. Items in the test did reflect content strands in the curriculum. IGAP school scores can range from 0 to 500.

Results of this study showed third graders using UCSMP materials had a mean school score of 337 compared to state counterparts (268) and Cook County (295). The fourteen schools using the program since Kindergarten had a higher mean score (351). The study illustrated a positive longitudinal effect for low income populations included in the study. For students in the program since Kindergarten 54% exceeded state goals and 2% failed to meet these goals in algorithmic thinking. For the 12 schools new to the program achievement was still better than state counterparts but not as dramatic as for those in the program from kindergarten. In an analysis of the content strands addressed, the 382 children who had been in the program since kindergarten had a mean gain of 23 points. Their area of largest gain was in geometry (47 points) between 1990-1993 (Carroll, 1997). According to the author the implications of this study include:

(1) Reform mathematics does not mean falling scores on standardized tests.

(2) Scores indicate it works with at risk students.

(3) Gains in geometry and data collection indicate better understanding of traditionally underrepresented areas.

In general this study indicated a positive longitudinal effect with strongest gains for children in the program since Kindergarten.

The Everyday Mathematics Curriculum covers content and concepts about 1/2 to 1 year ahead traditional math programs. For example, basic addition and subtraction facts and three digit numbers are introduced in the first grade curriculum although mastery is not expected until second grade. Exposure to more advanced concepts at a younger age may inflate score reports that compare these students to their same age counterparts. It is important to remember that the standardized instruments used to assess these students were standardized on a different population. They were standardized on students using traditional math programs using a hierarchy of math skill development. It would not be surprising if the scores of children using the EM curriculum were higher than children using a traditional program since the children in the traditional program have not been taught the same curriculum. Valid assessment instruments need to be developed that are aligned with the reform mathematics approach that is presented in the current Everyday Mathematics curriculum and other new programs that attempt to remedy deficits in the mathematical thinking and problem solving strategies of American Students with core content standards.

As part of the field testing for the fifth grade Everyday Mathematics Curriculum, William M. Carroll investigated the mental computational skills and number sense of four fifth grade classes (n=78) who had used the program since Kindergarten. The author used a test designed to test mental computation and estimation then compared test results to a study done in 1993 by B. J. Reys et al. Students were asked solution preferences in an inventory and the solution methods of five students were analyzed using videotape. Students from the EM group had a mean correct score of 47% compared to baseline sample of 24% (Carroll, 1996). Results indicated that student demonstrated areas of strengths and weakness. Their strong mental computation reflected the use of "invented algorithms", an understanding of the relationships between operations, and the number sense developed in younger grades. However they failed to use easy strategies that may have helped them in some problems. The author of the study admitted that in the EM curriculum "few specific mental strategies are taught in the curriculum through fourth grade" and that this is an area in need of supplementary experience and explicit instruction.

The strength of the program lies in the flexibility it allows when students are encourage to invent and explore alternate solution methods and teaching them strategies may limit this experience (Carroll, 1996). However, some students will not "invent" strategies on their own and may need more direct instruction. The author of the study concluded that a balance between direct instruction in the use of strategies and encouraging students to "invent" algorithms would help this problem however it would require a teacher knowledgeable in mental computation and how students think about mathematics.

Application for Students with Special Needs

Special education researchers have identified effective use of problem-solving strategies, memory, generalization skills, and cognitive deficits as weak areas for children with math learning disabilities (Rivera, 1997). Interventions have included teaching explicit strategies, relevant practice, alternative algorithms and alternate forms of assessment that focus as much on the process as the product of conceptual understandings. The Everyday Mathematics Curriculum taps into some of the best practice approaches endorsed by researchers in the field of special education.

The Standards developed by the NCTM and at the state level have reflected a shift from a behaviorist to a constructivist approach to teaching mathematics. This had caused concern in the special education community because of the following issues:

> The standards make limited reference to students with special needs.
> The standards are based on vague theoretical constructs.
> Limited research concerning valid instructional practice.
> Limited research on the effectiveness of a constructivist approach with learning disabled students (Rivera, 1997).

Math learning disabilities can be viewed through three perspectives: developmental, neurological and neuropsychological, and educational (Rivera, 1997). Curriculum reform based on developmental research and best practices can make significant differences in the development and prevalence of math learning disabilities. Students who are "curriculum disabled" will benefit from greater emphasis on number sense, estimation, data analysis, spatial sense and geometric thinking, patterns and relationships (Thornton, Langrall, Jones, 1997).

Douglas Carnine and researchers at the University of Oregon have identified five design principles for instruction that address areas of weakness for students with learning disabilities. The five principles for effective instruction are: big ideas; conspicuous strategies; efficient use of time; clear and explicit instruction on strategies; and appropriate practice and review (Carnine, 1997).

Although few strategies are explicitly taught through the fourth grade (Carroll, 1996) the Everyday Mathematics Curriculum is based on "big ideas" or the themes of mathematics intricately woven throughout content topics and lesson activities. Themes throughout the program include: algorithmic and procedural thinking, estimation and number sense, mental arithmetic skills and reflexes and problem solving. For example, the program connects experiences with money, operations, and base ten blocks structures to build foundations in our number system. Activities rarely use isolated skills without connecting them to larger themes. The focus on the "big ideas" and low priority on teaching to mastery at a certain point allow a two-year period for understanding to develop to a secure level. However this may create gaps for children new to the program. Fewer and fewer children remain in one school district from K-6 than ever before and this is an issue that needs to be addressed by this program.

The EM second grade program consists of 120 lessons and each takes approximately 70 minutes of instructional time. The curriculum recommends incorporating mathematics throughout the school day and making connections an integral part of the classroom management system. These recommendations assist the teacher in making "mathematically" efficient use of time. However, the program is very time consuming and for students to achieve the maximum benefit time must be spent on games, activities and explorations that provide background for future learning. As with any new program, the first year of implementation will ultimately cause adjustment problems. However the EM curriculum is dramatically different from the traditional program and it may take a teacher a few years in the program before they are using all their time efficiently. The assessment recommended by the program is highly individualized and time consuming. This can be challenging in a class larger than fifteen students.

Judicious practice and review are an important part of the Everyday Mathematics curriculum. They have replaced drill worksheets with "Math Boxes" designed to review previously learned skills daily. A "Math Box" is a page divided into 6 squares or cells in which review problems are written in four and two are left empty for teacher's use. The problems represent different topics and are not limited to the lesson content presented that day. The children practice through games designed to incorporate cooperative learning and problem solving. The "explorations" provided for each unit are small group activities designed to provide practice and preview more challenging concepts. For example, in one second grade exploration children build arrays with pattern blocks then count "How many rows? How many in each? How many all together?" This activity is worked through before symbolic representation of multiplication and division are introduced.

The weakest area of the five design principles in the Everyday Mathematics seems to be its lack of explicit direct instruction in conspicuous strategies (Carroll, 1997). EM seeks to maximize children's intuitive math knowledge and promote "algorithmic thinking". The program expects children to "invent algorithms" based on prerequisite skills that some children may not possess. Children new to the program may not have the number sense necessary to do this and may require more teacher support. Children with attention problems may have difficulty with more self-directed kinds of activities and connections may have to be made more explicit.

As a reform curriculum that attempts to address the imperfections in our existing system, the Everyday Mathematics Program may open up different possibilities and opportunities for students who are labeled learning disabled. "By recent estimates, 80% of the children who are classified as learning -disabled should not have been" (Ginsburg, 1997). A developmental perspective of learning disabilities takes into account the ecology within which formal learning evolves and seeks to understand cognition within the context of school.

Although poor children differ in their level of informal mathematical abilities, all children develop some informal understandings about quantity before they come to school (Ginsburg, 1997). Everyday Math attempts capitalize on that knowledge without dampening their enthusiasm for challenge. American children live in a culture that devalues math and attend schools where they may find poor teachers, bad textbooks and irrelevant curriculum (Ginsburg, 1997). The Everyday Math curriculum links informal math with the formal mathematical symbols and language of school. The use of calculators and multiple methods for problem solving can address traditionally weak areas for children with learning problems.

The variety of assessment opportunities in the Everyday Mathematics program may provide for a more individualized assessment orientation. The program assumes three levels of understanding for quarterly objectives: beginning, developing and secure.

There are no "tests" provided in the program. Teachers can use multiple measures to assess understanding. These include portfolios, observations and anecdotal records that assess process and progress rather than mastery. Analysis of work samples and math interviews can shed light on strategies used and allow the teacher to analyze errors.

Summary

The utility of any curriculum depends on the degree to which it prepare students to deal with the challenges they will meet when they leave school. Most real-life mathematics is problem solving in daily living. Managing money and time present the greatest challenges in real-life (Patton et. al, 1997). The Everyday Mathematics Program's strength lies in its practical applications and connections to real-life situations.

The definition of math literacy is changing and this applies to all students (Goldman, 1997). Susan Goldman and Ted S. Hasselbring and the Cognition and Technology Group at Vanderbilt proposed a "hybrid model of math instruction" where skills are learned in meaningful contexts. Problem solving and using technology prepares students to compete in the workplace where the ability to work collaboratively, communicate and be technologically literate will be employable skills (SCANS report US. Department of Labor, 1992). These authors state that standards do not indicate that teachers should not teach and that students should be left to "discover" math. The implications of the standards are that children need to be active participants in their learning and develop the ability to construct concepts and assess the reasonableness of their results. They echo the researchers who developed the Everyday Mathematics curriculum when they state that children come to school with intuitive knowledge about math. Effective learning environments set up "triggering conditions" that require the learner to link their declarative (facts), procedural (algorithms), and their conceptual (understanding relationships) knowledge (Goldman, 1997).

Test scores indicate American students can compute but cannot apply procedures to problem solve. They posses "inert knowledge" that they fail to generalize and apply to new situations. Learning disabled students have problems with both computation and problem-solving. Special educators are concerned about the applicability of the standards to student with learning problems (Goldman, 1997).

Through the use of "anchored instruction" (cognitive learning theory and technology) Goldman and Hasselbring used meaningful authentic video situations in a hybrid model of instruction that provides practice in procedures, applications and conceptual links. They cite a study that investigated the effectiveness of video simulations in problem solving with two groups of adolescents. One group used a traditional approach for teaching word problems and one group used the video simulation "Ben's Pet Project". Both groups improved in problem solving. However the group that used the video simulation demonstrated an increased ability to generalize and transfer problem- solving skills to other areas. The video situations such as "The Adventures of Jasper Woodbury" have been effective for slow learners. They provide real life situations to practice mental elaboration and the context is motivating.

The Everyday Mathematics curriculum is built on a solid foundation of research and is designed to meet the NCTM standards in American classrooms. It introduces content and vocabulary much earlier than traditional programs as it seeks to bridge the gap between informal and formal mathematics knowledge. But ultimately its success depends on the classroom teacher. With a firm foundation in mathematics and the ability to make connections and elicit student understandings, the classroom teacher orchestrates the program for maximum effectiveness. This program requires major shifts in thinking as well as practice.

Chapter 3

DESIGN OF THE STUDY

The Everyday Mathematics curriculum was introduced to a suburban South New Jersey school district in grades K-2 with two pilot classes in grade three for the 2000-2001 school year. Prior to curriculum changes intended to align district curriculum to the New Jersey Core Content Standard, this district had been using Mathematics in Action published by Macmillan /McGraw-Hill (1994).

The purpose of this study was to analyze the effects of first year implementation in a class of twenty-three second grade students who had not gone through the Everyday Mathematics curriculum in kindergarten and first grade. In addition, teacher opinions and observations were gathered in the spring to evaluate perceived implementation effectiveness and growth results for year one in the Everyday Mathematics curriculum in grades K-2 with two pilot classes in grade 3. In March 2001, the parents of the students tested were asked to reflect on their child's progress in mathematics. Level of involvement in Home- links was rated by the teacher on a scale of 1 (rarely completed) to 4 (consistently completed).

Subjects of the Study

Twenty -three second grade students in a suburban elementary school located in Southern New Jersey were tested using the Key Math Revised NU. That is a diagnostic inventory of essential mathematics (Connolly, 1998) in the fall of the 2000-2001 school year. Using an October pre-test followed by post testing in March, this study compared achievement growth in three areas: (1) basic concepts, (2) operations and (3) applications. "Fact Power" was also assessed using a pre-post test design. In September the children were given the Level A (addition and subtraction facts to 10) and Level B (addition and subtraction facts to 18) One- Minute Math (Frank Schaffer Publications) tests to assess % correct on an untimed fact drill test. This measure was administered as a group test. The children in the study were also administered an Everyday Mathematics Interest Inventory in the fall and again in the spring. This measure was given to evaluate changes attitude toward mathematics in general.

In September, the class consisted of ten girls and thirteen boys between the ages 7.0 years and 8 years 8 months. In this second grade class, 21% of the students qualified for free and reduced lunches; 17 % of the class received basic skills instruction for reading; 13% had previously qualified for special education and related services but have since been declassified. Thirteen per cent of the class was African American with 87% Caucasian. The children in the study were drawn from a suburban South Jersey community in which PSE&G Area Development demographic report projects for the year 2002 the following data:

Race and Ethnicity

80.86% Caucasian
13.38% African American
3.6% Hispanic
1.8 Asian
.36 Other.

Median Household Income

1997- $47,219 projected 2002- $53,923 (PSE&G, 2000)

School district

76% white; 19% black; 0% Asian; 0% Hispanic
15% special education;
14% gifted (Philadelphia Inquirer, 2000)

School rank

898/1906

Elementary Proficiency Tests (ESPA) 1999-00 reported in
New Jersey School Report Card Elementary/ Middle 1999-00

General Education Students

Language Arts Proficiency Exam
Advanced: 0% Proficient: 37% Partially Proficient: 63%

Science Proficiency Exam
Advanced: 17.4 % Proficient: 73.9 % Partially Proficient: 8.7%

Mathematics Proficiency Exam
Advanced: 6.5% Proficient: 54.3 % Partially Proficient: 39.1%

Special Education Students

Language Arts Proficiency Exam
Advanced: 0.0% Proficient: 7.7% Partially Proficient: 92.3 %

Science Proficiency Exam
Advanced : 25 % Proficient: 58.3% Partially Proficient : 16.7%

Mathematics
Advanced: 7.7 % Proficient: 0.0% Partially Proficient: 92.3 %

Instrumentation

The children were given the Key Math Revised (NU) in the fall of 2000 and re-tested with the same form (A) in the spring 2001. Tests were individually administered before and after school and each lasted approximately 30-40 minutes. The children were tested over several weeks so the results for students tested toward the end of the time frame may have been affected by the amount of mathematics instruction they received. The class composition changed by the time post-testing began in the spring. One child joined the group after pre-testing in the fall. This student was classified eligible for special education services and mainstreamed for mathematics only. Two children left the class in the course of the year and one was unavailable for spring post testing.

Score summaries of the Key Math-NU yield scaled scores, standard scores and percentile ranks in three key areas: basic concepts, operations and applications. Total test raw scores were converted to standard scores and percentile rank according to age-based norms. Standard scores have a mean of 100 and a standard deviation of 15. Assuming a normal distribution a standard score of 100 could reflect a true score falling within the range of 85-115. 90% confidence intervals were used in computing score ranges for parents. Scores reflect the revised normative updated version of the test (1998). Pre- and post-test results are listed in Tables 1 to 23.

The KeyMath test was composed of thirteen sub-tests in three areas: Basic Concepts, Operations and Applications (Appendix II). The age of the children in this study may have affected the reliability of results in certain sub-tests. For example, no scaled scores are provided for rational numbers, multiplication and division in certain age ranges.

Test manual specifies sub-tests must be administered in order. However due to time constraints and to avoid fatigue, sub-tests were not always administered in order or at the same time during the March post-testing. This may have affected validity of results. The Numeration sub-test was used as a basal for subsequent sub-tests. Reliability of the KeyMath test using Split-Half Coefficients for Grade 2 Total test: fall- .94; spring - .97. Age 7: Total Test- fall .95; spring .97; Age 8 Total test - fall .97; spring .98. Validity studies yielded the following Inter-correlations between Sub-test Scaled Scores and Area and Total Test Standard Scores for Second Graders in Spring standardization sample: (N=99) Area 1: Basic Concepts- Total Test: .88; Area 2: Operations- Total Test: .88; Area 3: Applications Total Test: .92

Age Norms were used in computing scaled scores, standard scores and percentile ranks in all cases except were noted.

Table 1.

Student 101 Home Link Involvement rating: 3

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/Spring	Standard Score Fall/Spring	Standard Score Difference Fall / Spring	Descriptive Category Fall/Spring
Numeration	14 / 16	91 /98			
Geometry	16 / 15	98 / 95			
Basic Concepts		87 / 98	117 / 131	+ 14	above average/ markedly above aver.
Addition	10 /13	50 / 84			
Subtraction	13 / 12	84 / 75			
Operations		63 / 81	105 / 113	+ 8	average/ above aver.
Measurement	13 / 15	84 / 95			
Time and Money	14 / 15	91 /95			
Estimation	9 / 6	37 / 9			
Interpreting Data	15 / 14	95 / 91			
Problem Solving	13 / 14	84 / 91			
Applications		81 / 86	113 / 116	+ 3	above average/ above average
Total Test		82 / 91 %	114 / 120	+ 6	above average / above average

Table 2.

Student 102 Home Link Involvement Rating: 3

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Difference Fall / Spring	Descriptive Category Fall /Spring
Numeration	10 / 12	50 / 75			
Geometry	9 /14	37 / 91			
Basic Concepts		39 / 82	96 / 114	+ 18	average / above aver.
Addition	8 / 9	25 / 37			
Subtraction	7 / 11	16 / 63			
Operations		16 / 37	84 / 95	+ 11	below average / aver.
Measurement	12 / 9	75 / 37			
Time and Money	11 / 11	63 / 63			
Estimation	7 / 4	16 / 2			
Interpreting Data	9 / 11	37 / 63			
Problem Solving	11 / 11	63 / 63			
Applications		53 / 47	101 / 99	- 3	average / average
Total Test		34 / 53	94 / 101	+ 7	average / average

Table 3.
Student 103 Home Link Involvement Rating: 3

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall /Spring	Standard Score Fall/ Spring	Standard Score Difference Fall /Spring	Descriptive Category Fall/ Spring
Numeration	12 / 14	75 / 91			
Geometry	15 / 15	95 / 95			
Basic Concepts		81 / 87	113 / 117	+ 4	above average/ above average
Addition	11/ 12	63 / 75			
Subtraction	12 / 13	75 / 84			
Operations		61 / 68	104 / 107	+ 3	average / average
Measurement	12 / 12	75 / 75			
Time and Money	11 / 13	63 / 84			
Estimation	11 / 12	63 / 75			
Interpreting Data	13 / 12	84 / 75			(grade norms used)
Problem Solving	11 / 14	63 / 91			(grade norms used)
Applications		66 / 81	106 / 113	+ 7	average
Total Test		73 / 82	109 / 114	+ 5	average

Table 4.
Student 104 Home Link Involvement Rating: 3

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Difference Fall / Spring	Descriptive Category Fall /Spring
Numeration	9 / 14	37 / 91			
Geometry	7 / 9	16 / 37			
Basic Concepts		13 / 61	83 / 104	+ 21	below average / average
Addition	10 / 12	50 / 75			
Subtraction	5 / 13	5 / 84			
Operations		18 /68	86 / 107	+21	below average / average
Measurement	10 / 11	50 / 63			
Time and Money	11 / 14	63 / 91			
Estimation	7 / 9	16 / 37			
Interpreting Data	9 / 12	37 / 75			
Problem Solving	11 / 11	63 / 63			
Applications		45 / 73	98 / 109	+ 11	average /average
Total Test		23 / 73	89 / 109	+ 20	below average / average

Table 5.
Student 105 Home Link Involvement Rating: 3

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Difference Fall / Spring	Descriptive Category Fall/ Spring
Numeration	12 / 14	75 / 91			
Geometry	10 / 11	50 / 63			
Basic Concepts		55 / 81	102 / 113	+ 11	average / above aver.
Addition	12 / 14	75 / 91			
Subtraction	12 / 13	75 / 84			
Operations		55 / 84	102 / 115	+ 13	average / above aver.
Measurement	11 / 18	63 / >99			
Time and Money	11 / 14	63 / 91			
Estimation	6 / 13	9 / 84			
Interpreting Data	13 / 13	84 / 84			(grade norms used)
Problem Solving	9 / 14	37 / 91			(grade norms used)
Applications		53 / 92	101 / 121	+ 20	average / above aver.
Total Test		53 / 90	101 / 119	+ 18	average / above aver.

Table 6.
Student 106 Home Link Involvement Rating : 4

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Difference Fall / Spring	Descriptive Category Fall /Spring
Numeration	11 / 16	63 / 63			
Geometry	14 / 15	91 / 95			
Basic Concepts		70 / 92	108 / 121	+ 13	average / above aver.
Addition	11 / 10	63 / 50			
Subtraction	10 /11	50 / 63			
Operations		45 /58	98 / 103	+ 5	average / average
Measurement	14 / 16	91/ 98			
Time and Money	13 / 13	84 / 84			
Estimation	12 / 12	75 / 75			
Interpreting Data	11 / 14	63 / 91			
Problem Solving	13 / 14	84 / 91			
Applications		79 /88	112 / 118	+ 6	above average / above average
Total Test		70 / 87	108 / 117	+ 9	average / above aver.

Table 7.
Student 107 Home Link Involvement Rating: 3

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Difference Fall / Spring	Descriptive Category Fall/ Spring
Numeration	9 / 11	37 / 63			
Geometry	8 / 14	25 / 91			
Basic Concepts		27 / 58	91 / 103	+ 12	average /average
Addition	9 / 9	37 / 37			
Subtraction	7 / 11	1 / 63			
Operations		16 / 39	85 / 96	+ 11	below average / average
Measurement	9 / 8	37 / 25			
Time and Money	10 / 12	50 / 75			
Estimation	9 / 14	37 / 91			
Interpreting Data	12 / 12	75 / 75			
Problem Solving	12 / 10	75 / 50			
Applications		53 / 66	101 / 106	+ 5	average / average
Total Test		32 / 61	93 / 104	+ 11	average / average

Table 8.
Student 108 (Spring scores not available)

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Differences Fall/ Spring	Descriptive Category Fall/ Spring
Numeration	10	50			
Geometry	9	37			
Basic Concepts		34	94		average
Addition	4	2			
Subtraction	4	2			
Operations		4	74		markedly below average
Measurement	9	37			
Time and Money	12	75			
Estimation	8	25			
Interpreting Data	11	63			(grade norms used)
Problem Solving	11	63			(grade norms used)
Applications		47	99		average
Total Test		25	90		average

Table 9.
Student 109 Home Link Involvement Rating: 4

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall/ Spring
Numeration	13 /14	84 / 91			
Geometry	11 / 15	63 / 95			
Basic Concepts		70 / 92	108 / 121	+ 13	average / above average
Addition	13 /11	84 / 63			
Subtraction	11 / 10	63 / 50			
Operations		70 / 63	108 / 105	- 3	average / average
Measurement	12 / 10	75 / 50			
Time and Money	12 / 14	75 / 91			
Estimation	10	50 / 95			
Interpreting Data	12	75 / 84			(grade norms used)
Problem Solving	12	75 / 84			(grade norms used)
Applications		73 / 81	109 / 113	+ 4	average / above average
Total Test		75 / 84	110 / 115	+ 5	average / above average

Table 10
Student 110 Home Link Involvement Rating: 3 Spring scores not available.

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall/ Spring
Numeration	9	37			
Geometry	11	63			
Basic Concepts		37	95		average
Addition	7	16			
Subtraction	9	37			
Operations		18	86		below average
Measurement	12	75			
Time and Money	10	50			
Estimation	7	16			
Interpreting Data	7	16			
Problem Solving	11	63			
Applications		39	96		average
Total Test		30	92		average

Table 11.
Student 111 Home Link Involvement Rating: 4

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall/ Spring
Numeration	9 / 9	37 / 37			
Geometry	11 / 13	63 / 84			
Basic Concepts		37 / 53	95 / 101	+ 6	average /average
Addition	7/ 10	16 / 50			
Subtraction	9 / 8	37 / 25			
Operations		13 / 34	83 / 94	+11	below average / average
Measurement	10 /10	50 /50			
Time and Money	10 / 11	50 / 63			
Estimation	7 / 9	16 / 37			
Interpreting Data	7 / 12	16 / 75			
Problem Solving	9 / 13	37 /84			
Applications		25 / 58	90 / 103	+ 13	average / average
Total Test		21 / 50	88 /100	+12	below average / average

Table 12.
Student 112 Home Link Involvement Rating: 3

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall/ Spring
Numeration	12 /15	75 /95			
Geometry	10 / 10	50 /50			
Basic Concepts		55 / 96	102 / 127	+ 25	average / markedly above average
Addition	12/ 11	75 / 63			
Subtraction	12 / 13	75 / 84			
Operations		61 / 68	104 / 107	+ 3	average / average
Measurement	12 / 16	75 / 98			
Time and Money	11 / 13	63 / 84			
Estimation	8 / 13	25 / 84			
Interpreting Data	9 / 11	37 / 63			
Problem Solving	14 / 14	91 / 91			
Applications		53 / 84	101 / 115	+ 14	average / above average
Total Test		55 / 87	102 / 117	+ 15	average / above average

Table 13.
Student 113 Home Link Involvement Rating: 4

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall/ Spring
Numeration	11 / 13	63 / 84			
Geometry	9 / 9	37 / 37			
Basic Concepts		47 / 55	99 / 102	+ 3	average / average
Addition	8 / 11	25 / 63			
Subtraction	11 / 13	63 / 84			
Operations		42 / 73	97 / 109	+ 12	average / average
Measurement	12 / 11	75 / 63			
Time and Money	12 / 11	75 / 63			
Estimation	10 / 7	50 / 16			
Interpreting Data	12 / 14	75 / 91			(grade norms used - fall)
Problem Solving	11 / 12	63 / 75			(grade norms used - fall)
Applications		70 / 58	108 / 103	- 5	average / average
Total Test		61 / 66	104 / 106	+ 2	average / average

Table 14
Student 114 Home Link Involvement Rating: 4

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall/ Spring
Numeration	11 / 14	63 / 91			
Geometry	17 / 15	99 / 95			
Basic Concepts		79 / 95	112 / 125	+ 13	above average / markedly above aver.
Addition	12 / 12	75 / 75			
Subtraction	10 / 14	50 / 91			
Operations		66 / 81	106 / 113	+ 7	average / above aver.
Measurement	13 / 12	84 / 75			
Time and Money	14 / 15	91 / 95			
Estimation	6 / 8	9 / 25			
Interpreting Data	13 / 12	84 /75			(grade norms used)
Problem Solving	14/ 13	91 / 84			(grade norms used)
Applications		86 / 98	116 / 131	+ 15	above average / markedly above aver.
Total Test		82 / 91	114 / 120	+ 6	above average/ above average

Table 15.
Student 115 Home Link Involvement Rating: 4

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall/ Spring
Numeration	13 / 14	84 / 91			
Geometry	15 / 13	95 / 84			
Basic Concepts		79 / 84	112 / 115	+ 3	above average / above average
Addition	12 / 13	75 /84			
Subtraction	11 / 15	63 / 95			
Operations		47 / 86	99 /116	+ 17	average / above aver.
Measurement	10 / 11	50 /63			
Time and Money	11 / 14	63 /91			
Estimation	8 / 14	25 /91			
Interpreting Data	10 / 12	50 /75			(grade norms used)
Problem Solving	13 / 12	84 /75			(grade norms used)
Applications		63 / 81	105 / 113	+ 8	average / above aver.
Total Test		68 / 87	107 / 117	+ 10	average / above aver.

Table 16.
Student 116 Home Link Involvement Rating: 3

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall/ Spring
Numeration	11 / 16	63 / 98			
Geometry	15 / 13	95 / 84			
Basic Concepts		75 / 95	110 / 125	+ 15	average / markedly above average
Addition	10 / 13	50 / 84			
Subtraction	10 / 16	50 / 98			
Operations		34 / 81	94 / 113	+ 19	average / above average
Measurement	9 / 15	37 / 95			
Time and Money	12 /15	75 / 95			
Estimation	10 / 16	50 / 98			
Interpreting Data	11 / 10	63 / 50			
Problem Solving	12 / 15	75 / 95			
Applications		58 / 94	103 / 123	+20	average / above average
Total Test		58 / 93	103 / 122	+ 19	average / above average

Table 17.
Student 117 (Spring scores not available)

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Descriptive Category Fall/ Spring
Numeration	8	25		
Geometry	9	37		
Basic Concepts		19	87	below average
Addition	6	9		
Subtraction	7	16		
Operations		8	79	below average
Measurement	6	9		
Time and Money	9	37		
Estimation	9	37		
Interpreting Data	6	9		
Problem Solving	7	16		
Applications		9	80	below average
Total Test		12	82	below average

Table 18.
Student 118 Home Link Involvement Rating: 3

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall/ Spring
Numeration	11 / 11	63 / 63			
Geometry	13 / 14	75 / 91			
Basic Concepts		68 / 79	107 / 112	+ 5	average / above average
Addition	11 / 11	63 /63			
Subtraction	12 / 12	75 / 75			
Operations		63 / 61	105 / 104	-1	average
Measurement	10 / 11	50 /63			
Time and Money	9 / 14	37 / 91			
Estimation	11 / 8	63 / 25			
Interpreting Data	13 / 14	84 / 91			
Problem Solving	13 / 13	84 / 84			
Applications		58 / 79	103 / 112	+ 9	average / above average
Total Test		66 / 77	106 / 111	+ 5	average

Table 19.
Student 119 Home Link Involvement Rating: 4

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall/ Spring
Numeration	13 / 18	84 / > 99			
Geometry	14 / 15	84 / 95			
Basic Concepts		81 / 99%	113 / 138	+ 25	above average / markedly above
Addition	14 / 19	91 / > 99			
Subtraction	13 / 12	84 / 75			
Operations		84 / 92	115 / 121	+ 6	above average/ above average
Measurement	19 / 18	99 / > 99			
Time and Money	16 / 16	98 / 98			
Estimation	14 / 16	91 / 98			
Interpreting Data	16 / 15	98 / 95			
Problem Solving	17 / 15	99 / 95			
Applications		99 / 99	134 / 133	-1	markedly above average/ same
Total Test		95 / 98	125 / 132	+ 7	markedly above average /same

Table 20.
Student 120 Home Link Involvement Rating: 2

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall/ Spring
Numeration	10 / 10	50 / 50			
Geometry	12 / 11	75 / 63			
Basic Concepts		53 / 37	101 / 95	-6	average / average
Addition	9 / 10	37 / 50			
Subtraction	8 / 7	25 / 16			
Operations		25 / 19	90 / 87	-3	average / below average
Measurement	10 / 9	50 / 37			
Time and Money	11 / 9	63 / 37			
Estimation	8 / 11	25 / 63			
Interpreting Data	10 / 11	50 / 63			
Problem Solving	11 / 11	63 /63			
Applications		50 / 45	100 / 98	-2	average / average
Total Test		39 / 32	96 / 93	-3	average / average

Table 21.
Student 121 Home Link Involvement Rating: 4

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall / Spring
Numeration	10 / 13	50 / 89			
Geometry	12 / 9	75 / 37			
Basic Concepts		50 / 55	100 / 102	+ 2	average / average
Addition	9 / 10	37 / 50			
Subtraction	11 / 13	63 / 84			
Operations		30 / 37	92 / 95	+ 3	average / average
Measurement	10 / 12	50 / 75			
Time and Money	11 / 12	63 / 75			
Estimation	7 / 15	16 / 95			
Interpreting Data	10 / 14	50 / 91			
Problem Solving	10 / 13	50 / 84			
Applications		50 / 82	100 / 114	+ 14	average / above average
Total Test		39 / 66	96 / 106	+ 10	average / average

Table 22.
Student 122 Home Link Involvement Rating: 3

Subtest	Scaled Score Fall/ Spring	%ile Rank Fall/ Spring	Standard Score Fall / Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall / Spring
Numeration	15 / 15	95 / 95			
Geometry	8 / 13	25 / 84			
Basic Concepts		68 / 96	107 / 127	+ 20	average / markedly above average
Addition	11 / 14	63 /91			
Subtraction	13 / 13	84 / 84			
Operations		79 / 97	112 / 129	+ 17	above average/ markedly above
Measurement	11 / 16	63 / 98			
Time and Money	15 /16	95 / 98			
Estimation	15/ 13	95 / 84			
Interpreting Data	15 /16	95 / 98			
Problem Solving	14 / 14	91/ 91			
Applications		91/ 97	120/ 128	+ 8	above average/ markedly above
Total Test		87 / 98	117 / 130	+ 13	above average/ markedly above

Table 23.
Student 123 - Home Link Involvement Rating: 4

Subtest	Scaled Score Fall /Spring	%ile Rank Fall / Spring	Standard Score Fall/ Spring	Standard Score Differences Fall / Spring	Descriptive Category Fall/ Spring
Numeration	9 / 11	37 / 63			
Geometry	8 / 13	25 / 25			
Basic Concepts		19 / 63	87 / 105	+ 18	below aver./ average
Addition	11 / 11	63 / 63			
Subtraction	5 / 13	5 / 25			
Operations		30 / 47	92 / 99	+ 7	average/ average
Measurement	8 / 11	25 / 63			
Time and Money	11 / 11	63/ 63			
Estimation	9 / 10	37 / 50			
Interpreting Data	9 / 9	37 / 37			
Problem Solving	9 / 12	37 / 75			
Applications		30 / 58	92 / 103	+ 11	average / average
Total Test		25 / 58	90 / 103	+ 13	average / average

Fall (2000) / Spring (2001) Class Summary
Scores reflect averages in each category.

Subtest	Scaled Score Fall /Spring	%ile Rank Fall/ Spring	Standard Score Fall/ Spring	Standard Score Difference Fall / Spring	Descriptive Category Fall/ Spring
Numeration	10	50			
Geometry	11	63			
Basic Concepts			102 / 115	+ 13	average/ above average
Addition	10	50			
Subtraction	10	50			
Operations			97 / 107	+ 10	average / average
Measurement	11	63			
Time and Money	12	75			
Estimation	9	37			
Interpreting Data	11				
Problem Solving	12				
Applications		61	104 / 113	+ 9	average / above average
Total Test		53	101 / 112	+11	average / above average

The Everyday Mathematics Program Assessment Manual provides quarterly checklists for grade K-3 with shaded areas indicating expected stages of development for individual skills and concepts. Theses were modified and adapted to suit the particular needs of the district (See Appendix III). These checklists were used to report quarterly progress to parents. The program recommends that observations, portfolios and anecdotal records comprise the primary assessment tools of student growth in the primary grades. Various black line masters can be used to gather portfolio pieces in areas such as student generated number stories, problem solving, and student or parent reflections. The children who participated in the study were asked to respond to a publisher made Interest Inventory (Appendix IV). Statements and responses are reproduced below.

Results of Interest Inventory given fall (2000) / spring (2001)

1. This is how I feel about math:
   Good: 15 /10 OK: 5 / 5 Not so good: 3 / 7

2. This is how I feel about working with a partner or in a group:
   Good: 14 /16 OK: 8 / 5 Not so good: 1 / 1

3. This is how I feel about working by myself:
   Good: 7 / 4 OK: 5 / 8 Not so good: 11/ 9

4. This is how I feel about solving number stories:
   Good: 10 /10 OK: 10 /9 Not so good: 3 / 2

5. This is how I feel about doing Home Links with my family:
   Good: 14 / 12 OK: 5 / 6 Not so good: 4 / 3

6. This is how I feel about finding new ways to solve problems:
   Good: 10 / 10 OK: 8 / 7 Not so good: 5 / 4

7. I like to figure things out. I am curious.
   yes: 12 / 8 sometimes: 7 / 11 no: 4 / 2

8. I keep trying even when I don't understand something right away.
   yes: 14 / 12 sometimes: 6 / 9 no: 3 / 0

Everyday Mathematics defines "fact power" as the automatic recall of basic number facts. Student levels of fact mastery were assessed using commercially prepared One Minute Math (Frank Schaffer Publications) drill tests. The children were not timed during these assessments.

Table 24.
"Fact Power" assessment Fall/ Spring

Level A= Addition and Subtraction facts to 10
Level B= Addition and Subtraction facts to 18

Student #	Level A (+) % correct Fall/ Spring	Level A (-) % correct Fall/ Spring	Level B (+) % correct Fall/ Spring	Level B (-) % correct Fall /Spring
101	100 / 100	100 / 97	97 / 100	50 / 100
102	100 / 97	47 / 90	30 / 90	27 / 97
103	100 / 93	97 / 93	93 / 97	33 / 90
104	93 / 100	73 / 100	43 / 100	93 / 100
105	93 / 100	87 / 97	100 / 100	23 / 60
106	100 / 100	77 / 100	100 / 93	30 / 87
107	97 / 100	100 / 90	100 / 97	23 / 73
108	90 / **	60 / **	73 (**)	63 /**
109	90 / 97	93 / 93	53 / 90	3 / 93
110	93 / 100	63 / 57	60 /93	13 / 23
111	70 / 100	47 / 90	60 / 90	47 / 97
112	100 / 100	80 / 57	40 / 97	3 / 90
113	47 / 100	20 / 90	3 /97	0 / 20
114	100 / 100	97 / 100	97 / 100	70 / 100
115	97 / 100	93 / 100	100 /100	83 / 100
116	100 / 100	90 / 100	93/ 97	0 / 90
117	20 /**	0 /**	0 /**	0 /**
118	100 / 100	97 / 100	97 / 97	50 / 100
119	100 / 100	97 / 97	97 / 100	90 / 97
120	100 / 100	87 / 100	17 / 67	10 / 87
121	** / 100	** / 90	** / 63	30 / 27
122	100 / 100	100 / 100	100 / 100	97 / 100
123	97 / 100	73 / 93	97 / 100	80 / 90

Level of Fact Power in the spring: $\geq$ 93 % on untimed fact drill.

addition facts to 10: 100% subtraction facts to 10: 65 %

addition facts to 18: 74 % subtraction facts to 18: 50 %

The Everyday Mathematics Instructional Program

The second grade program consisted of 120 lessons, exploration activities, review lessons, games and home-link activities to reinforce lesson content. Lessons incorporated dialog and discovery learning to promote mathematical thinking and real life applications. The children utilized mathematical tools such as calculators, templates, measuring tapes and real coins regularly and these are stored in their personal tool kits. The children spent approximately 70 minutes per day on mathematics. The lessons were taught according to a pacing guide developed by another school district and certain modifications were made to accommodate deficits in background knowledge needed for certain lessons. The lessons were taught in sequential order Monday through Thursday. Fridays were reserved for Explorations and/ or games.

The program used everyday experiences as material for problem solving situations and incorporates a classroom management system that builds on mathematical connections in daily routines and procedures. Hands-on manipulatives provided a developmentally appropriate context for exploring mathematical concepts. New concepts were linked to previously learned material and revisited in a different way to connect the concrete to more abstract symbols. Discussion of discoveries and problem solving strategies promoted language development and listening skills. Games replaced drill worksheets as a method of attaining automaticity. Occasionally drill worksheets that were not part of the program were used for extra practice.

Concepts are revisited throughout the curriculum. Every concept is introduced 5 to 15 times in 5 different ways over a two-year period before mastery is expected. The

K-3 curriculum is designed to build a foundation for Gr. 4-6 proficiencies. The program is based on the premise that children need repeated exposure before a skill or concept is firmly established and transfer can occur. Mastery levels or secure proficiency can be achieved through repeated exposure of various topics in different contexts.

The philosophy behind assessment recommendations is that children experience varying levels of understanding as they progress through the program. These understandings are characterized as *beginning* (demonstrating little or no understanding of a concept or skill), *developing* (some understanding with errors), *or secure* (the child can apply the concept or skill independently and accurately). The program recommends that teacher use an age appropriate balance of product (work samples), periodic (unit tests), standardized and ongoing observational assessment instruments. Assessment checklists that come with the program were adapted to allow for the fact that these second graders did not have the program in kindergarten and first grade. Therefore secure levels expected by the program were not realistic this year. Assessments were conducted through on-going observations and end-of -quarter teacher made tests scored according to a rubric for beginning, developing and secure concepts covered that quarter.

The curriculum is organized in a spiral by grade level into "content strands": Algebra and Use of Variables, Exploring Data and Chance, Geometry and Spatial Sense, Measures and Measurement, Numeration and Order, Operations, Patterns, Functions, and Sequences, and Reference Frames. Within the "strands" of content are the following themes (big ideas): Algorithmic and Procedural Thinking, Estimation skills and Number Sense, Mental Arithmetic Skills and Reflexes, Problem Solving. The Everyday

Mathematics program is closely aligned with the New Jersey Core Content Curriculum Standards for both process and content standards.

Lesson Format: Everyday Mathematics Grade 2 First Edition)
(each lesson took approximately 1.5 to 2 days to complete this year)

I. Math Message
brief task or story problem related to lesson content or review

II. Instruction and Discussion
Home-link follow -up from the night before
solution strategies and discussion of alternative problem solving approaches
diagrams may be used to help organize information
time for students to generate solution methods

III. Teacher-Directed Activities
Journals 1 or 2 performance component
children work on their own or with a partner (more teacher directed this year)
teacher elicits solution strategies with some direct instruction
games may be taught or practiced to promote skill development

IV. Independent Activities
Continue to play game taught
complete Math Boxes
Home-Link assigned for homework
sample: Go shopping and estimate that each item costs $1. Estimate the total cost and compare your estimate to the real cost.
Home-Links are written on half-sheets of paper that are kept in a notebook.

Recommended Classroom Management

Daily Routines

Children work with calendar and data collection activities such as weather conditions and temperature recording daily. The daily calendar routine includes questions about the date number, roman numerals for the date or equivalent names for the date. The date was used as a starting point for rote counting by 2s, 5, or 10s forward or backward each day. Data collected on class data pad could be used to create number stories such as: "What is the difference between the a.m. temperature and the p.m. temperature?" Tally marks were used to record types of weather conditions.

The class number line included numbers from -30 to 180 and was used to practice rote counting and keeping track of the number of days in school. The math center included a bulletin board "Numbers in My World" that contained various posters for problem solving, number grids, and vocabulary. The math center was used for additional time with Exploration small group activities.

The Everyday Mathematics Program utilizes basic classroom management routines and procedures as avenues for children to use math in their daily lives and see the connections in real-life problem solving situations. The program takes a typical day in the classroom and uses concepts like time schedules, data collection (lunch counts, weather, and attendance), money and classification to pose realistic mathematical problem situations. Cooperative grouping structures are used for games and journal activities. Rules for healthy cooperation and competition are continually reinforced. This is especially challenging in second grade.

Themes

Themes are the "big ideas" woven into the program content strands. They are used at every grade level with varying amounts of emphasis. While some strategies are directly taught such as diagram representation, most lessons and activities require children to construct their own strategies and be ready to discuss them. The following is a brief summary of the theme descriptions provided in the Everyday Mathematics Teacher's Resource Manual.

Algorithmic and Procedural Thinking

The main goal of the program is for children to understand the "idea of an algorithm" as a mean to achieve a desired outcome rather than rote memorization of the traditional standard algorithms for the four operations. The program does teach some algorithms. Before specific algorithms are taught children have the opportunity to construct their own and develop a deeper understanding. This type of understanding evolves with time to explore alternative solution methods. It also requires a firm foundation in number sense and the meaning of operations. Children need time to experiment and discuss solution strategies. Left to right partial sums and subtraction algorithms are taught to reduce the problems children usually encounter with regrouping. Partial-product algorithms are introduced in Gr. 3 for multiplication and division is taught through equal sharing and estimation. The Everyday Mathematics Program does not want children to waste "problem-solving" time with rote computation. When algorithms are understood children can speed up processing time with a calculator. Calculators are not intended to replace mastery of basic facts or as a substitute for thinking.

Estimation and Number Sense

In Everyday Mathematics children develop a sense of the necessity of estimation and when to use it appropriately. For example, in a lesson on telling time children use the hour hand only to estimate the time and develop vocabulary to describe it: "about __o'clock, between __ and __ o'clock, just before (after) ____ o'clock. " Number sense starts in Kindergarten and takes up most of the K-2 program. Strong number sense cuts across all topics and themes within the program. The program uses the number grid to

100 extensively to develop the idea of counting patterns. Children create number scrolls for numbers to 1000.

Mental Arithmetic Skills and Reflexes

The development of mental math skills relies on a firm foundation in basic fact knowledge for the four operations. Everyday Mathematics refers to this as "Fact Power". The program relates automaticity with number facts with the need to develop sight word knowledge in reading. "Fact power" is achieved through games, fact families, triangle flashcards, and daily slate drills. Children experience addition and subtraction facts to 18 in Grade 1 even though mastery is not expected until the end of Grade 2. Children are given the opportunity to develop "common sense" about numbers and check the reasonableness of their results. Some strategies are taught such as rounding, looking for easy combinations, using multiples of ten, using basic facts, finding distance on the number grid before more formal algorithms are taught.

Problem Solving

The program uses four basic problem representations or models: verbal (a number story), pictorial (drawings), concrete (counters), and finally the symbolic (number model 3+4=7). Number models are rarely used without a context or a "unit" label. Everyday Mathematics calls the problem-solving process "mathematical modeling". The goal of the program is for children to understand the problem with a relevant context before working toward a solution. Using age appropriate everyday experiences and working with language skills toward deeper understanding, children using this program learn to identify the problem and check the reasonableness of their results. Basic guidelines help them understand the problem rather than the traditional "steps in problem solving" taught in traditional math programs. There is more emphasis on understanding the language of the situation rather than identifying "key words".

Number stories are generated from everyday experiences, posters with numerical information, and data collection activities. Language and literacy skills are an important component of the program. In fact the Everyday Mathematics program makes the connections across all subject areas and provides a method for integrating the general curriculum toward practical application and utility. Knowledge does not seem so isolated and motivation increases as students make useful connections to their personal lives.

Second Grade Units and suggested pacing

Quarter 1

- Unit 1: Routines & Assessments
- Unit 2: Addition & Subtraction Facts
- Unit 3: Place Value, Money & Time

Quarter 2

- Unit 4: Mental Arithmetic: Addition & Subtraction
- Unit 5: 3-D & 2-D Shapes
- Unit 6: Review & Extension of Whole-Number Operations

Quarter 3

- Unit 7: Patterns & Rules
- Unit 8: Fractions
- Unit 9: Measurement

Quarter 4

- Unit 10: Decimals & Place Value
- Unit 11: Whole-Number Operations Revisited
- Unit 12: Year- End Reviews & Extensions

Results of teacher surveys

Thirty-four district teachers in grades kindergarten through third completed a survey with statements summarizing three key areas of effectiveness: instructional design, assessment procedures and level of adaptability. The 2000-2001 school year was the initial introduction for students and teachers. Students in both regular and special education classes received instruction using the Everyday Mathematics Program. Students with more severe and profound cognitive disabilities did not. Teachers were asked to rate their responses to statements on the following scale:

1 = strongly disagree; 2= strongly disagree; 3 = not sure; 4 = agree; 5= strongly agree

(All teachers did not respond to every item. Percentages were calculated on the number of responses for each item. Item responses ranged from 29 to 34 teachers for each item surveyed.)

Instructional Design

1. Lessons had clear objectives which were presented in a clear and well-developed format.

strongly disagree	disagree	not sure	agree	strongly agree
(3%)	(29%)	(0%)	(44%)	(24%)

2. Everyday Mathematics provides sufficient practice and review for key concepts and skills.

strongly disagree	disagree	not sure	agree	strongly agree
(15%)	(35%)	(12%)	(32%)	(6%)

3. Students in my class routinely used math tools and technology.

strongly disagree	disagree	not sure	agree	strongly agree
(0 %)	(3%)	(6%)	(62%)	(24%)

4. Key math concepts or the "big ideas" were integrated throughout the program.

strongly disagree	disagree	not sure	agree	strongly agree
(3%)	(18%)	(21%)	(38%)	(24%)

5. Home Links provided sufficient practice and review

strongly disagree	disagree	not sure	agree	strongly agree
(9%)	(44%)	(21%)	(27%)	(0%)

6. Students who routinely used home links were more successful in the program.

strongly disagree	disagree	not sure	agree	strongly agree
(0 %)	(18%)	(47%)	(35%)	(0 %)

7. Students developed solution strategies independently.

strongly disagree	disagree	not sure	agree	strongly agree
(3%)	(21%)	(9%)	(65%)	(3%)

8. Problem-solving strategies needed to be directly taught.

strongly disagree	disagree	not sure	agree	strongly agree
(3%)	(3%)	(3%)	(67%)	(23%)

9. Students developed an improved ability to communicate mathematically.

strongly disagree	disagree	not sure	agree	strongly agree
(3%)	(6%)	(12%)	(59%)	(21%)

10. Students make more connections to their daily lives.

strongly disagree	disagree	not sure	agree	strongly agree
(0%)	(3%)	(24%)	(47%)	(26%)

11. Students made more connections across subject areas.

strongly disagree	disagree	not sure	agree	strongly agree
(0%)	(15%)	(29%)	(45%)	(9%)

12. The program teaches effective strategies for problem solving.

strongly disagree	disagree	not sure	agree	strongly agree
(0%)	(9%)	(29%)	(53%)	(9%)

13. Students in my class enjoy math more than in previous years.

strongly disagree	disagree	not sure	agree	strongly agree
(6%)	(0%)	(3%)	(38%)	(53%)

21. Games were effective practice.

strongly disagree	disagree	not sure	agree	strongly agree
(0 %)	(6%)	(15%)	(59%)	(21%)

<u>Assessment</u>

7. Assessment recommended by the program was sufficient and effective.

strongly disagree	disagree	not sure	agree	strongly agree
(33%)	(41%)	(3%)	(38%)	(24%)

8. I supplemented the program with teacher made assessment instruments and practice activities.

strongly disagree	disagree	not sure	agree	strongly agree
(9%)	(0%)	(0%)	(53%)	(38%)

<u>Level of Adaptability</u>

3. Students in my class adjusted quickly to routines and procedures.

strongly disagree	disagree	not sure	agree	strongly agree
(0 %)	(21%)	(6%)	(50%)	(24%)

4. Students in my class will be ready for Everyday Mathematics next year.

strongly disagree	disagree	not sure	agree	strongly agree
(3%)	(6%)	(32%)	(32%)	(24%)

18. Students new to my class throughout the year adjusted in a reasonable amount of time.

strongly disagree	disagree	not sure	agree	strongly agree
(10%)	(41%)	(24%)	(21%)	(3%)

19. Students with learning problems were successful in the program.

strongly disagree	disagree	not sure	agree	strongly agree
(6%)	(53%)	(15%)	(27%)	(0%)

20. Students with behavior problems were successful in the program.

strongly disagree	disagree	not sure	agree	strongly agree
(20%)	(27 %)	(20 %)	(27%)	(7%)

22. Students were able to learn games quickly and play them independently with a minimum amount of help.

strongly disagree	disagree	not sure	agree	strongly agree
(3%)	(38%)	(0 %)	(47 %)	(12%)

Average time spent on Everyday Mathematics each day:

Kindergarten: (38 minutes) Grade 1 (75 minutes)

Grade 2 (80 minutes) Grade 3 (80 minutes)

Special Class for Learning Disabilities 1-2 (75 minutes)

Special Class for Learning Disabilities 2-3 (50 to 60 minutes)

K-5 Multiply Disabled (20-30 minutes)

Resource Room Grades 1-2 (45 minutes)

Results of Teacher Surveys: Comments

"The language in teacher's manual is vague--assumes previous experiences with the program"

"challenging program for multiply disabled students
abstract with difficult concepts
don't feel it meets the needs of special learners
many students have difficulty using manipulatives in multi-step processes
unable to work independently/cannot do math message without assistance and lessons take much longer with these students"

"I love the program!"

"The Everyday Mathematics Program has many new and creative ways to introduce and reinforce math concepts. The games and reinforcement activities are introduced very quickly and then move on so quickly that the kids don't really have a chance to get to know the activities. The activities are good but I feel a need to take the time to really enjoy the activity. There is so much in every lesson. There is no time to slow down and enjoy the games and new ideas."

"Kindergarten-The 30 minute period is the amount of time from opening exercises and a lesson from the manual. However, other math is integrated throughout the day which lengthens the students involvement in math --center activities"

"Teacher's guide explanations are sometimes confusing."

"I found that the math message was not very useful. I have implemented Read it Draw it Solve it instead. This challenges the students a lot more they love to illustrate their problems. I do feel you must supplement math facts because 2nd grade program is very weak here."

"I like teaching the program. Students enjoy math, but I wish more there was more practice/ review. Children with behavior and learning problems are unable to function independently or make many of the observations. Teacher is constantly explaining the strategies."

"I think it will become easier as we move into another year. The first graders will be better prepared as a result of having Everyday Mathematics in Kindergarten. A full day kindergarten will be helpful in allowing more time for the math. Teacher time will be lessened as we can use whatever we made last year. Preparation for lessons was very time consuming. I really enjoy the program."

"Home Links provide some practice and review but math boxes provide more. I did supplement, however as time went on I relied more on the math boxes to provide review. Regarding problem-solving strategies, since this was the first year for the students and I, perhaps the students with learning problems may have eventually arrived at their own strategies, I was concerned about keeping pace so I taught them some strategies."

"I love the hands-on activities. Children are learning through fun. My only concern is the limited amount of paper and pencil practice --printing numbers. I am supplementing these areas."

"I do like teaching this program, but it does take so much time. With so much time needed for reading, there doesn't leave much time for Science, Social Studies, and Health and other projects. That's a problem for grading at report card time! We're on the rush, rush schedule all the time! I worry because there doesn't seem to be much mastery. The students are exposed to a lot in one lesson. I hope the first graders will show mastery and understanding of skills by the end of second grade. I'm assuming that it's a two- year program. Math Boxes and Math Messages often become mini-lessons which are time consuming."

"Since I am teaching the 3rd grade pilot program I tried to incorporate many 2nd grade lessons to get students secure in skills that they were expected to be secure in. This is why I did not have as much time for games as I would have liked, also I needed to stay on schedule. Any extra game time was used extending lessons or teaching skill another day."

"Insufficient assessment
More practice of specific skills needed
not enough repetition and reinforcement"

"The program is a lot of fun to teach and the kids really enjoy it. I do not have a good feel for how well the kids are doing."

"There is not enough time for students to practice skills before moving on to the next concept or skill."

Results of Parent Survey

Parents of the children involved in this study were asked to complete a survey responding to the following questions from the Everyday Mathematics Assessment Manual. Twelve parents of the twenty-one students involved in the final assessment returned Parent Reflections.

1. *Do you see evidence of your child using mathematics at home?*
2. *What do you think are your child's strengths and challenges in mathematics?*
3. *Does your child demonstrate responsibility for completing Home Links?*
4. *What thoughts do you have about your child's progress in mathematics?*

Parent Responses:

"I do see evidence of ** using math at home. ** does his Home Links fine. He usually shows me how to do them.

"Yes I do see evidence of my child using math at home, especially with money. I feel strengths are addition, with weaknesses in subtraction and multiplication tables.
Question 3. Sometimes --depends on mood.
Question 4. Getting much better."

"Everyday Math overall has been a positive experience for **. The program has sparked more of an interest in math for her than I previously noticed and I do see her using the concepts occasionally. Specifically, she will see patterns in say, the colors of cars in line and she can see how various geometric shapes fit together to form another shape. She does feel confident in completing her Home Links. Some of the more advanced skills such as comparing fractions without a visual model are not "secure". Concepts such as negative numbers, fractions, and double- digit addition are not real solid yet either. Overall this seems to be helping math become and "everyday" skill and I know the ideas are advanced but she frequently complains of being bored."

" So far Everyday Mathematics has been a pleasant experience. I agree with teaching the same concept in several different ways for complete understanding. ** has shown much progress this year in math. She uses what she has learned in school when we bake, when telling time, when playing store and when trying to solve problems. Her strengths are that she tells time easily, knows most addition and subtraction facts, understands the concept of multiplication and grouping, can identify fractions. She has difficulty with <, > symbols, making change with coins, fractions with the rule. All Home Link assignments have been completed to date. I am pleased with my child's progress and I would like to have materials to work on for summer vacation for review."

" I see ** using mathematics at home when we play video games. She counts as well as multiplies. ** loves to count money . I see she is very good at counting money when we go to the store to purchase things (food, etc.) I am extremely proud of ** progress in mathematics. Her mother and I are happy for our daughter."

"1. No, I do not see my child using Math at home on an everyday basis.

2. I know her strengths are more in the classroom but at home it's more of a challenge for her because her parents are still learning this along with her.

3. Yes, my daughter does show a need to complete her Home Links, and responsible enough to make sure it is done.

4. I feel the progress is a little slow. I know my child understands the material but hesitates when applying it at home."

"1. Yes, ** always tries to use math when we play cards, she keeps score.
2. ** has always done well in math. She seems to really concentrate.
3. ** Home links are always done.
4. I think ** is doing very well in math and hope she continues to do well"

Do you see evidence of your child using math at home? "Somewhat"
What do you think are your child's strengths and challenges in math?
"Strengths-everything until fractions."
Does your child demonstrate responsibility for completing Home Links?
"Yes, he really enjoy math."
What thoughts do you have about your child's progress in math?
"I feel that he understands and enjoys math to the fullest."

"** does well with her math and seems to understand the basic principles behind the various math problems. ** does have a bad habit of rushing her work and making errors. ** takes on the responsibility of doing her math links herself. I am happy with her progress."

" ** enjoys Everyday Mathematics. He uses it to help cook (fractions, etc.), grocery shopping--counting his money in his bottle bank (including skip counting)--while playing with his toys, playing on the computer, and measurements helping dad fix things. He likes his flash cards and uses his calculator. He does extremely well in addition but is slower at subtraction. He does his Home Links usually without hesitation as he enjoys a challenge. I think he is adapting well to the new program and should do well."

"** has definitely proven evidence of interest in mathematics. He looks to be challenged with math problems while at home, riding in the car, and even when getting dressed for bed. His strengths and challenges in math are addition and completes his Home Links. I think ** will progress in all the areas of mathematics as he challenges himself."

" Yes, she always wants to pay for things and counts the change. ** never needs help with any of her homework. When we check it she usually has everything correct. At this time I have no worries about her in math."

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

Everyday Mathematics presents a clear and dramatic change in the way mathematics is taught in elementary school. The program addresses goals outlined by the NCTM and the New Jersey Core Content Curriculum standards through experiences that promote deeper understanding of key math concepts. The purpose of this study was to examine a sample of student growth and gauge parent / teacher reactions during first year implementation in a suburban community. The students who participated in the KeyMath fall / spring assessments did not have Everyday Mathematics in grades kindergarten and first. Post-tests in the spring were completed before students had completed the second grade program. Results may have been affected because the following units had not been covered yet:

Unit 9: Measurement
Unit 10: Decimals and Place Value
Unit 11: Whole-Number Operations Revisited
Unit 12: Year-End Reviews and Extensions.

Achievement Effects in Basic Concepts, Operations and Applications

Basic Concepts

The Basic Concepts Area of the KeyMath Diagnostic Inventory of Essential Math skills assessed achievement in Numeration, Rational Numbers and Geometry. The age of the students eliminated standardized scaled scores for the Rational Numbers sub-test. However correct responses were included in the total sub-test raw score. The Numeration sub-test is considered the most important because concepts of quantity, order, and place value are important in the development of subsequent math skills (AGS Manual). Numeration basal scores determined starting points for the rest of the sub-tests.

The average difference between fall / spring standard scores in the area of basic concepts was + 11.75 points. Standard scores improved within a range of + 25 points to - 6 point difference for one student. This was probably due to the fact that this student was returning after a week long absence with chicken pox. Numeration percentile rank differences for fall / spring ranged fro m an increase of 54 percentile points in rank to an increase of zero. The average increase in percentile rank in numeration was + 17.1. Spring percentile ranks for the Geometry sub-test ranged from an increase + 54 points to a decrease of - 38 points. The average increase in percentile rank in geometry for the class was + 10.9 . The average increase in standard scores for the Numeration sub-test fall / spring for students who ranked highest (4) in Home Link involvement was 9.2 points. The average increase in Numeration standard scores for students for ranked (3) in Home Link Involvement was 14.36 points. Completing and extending Home Links consistently throughout the year (rank 4) did not necessarily correlate with a larger increase in standard scores. Eight of the twenty students who were available for post testing in the spring (40 % of the class) demonstrated percentile rank increases of ≥ 20 points in Numeration. Six of the twenty students (30 %) demonstrated percentile rank increases of ≥ 20 points in Geometry. Six of the twenty students (30%) demonstrated percentile rank decreases in the Geometry subtests. Largest area of growth in the Basic Concepts area was in Numeration concepts and skills. The average standard score in the area of Basic Concepts after spring post testing was 115 placing the class in the above average range for this area.

Operations

The Operations Area consisted of five sub-tests assessing addition, subtraction, multiplication, division and mental computation. The average difference between fall/ spring standard scores in the area of operations was + 8.2. The average spring standard score in this area was 107 placing the class as a whole in the average range of progress in this area. The average percentile rank for addition in the spring was the 67%ile or the upper average range. The average increase in percentile rank in the addition sub-test was + 10.5. The range of percentile change went from an increase of 38 points to a decrease of 13 points in percentile rank. Five out of twenty students available for spring post testing (25%) increased percentile rank by ≥ 20 points; six out of twenty students (30%) increased percentile rank by ≥ 10 points and four out of twenty students (20 %) made no change in percentile rank in this area. In fact three out of twenty students (15 %) actually decreased percentile rank by > 10 points.

The Everyday Mathematics Program refers to the automatic recall of basic number facts as "Fact Power". The level of "fact power" students arrived with in the fall was evaluated using four separate tests for addition / subtraction facts 0-10, and 0 - 18 respectively. This was again evaluated in the spring to gauge progress and level of mastery achieved. Practice activities recommended by the program were primarily through triangle flash cards using a fact family approach. Flash cards were copied and sent home for review on three separate occasions throughout the year and parents were continually reminded to practice facts with the children. The teacher supplemented this with other materials that were not part of the program. She felt the amount of practice offered for this group of second graders this first year in the program was insufficient and students did not have enough opportunity to practice basic number facts before moving on to more complex concepts. In the spring, 100 % of the class achieved mastery ($\geq$ 93 % correct) of addition facts to 10 with 74 % achieving mastery with subtraction facts to 10. In addition, 65 % of the class demonstrated mastery of addition facts to 18, while only 50 % had achieved mastery of basic subtraction facts to 18. Clearly, half the class had not yet achieved "Fact Power" by the time they were post-tested in the spring.

While most students attempted multi-digit addition and subtraction problems they did not spontaneously use strategies for multi-digit addition or subtraction discussed and used in class. Only two students made obvious use of the number grid hanging in the classroom during testing. The average increase in percentile rank for students who ranked highest (4) in Home Link involvement was 8.5 while the average increase in percentile rank for students who ranked 3 in Home Link involvement was 12.9. The student who ranked lowest in Home Link involvement actually increased percentile rank in addition by 13 percentile points. This suggests minimal correlation between progress in addition and Home Links. In the spring, the average percentile rank for the subtraction sub-test was 70 %ile or the upper average range. The average increase in percentile rank for the subtraction sub-test was + 18.95 with 9 out of 20 students (45 %) increasing their percentile rank by $\geq$ 20 points and 4 out of 20 students (20 %) decreasing percentile rank by > 9 points. For the 9 students who rated highest in Home Link involvement (4) the average increase in percentile rank for subtraction was 12.66 points. The average increase for students ranked (3) in Home Link involvement was 21. 2 points. This again suggests a minimal correlation between Home Links involvement and achievement.

Although the student with the least Home Link support made no gains in progress as measured by this instrument at the time of post-testing.

Although scaled scores for multiplication, division and mental computation were not included in Tables 1-23 because of the age of the participants, raw scores for these areas were included in the total raw scores for the Operations Area, standard scores and percentile ranks. The average raw score for multiplication concepts was 3.5 which would be a scaled score between 12-13 (grade 2 spring norms used) placing the class in the 84 % ile (above average) in this area. This suggests exposure to multiplication concepts through games, number stories and arrays established an above average understanding of the basic concept even though generalization to multi-digit multiplication has not occurred. The foundation for further growth in this area is definitely established this year. The average raw score for division was 3 which would be a scaled score of 12 using grade 2 spring norms. This placed the class average in division at the 75 %ile; again above average in division concepts suggesting an advanced understanding before formal instruction in division. The average raw score for mental computation was 3 which would be a scaled score of 12 using grade 2 spring norms placing the class as a whole in the 75%ile for mental computation.

Applications

The Applications area is considered the highest level of performance incorporating concepts and skills from Basic Concepts and Operations. Sub-tests include Measurement, Time and Money, Estimation, Interpreting Data and Problem Solving. (AGS Manual). The average standard score in applications for the spring post testing was 113 with an average increase of 8 points. This is in the above average range. 9 out of 20 students were given the highest rating for Home Link involvement and the average increase for these students was 7 standard score points. Students rated (3) for Home Link involvement had an average gain of 10 standard score points and the student with the lowest Home Link Involvement decreased the standard score in applications by 2 points. This suggests a minimal correlation between Home Links and achievement.

Measurement

The average percentile rank in the spring for the measurement sub test placed the class in the 71 %ile, with an average scaled score of 13 in the average to above average range. The average difference between fall and spring percentile scores was + 8.65 with six out of twenty students (30%) increasing percentile rank by > 20 points. 30% also decreased percentile ranks by > 10 percentile points. 40 % of the class made between 0 to + 13 point change in percentile rank. Students had not yet covered Unit 9 -Measurement, by the time of post-testing in the spring and most of the their exposure to measurement concepts in the program to date had been considered review of concepts covered in grade one by the program. This "review" throughout the year was in the form of math boxes and supplemental material and lessons on time (to five minute intervals), temperature and money concepts. Formal lessons on linear and capacity measures had not been covered by the time of post-testing.

Time and Money

The average percentile rank in the spring for the time and money sub test was 81 % -tile with an average increase of + 11.95 percentile points. The average scaled score in the spring for the time and money sub-test was 13 placing the class average in the above average range.

Estimation

The average percentile rank in the spring for the estimation sub-test was in the 60.52%ile with an average increase of + 23 percentile points. The average scaled score in the spring for the estimation sub-test was 11 placing the class average in the average range. Sixty-five % of the class increased percentile ranks by $\geq$ 10 points with 40 % of the class increasing percentile scores by $\geq$ 30 points.

Interpreting Data

The average percentile rank in the spring for the Interpreting Data sub-test was 76 %ile with an average increase of 13 percentile points. The average scaled score in the spring for the Interpreting Data sub test was 13 placing the class average in the upper average range.

Problem Solving

The average percentile rank in the spring for the Problem Solving sub-test was in the 80%ile with an average increase of 11 percentile points. The average scaled score in the spring for the problem solving sub test was 13 placing the class average in the upper average range.

Total Test

The average total test standard score for spring post -testing was 112 placing the class in the above average range for all three areas: Basic Concepts, Operations and Applications. This represented an average increase of + 10 points from fall to spring. Individual Standard scores in the spring ranged from 93 to 132. The range of change from fall to spring standard scores was -3 to + 20. The average percentile rank for spring post testing was in the 75 %ile reflecting an average increase of + 20 for the class. The largest area of growth for the entire class was in the area of Basic Concept with an average standard score increase of +12 points. Specifically, the Numeration sub-test demonstrated the largest growth with an average increase of + 17 point increase in percentile rank and a scaled score average of 14 placing the class in the above average range in numeration achievement.

Student achievement as measured by the Key Math assessment demonstrated an average growth of + 8.2 points in standard scores in the area of Operations. Specifically, students improved percentile ranks in both addition and subtraction, with subtraction realizing the greatest gain of +18.95 %ile points and addition increased on average by +10.5 %ile points.

Student achievement in the area of Applications demonstrated the smallest growth area with an average standard score increase of + 7.8 points. Specifically, within this area student growth in estimation exceeded growth in interpreting data, problem solving and time and money. The smallest area of growth in applications was in the area of measurement.

Although 19 out of 20 students whose scores were available for spring comparisons regularly completed Home Links, teacher rated their level of involvement in Home Links on a scale of 1 (poor) to 4(consistent and expanded involvement). No students rated (1) for Home Link participation. One student received a rating of (2) for Home Link Involvement. This student made the least progress in overall mathematical achievement at the time of testing and this may have been due to a prolonged absence prior to testing and level of overall distractibility. Overall a rating of (4) for Home Link involvement did not directly correlate with higher levels of achievement gain. The fact that most of the class regularly completed Home Links may have contributed to their overall success.

The Everyday Mathematics Program implemented during the 2000-2001 school year for this group of second graders provided a strong foundation in Basic Concepts even though these students did not experience the program in kindergarten and grade one. Students demonstrated on average no deficits in numeration and geometry when compared to their age mates on this standardized tests of achievement. The rate of achievement for the total test placed this group of students in the above average range.

Teacher Perceptions and Observations

Teachers were asked their perceptions in three key areas of the program: instructional design, assessment and level of adaptability. Instructional design refers to content, presentation, skill sequence and instructional method. Lessons in the Everyday Mathematics Program are based on a constructivist philosophy and provide multi-sensory experiences that allow the learner to actively engage in construction of their own knowledge and understanding. Through repeated exposure in a variety of situations students develop deeper understandings of core mathematical concepts. In addition, judicious review and practice can be achieved through Math Boxes, slate drills, and Journal activities.

Of the thirty-four teachers surveyed, 67 % felt the lessons had clear objectives presented in a clear and well- developed format. 62 % felt the program integrated key math concepts or the "big ideas" throughout the program. 68% felt students were able to develop solution strategies but 90 % felt problem solving strategies needed to be directly taught. 62% felt the program did a good job of teaching effective strategies; while 30 %

were not sure and 9 % felt the program did not teach effective problem solving strategies. 85% felt students routinely used math tools and technology and 73 % felt students made more connections to their daily lives. 54% felt students made more connections across subject areas. 80 % felt students developed an improved ability to communicate mathematically.

Of the thirty-four teachers surveyed, 50 % felt the program did not provide sufficient practice and review for key concepts and skills; 12 % were not sure and 38 % felt practice and review were sufficient. 79 % felt games provided by the program were effective practice and 59 % felt students were able to learn games quickly and play them independently with a minimal amount of help. 91 % felt their students enjoyed math more than in previous years. 56 % felt their students will be ready for Everyday Mathematics next year and 32 % were not sure.

Assessment provides a critical component to instruction that is both diagnostic and prescriptive. The assessment philosophy outlined in the Everyday Mathematics Program allows for individual growth and "security" over time. The program does not expect students to achieve any level of mastery with a concept or skill before introducing or reviewing another concept or skill. This type of instruction can be unsettling for teachers accustomed to teaching for mastery with specific task analysis and sequential skill development taken into consideration. The Everyday Mathematics Program assumes students will need repeated exposure of key concepts and skills over at least a two- year span before a "secure" level can be achieved. In addition, judicious practice and review is integrated into the program and intended to part of the daily instructional sequence in slate drills, math boxes, and journal pages. In addition, quarterly expectations were modified during this first year of implementation in consideration of levels that could realistically be expected from students new to the program. These quarterly expectations were developed by another district that had formerly used the program for the first time (See Appendix III).

Assessment provided by the program recommends anecdotal records and observation check lists. Teachers developed quarterly assessments and some were borrowed from another district with very creative teachers. These assessments were not part of the program but were very useful in gathering data about student achievement. Some teachers felt relying purely on observations and anecdotal records was both unrealistic and unreliable in gather information about student achievement. The children who participated in this study were given quarterly and interim assessments developed by the classroom teacher to gauge progress in secure, developing and beginning levels. These teacher-made assessments were used to provide concrete evidence of student achievement in reporting to parents.

Of the thirty-four teachers surveyed, 90 % supplemented program materials with teacher made assessment instruments and practice activities this year. 74 % felt assessment recommended by the program was not sufficient or effective.

The level of adaptability for any instructional program is an important consideration especially in areas that are highly transient. With the current rate of student mobility in this country, it is more than likely that most students will attend more than one elementary school during the years they are in school. The student mobility rate for the state of New Jersey in 1999-00 was 14.3 % (NJ School Report Card). The Everyday Mathematics program is relatively new in this part of the country. This factor may become less of an issue as more districts adopt the program in response to curriculum reform. However, lessons in the Everyday Mathematics Program can be described as compacted and extended components of traditional math programs with a higher level of complexity and critical analysis. This has important implications for special education and students with unique learning needs.

The reality is no one program can be expected to meet the needs of all learners. But in an inclusive educational setting an effective program should provide a level of adaptability and program modifications to address the needs of students eligible for special education services. Slower pace may not allow the teacher to complete the program before the end of the year. Much of the success of the program depends on the spiral of content covered throughout kindergarten to grade six. Certain lessons must be covered each year therefore pacing guides have been developed by districts using the program.

Adaptability remains a concern, although 73 % of teachers surveyed felt their students adjusted quickly to routines and procedures. However, 52 % felt students new to their class throughout the year did not adjust in a reasonable amount of time; 24 % were not sure and 24 % felt they did adjust in a reasonable amount of time. 59 % felt students with learning problems were not successful in the program and 15 % were not sure; 27 % felt they were. 46 % felt students with behavior problems were not successful in this program; 20 % were not sure and 33 % felt they were successful.

Clearly the program allows for more student generated problem solving and requires a greater level of independence and responsibility than some children can accomplish. Children with learning, attention, and behavioral problems may require more structure and more direct instruction in specific strategies to promote a level of automaticity and number sense required for generating solution strategies and alternative algorithms. There seemed to be a clear link between cognitive ability and achievement gains for the children who participated in this study, however, cognitive scores were not available to make an accurate correlation. Cooperative learning situations allowed those who made the connections to help those who did not. If a child enjoyed a challenge the Everyday Mathematics Program was ideal. However, success in the program had to be more individually managed for children who frustrated easily or lacked the attention and organization skills necessary.

Home Links are designed to reinforce concepts and skills experienced in school. Most require some degree of parental support. In fact, the program provides detailed parent communication letters at the beginning of each unit defining term, routines and procedures for various topics. Parental support and knowledge can complement any instruction. This study attempted to evaluate perceived effectiveness of these home activities for student success in the program. The degree of parental support provided at home was another variable students had little control over and the question remained: How important were Home Links to success in the program?

53 % of the teachers surveyed felt Home Links did not provide sufficient practice and review; 21 % were not sure and 27 % felt they did provide enough practice. 18 % of the teachers surveyed disagreed with the statement: Students who routinely used Home Links were more successful; 47 % did not know and 35% felt those who used them were more successful. According to the results of this study, the level of Home Link involvement did not necessarily correlate with greater gains in achievement.

Student Interest Inventories

Students were asked to respond to statements about their experiences in math in the fall and again in the spring. Two students left the program and one student was mainstreamed into the class in November. 65 % of the children felt good about mathematics in the fall and 45 % of the class felt good about math in the spring. 60 % felt good about working with a partner in the fall and 73 % felt good about working with a partner in the spring. In the fall 48 % of the class did not feel very good about working by themselves and in the spring 42 % felt this way. 43 % of the class felt good about solving number stories in the fall and the spring. 60 % of the class felt good about doing Home Links with their family in the fall and 54 % still felt good about doing them in the spring. 43 % of the class felt good about finding new ways to solve problems in the fall and 47 % of the class felt good about this in the spring. In the fall 52 % of the class said they liked to figure things out and 30 % said they sometimes liked to figure things out and were curious. In the spring 38 % said they like to figure things out and 52 % said they sometimes like to figure things out. In the fall 60 % of the class said they keep trying even when they don't understand something and 26 % said "sometimes". In the spring 57 % of the class said they keep trying and 42 % said they "sometimes" keep trying even when they don't understand something.

Results of the student surveys do not indicate any dramatic changes in attitude toward mathematics in general. However, more children indicated they did prefer to work with a partner after a year in the program. This could indicate a positive relationship between cooperative game experiences, explorations and learning how to work with a partner. The results of this survey could also indicate students became more aware of themselves as learners, more objective and honest in their responses in the spring.

Summary

The purpose of this study was to gauge the progress of a heterogeneous group of second graders introduced to the Everyday Mathematics program during the 2000-2001 school year. Parent and teacher reactions were gathered to expand the scope of perceptions about the program in year one of implementation. Achievement in mathematics was evaluated using the KeyMath Diagnostic Inventory of Essential Math skills a pre- and post- test design. Student perceptions about mathematics were gathered using an Interest Inventory provided in assessment manual. Parents of those students were asked to comment on the program in March. Teachers were surveyed in the areas of instructional design, assessment and level of adaptability.

Results of post-testing in March demonstrated students largest area of growth was in the area of Basic Concepts (Numeration and Geometry). Specifically, numeration gains outweighed geometry gains. These results are commensurate with the focus of the kindergarten to second grade program designed to give students a firm foundation in basic concept areas. The second strongest area of growth was in Operations. While percentile scores for addition increased on average + 11 points, percentiles for the subtraction sub-test increased on average was + 19 points. All students had not yet achieved "Fact Power" by March. Raw scores in the Operations sub-test were elevated by greater knowledge of the basic concepts of multiplication and division. Students had dealt with these areas informally throughout the year through explorations and problem solving activities. The average increase in spring standard scores for the Applications sub test was + 8 points. The smallest area of growth in this area was measurement and the largest area of growth was in estimation skills.

Home Links were completed by the entire class throughout the year but level of involvement varied with students and the amount of support they received at home. The teacher rated their Home Link involvement on a scale of 1 (poor) to 4 (completed and elaborated). Comparing achievement scores and Home Link involvement demonstrated little correlation with Home Links and greater levels of performance. The teacher felt there was more of a correlation between cognitive ability and degree of achievement growth. However cognitive scores were not available to make a valid correlation.

Teacher perceptions were gathered with a survey conducted in February. Comments collected reflect an overall praise for the program with certain areas of concern. Generally, one year in any program is not enough time to make valid observations about any instructional program, especially one as radical as Everyday Mathematics. The reality of classroom dynamics and time constraints were addressed in teacher responses.

Teachers felt the design of the program was very good; however, assessment was weak and unrealistic. The level of complexity and assumed knowledge was a concern, especially for teachers of students with special needs. Pace was also a problem. The lessons were considered very compacted and time was an issue; both in lesson preparation and delivery. Math Messages, practice activities and Home Links were considered insufficient and teachers supplemented these areas with their own materials.

The level of adaptability was also a concern. Students moving into the program throughout the year had difficulty adjusting and students with learning and behavior problems had difficulty with the level of independence required for some activities. Introducing the program for the first time in second and third grade took time away from game play that is considered an important part of practice intended by the program designers. In conclusion, no one program should ever replace a well- written curriculum and teacher skill and intuition.

Parents of the children in the study were generally positive about their child's progress and grade level expectations. They were very open and supportive throughout the year. They were continually informed about topics and definitions through letters home provided by the program. Parents said their children became more aware of math in their "everyday lives" and used math at home making connections in shopping, cooking, and game activities. The children in the study were asked to rate their own interest in math in the fall and again in the spring. While there were no dramatic changes in their opinions of mathematics, they did respond more favorably about working with a partner in the spring than they did in the fall. The value of the cooperative experiences provided in the program may have seemed more beneficial to them than the actual gains they made in all areas of achievement.

CHAPTER V

SUMMARY, FINDINGS, AND CONCLUSIONS

Summary and Findings

Curriculum reform and national standards in mathematics are a direct response to the level of achievement American students demonstrate when compared to their global counterparts. The National Council of Teachers of Mathematics developed curriculum goals that will enable students to compete in a global, technological economy in the 21st century. Mathematics instruction can no longer consist of "learning terms and practicing procedures" (TIMSS) but must advance to the level of "structured problem- solving" (TIMSS) and critical analysis. In an inclusive educational setting, addressing the needs of special needs students in a compacted and advanced program may become more of a challenge.

The University of Chicago School Math Project started development of the Everyday Mathematics Program in 1983. After many years of field-testing and teacher training this program is currently in its second edition and in the hands of approximately 3 million students throughout the United States. It is based on constructivist theory and maximizes the potential of children's innate understandings about mathematics through their everyday experiences.

The purpose of this study was to investigate the achievement effects for a heterogeneous group of students from a suburban southern New Jersey school district, who were abruptly introduced to the program for the first time in second grade. In addition, the study conducted a survey of the teachers using the program for the first time in kindergarten through grade 3. Student and parent responses were also gathered to provide a more rounded perspective.

The achievement effects were measured through a pre- and post test design using the individually administered Key Math Diagnostic Inventory of Essential Math Skills. Scores reflected progress in the areas of Basic Concepts, Operations and Applications. Student perceptions about math were measured using an Interest Inventory fall / spring. Standard scores, scaled scores and percentile ranks demonstrated growth in all areas. The area of greatest growth was basic concepts, specifically, numeration. Advances in multiplication and division concepts increased raw scores in the area of operations. All students did not demonstrate mastery of basic addition and subtraction facts to 18 even though percentile scores in these areas increased. The smallest area of growth was in measurement. Home Links did not directly correlate with the level of achievement although all students used them regularly.

Teachers using the program for the first time acknowledged overall acceptance of the program and praise for instructional design. However, they felt assessment, instructional time required, and the level of adapting to the student's level of ability presented the greatest challenges. Teachers of students with special needs noted the level of compactness, volume, and complexity as areas of concern for students with special needs.

Discussion and Implications for Further Study

There are individual and inevitable changes that occur between curriculum design and real classroom applications. Change is never easy and in the field of education it seems to spark polar debates and shifting "pendulums". Instructional philosophies can be akin to religious beliefs. In her book about the Art of Teaching Reading, Lucy Calkins quotes Jerome Harste on the importance of professional inquiry, "You must always assume that one of the pillars of your thinking is dead wrong (Calkins, 2001)".

Today educators are seeking balance and have stopped looking for the shoe that will fit everyone. It doesn't exist. However, our classrooms are becoming increasingly diverse and inclusive. Curriculum standards and tests of student achievement are setting the bar of achievement and critical analysis higher and higher. In the end, it is the classroom teacher who is on the "front line" everyday performing the monumental task of bringing their diverse students from point A to point B in any given year with mediocre materials, textbooks, and a limited amount of instructional time. The Everyday Mathematics Program represents a dramatic departure from traditional math programs that have been used in American schools over the past twenty years. It is not a panacea nor does it claim to be. No curriculum or instructional approach can replace professional judgment and decision- making. Ultimately, we are teaching students not programs.

The Everyday Mathematics program was developed through the combined genius of the math and education departments at the University of Chicago School Mathematics Project. Each grade level was field- tested and modifications continue to be made as publishers respond to the practical applications of the program in American schools. Maximum benefit can be expected when a child progresses smoothly through the spiral curriculum from kindergarten through grade six. A firm foundation in numeration is established in kindergarten through grade 2 and concepts are revisited five to fifteen times over a two- year period before a secure level of proficiency can be expected. Initially implementing the program K-2 requires a certain level of modification to tailor it to the needs of the individual school district. Implementing the program above grade two may create more difficult challenges because of the lack of previous training.

The major limitations of the study included the lack of a control group, the limited duration of the study, and the scope and size of the sample population. Implications for future research include a longitudinal study of this same group over several years in the program and or a more diverse sampling of students at various grade levels. Following this same group (of 2nd graders) over the next four years in elementary school would offer a more complete assessment of the implications of introducing the program in second grade. Any gaps in learning may become more evident in future grades or students may have developed enough of a basic foundation starting the program in second grade to continue to be successful.

Any comparison of the Everyday Mathematics Program and other published programs needs to take instructional time into consideration. The average time required for Everyday Math is approximately 75 minutes per day. Future studies need to examine whether other programs taught for that length of time each day would account for similar gains in achievement.

The implications of Everyday Mathematics for special needs students should be investigated further. The sample student population used in this study was a regular education second grade. No students included in pre- and post- testing were classified as eligible for special education although some had been previously classified. One student eligible for special education had been mainstreamed in the second quarter but was not included in the study because of the lack of baseline data available. This student experienced difficulty meeting checklist expectations and making the transition from another school where he also been mainstreamed for mathematics. In addition, the teachers of special needs students voiced their concern about the level of complexity and pace in this math program. Assessment instruments used to determine eligibility for special education and related services will need to respond to current changes in instruction and curriculum to continue to have adequate reliability and validity.

Cognitive ability scores were not available for the children who participated in the study. However the teacher felt there was a clear link between achievement gains and the student's perceived level of cognitive ability. Future studies may examine the correlation between achievement gains in the program and cognitive test scores.

Assessment will continue to play an increasingly important role in accountability both at the local and national levels. Creating valid and reliable measures of student achievement will continue to be a challenge, especially in light of current reform curriculum standards. Assessments, correctly used, are an important tool toward student growth and development. However, to maintain validity they need to reflect the curriculum taught. Currently this continues to be a source of national debate and future studies of reform programs need to take the level congruency of instruction and assessment tools used into consideration.

In conclusion, Everyday Mathematics is a refreshing change that offers an alternative approach to math instruction in the 21st century. It is based on practical real world applications that foster deeper understanding of key concepts and the analysis required for higher levels of problem solving. The benefits of its instructional design may also pose a challenge for students with special needs.

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Appendix I

Dear Teachers,

This school year I have been gathering information for my master's thesis project for Rowan University. My project investigates the effects of the first year implementation of the Everyday Mathematics Program for a group of second grade students. I am also interested in your perceptions and observations of the first year of implementing the Everyday Mathematics Program in your classroom. I would greatly appreciate it if you could take a few minutes to respond to the following questionnaire. Any results included in my thesis are completely anonymous. Thank you in advance for your time and consideration. Just mail the completed questionnaire in the post paid envelope.

Sincerely,
Johanna Vicchairelli
Oak Valley School

Please circle:
1=Strongly disagree 2= disagree 3= not sure 4= agree 5= strongly agree

Lessons had clear objectives which were presented in a clear and well developed format	1	2	3	4	5
Everyday Mathematics provides sufficient practice and review for key concepts and skills.	1	2	3	4	5
Students in my class adjusted quickly to routines and procedures.	1	2	3	4	5
Students in my class will be ready for Everyday Mathematics next year.	1	2	3	4	5
Students in my class routinely used math tools and technology.	1	2	3	4	5
Key math concepts were integrated throughout the program.	1	2	3	4	5
Assessment recommended by the program was sufficient and effective.	1	2	3	4	5
I supplemented the program with teacher made assessment instruments and practice activities.	1	2	3	4	5
Homelinks provided sufficient practice and review	1	2	3	4	5
Students who routinely used home links were more successful in the program.					

Students developed solution strategies independently.	1	2	3	4	5
Problem-solving strategies needed to be directly taught.	1	2	3	4	5
Students in my class enjoy math more than in previous years.	1	2	3	4	5
Students developed an improved ability to communicate mathematically.	1	2	3	4	5
Students make more connections to their daily lives.	1	2	3	4	5
Students made more connections across subject areas.	1	2	3	4	5
Students new to my class throughout the year adjusted in a reasonable amount of time.	1	2	3	4	5
Students with learning problems were successful in the program.	1	2	3	4	5
Students with behavior problems were successful in the program.	1	2	3	4	5
Games were effective practice.	1	2	3	4	5

Average time spent on Everyday Mathematics each day ________________________

There are ______________ children in my class.

Grade ____________________

Comments/ Suggestions

____

____

____

____

____

____

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Appendix II

[i] National Center for Education Statistics. (1996).*Pursuing excellence: Initial Findings from the Third International Mathematics and Science Study.* Washington, DC. : U.S. Department of Education. In <u>The Teaching Gap.</u> by James W. Stigler & James Hiebert.

[ii] Content Specification of KeyMath-R: Areas, Strands, and Domains.

Areas: *Basic Concepts* — *Operations* — *Applications*

Basic Concepts

Numeration
1. Numbers 0-9
2. Number 0-99
3. Numbers 0-999
4. Multi-digit numbers and advanced numeration

Rational Numbers
1. Fractions
2. Decimals
3. Percents

Geometry
1. Spatial and attribute relations
2. Two-dimensional shapes and their relations
3. Coordinate and transformational geometry
4. Three-dimensional shapes and their relations

Operations

Addition
1. Models and basic facts
2. Algorithms to add whole numbers
3. Adding rational numbers

Subtraction
1. Models and basic facts
2. Algorithms to subtract whole numbers
3. Subtracting rational numbers

Multiplication
1. Models and basic facts
2. Algorithms to multiply whole numbers
3. Multiplying rational numbers

Division
1. Models and basic facts
2. Algorithms to divide whole numbers
3. Dividing rational numbers

Mental Computation
1. Computation chains
2. Whole numbers
3. Rational numbers

Applications

Measurement
1. Comparisons
2. Using non-standard units
3. Using standard units- length, area

Time and Money
1. Identify the passage of time
2. Using clocks and clock units
3. Monetary amounts to one dollar
4. Monetary amounts to one hundred dollars and business transactions

Estimation
1. Whole and rational numbers
2. Measurement
3. Computation

Interpreting Data
1. Charts and tables
2. Graphs
3. Probability and statistics

Problem Solving
1. Solving routine problems
2. Understanding non-routine problems
3. Solving non-routine problems

Appendix III

EVERYDAY MATHEMATICS

Grade: 2 Quarter: 1

Key: Shaded area indicates the expected stage of development for this quarter.
B = Beginning
D = Developing
S = Secure

B	D	S	CONCEPTS & SKILLS

1. NUMBERATION & COUNTING:

			Writes 3-digit numbers from dictation
			Counts by 2's from any given 2-or 3-digit number
			Counts by 10's from any given 2-or 3-digit number
			Counts backward by 10's from any given 2-or 3-digit number
			Writes 1-to 3-digit odd and even numbers
			Identifies place value in 3-digit numbers
			Understands concept of equivalent number names for 2-digit numbers

2. OPERATIONS AND MENTAL MATH:

			Writes "turnarounds" for given facts
			Constructs fact families
			Solves missing addends for complements of 10 (e.g., 64 + ___ =70)
			Adds a 1-digit number to any 2-digit number
			Solves missing addend for 2-digit decade numbers (e.g., 30 + ___=78)
			Solves number stories involving money

3. DATA COLLECTION AND ANALYSIS:

			Continues to show understanding of data collection and simple analysis (no new concept this quarter)

4. MEASUREMENT, GEOMETRY AND REFERENCE FRAMES:

			Uses linear measuring tools: centimeters and inches
			Shows coins for given amount, penny, nickel, dime and quarter
			Tells time to 5-minute intervals

5. PATTERNS, RULES, FUNCTIONS, AND PROBLEM SOLVING:

			Completes simple "Frames & Arrows" patterns – when first frame is given
			Understands "What's My Rule?" routine (with unknown rule)

EVERYDAY MATHEMATICS

Grade: 2 Quarter: 2

Key: Shaded area indicates the expected stage of development for this quarter.
B = Beginning
D = Developing
S = Secure

B	D	S	CONCEPTS & SKILLS

1. NUMBERATION & COUNTING:

B	D	S	
		■	Reads 3-digit numbers
		■	Uses comparison symbols (>, <, =) correctly when given 2 numbers (up to 3 digits)
	■		Reads 4-digit numbers.

2. OPERATIONS AND MENTAL MATH:

B	D	S	
		■	Uses calculator to add three or more 2-digit numbers
	■		Adds three 1-digit numbers mentally
	■		Extends addition and subtraction facts to tens and hundreds (e.g., 50 + 70; 500 + 700)
	■		Devises solution strategies for sums of 2-digit numbers
	■		Devises solution strategies for differences between 2-digit numbers
	■		Solves "equal-group" number stories using counters
	■		Understands concept of multiplication arrays
	■		Solves " equal-sharing" division problems using counters
■			Uses estimation to approximate costs
■			Adds two 2-digit numbers mentally

3. DATA COLLECTION AND ANALYSIS:

B	D	S	
	■		Plots data on a bar graph

4. MEASUREMENT, GEOMETRY AND REFERENCE FRAMES:

B	D	S	
		■	Identifies common 3-D shapes such as prisms, cylinders, pyramids, cones and spheres
		■	Draws and labels line segments
	■		Identifies lines of symmetry
	■		Reads Fahrenheit and Celsius temperature correctly
	■		Determines temperature differences
■			Solves money "change" problems

5. PATTERNS, RULES, FUNCTIONS, AND PROBLEM SOLVING:

B	D	S	
	■		Continues to show understanding of "Frames & Arrows": patterns and "What's My Rule?" routines

EVERYDAY MATHEMATICS

Grade: 2 Quarter: 3

Key: Shaded area indicates the expected stage of development for this quarter.
B = Beginning
D = Developing
S = Secure

B	D	S	CONCEPTS & SKILLS
			1. NUMBERATION & COUNTING:
			Shades requested fractional parts of a region
			Gives fraction name for shaded part of a region
			Counts by 2's forward and backward from any given even 2-digit number
			Counts by 10's forward and backward from any given even 2-digit number
			Uses calculator to show the change from one number to another
			Understands doubles, triples, quadruples, X5 and X10 for 1-digit numbers
			Understands fractions as equal parts of a region or set
			Concretely recognizes equivalent fraction names for ½ =2/4 = 4/8
			Understands the larger the denominator, the smaller the parts of the whole
			2. OPERATIONS AND MENTAL MATH:
			Knows complements of 10 (e.g., 10=3 +___)
			Solves complements of multiples of 10 (e.g. 26 + ____=30)
			Adds two 2-digit numbers with developing strategies
			Subtracts two 2-digit numbers with developing strategies
			3. DATA COLLECTION AND ANALYSIS:
			Finds median (middle) value of a data set
			4. MEASUREMENT, GEOMETRY AND REFERENCE FRAMES:
			Uses ruler, tape measure, meter/ yardstick, understanding ½ inch and ½ centimeter
			Uses metric units for linear measure: centimeter, decimeter, meter and kilometer
			Uses customary units for linear measure: inch, foot, yard and mile
			Recognizes customary and metric units of capacity: cup, pint, quart, gallon and liter
			Recognizes customary and metric units of weight: pounds and kilograms

EVERYDAY MATHEMATICS

Grade: 2 Quarter: 4

Key: Shaded area indicates the expected stage of development for this quarter.
B = Beginning
D = Developing
S = Secure

B	D	S	CONCEPTS & SKILLS

1. NUMBERATION & COUNTING:

			Knows and expresses automatically the value of digits in 2-and 3-digit numbers
			Reads 4-digit numbers
			Writes from dictation 4-digit numbers
			Knows and expresses automatically the value of digits in 4-digit numbers
			Understands decimal and fraction names for penny and dime

2. OPERATIONS AND METAL MATH:

			Multiplies numbers with 1 as a factor
			Given an array, can name the multiplication factors
			Shows progress with 2-digit addition and subtraction strategies
			Multiplies numbers with 10 as a factor
			Constructs multiplication and division fact families
			Draws arrays for multiplication facts
			Estimates totals for " ballpark" check of exact answers
			Understands and solves money stories involving change
			Estimates and solves addition and subtraction number stories with dollar and cents amounts
			Concretely solves single-digit multiplication stories (equal groups)
			Concretely solves simple division stories (sharing things equally)
			Solves mentally, addition and subtraction fact extensions (e.g. 40 = 90- ___)

3. DATA COLLECTION AND ANALYSIS:

			Compares quantities from bar graphs

4. MEASUREMENT, GEOMETRY AND REFERENCE FRAMES:

			Knows cent values of all coins and a dollar
			Knows exchange values among U.S. coins (e.g., quarter = 5 nickels)
			Uses coins to show equivalent money amount to $1.00
			Shows progress with time telling concepts and skills to 1-minute intervals

5. PATTERNS, RULES, FUNCTIONS, AND PROBLEM SOLVING:

			Uses a calculator for entering and computing money amounts

Appendix IV

Name ______________________ Date ____________

About My Math Class

Draw a face or write the words that show how you feel.


Good


OK


Not so good

1. This is how I feel about math:	**2.** This is how I feel about working with a partner or in a group:	**3.** This is how I feel about working by myself:
4. This is how I feel about solving number stories:	**5.** This is how I feel about doing Home Links with my family:	**6.** This is how I feel about finding new ways to solve problems:

Circle yes, sometimes, or no.

7. I like to figure things out. I am curious.

yes **sometimes** **no**

8. I keep trying even when I don't understand something right away.

yes **sometimes** **no**

Interest Inventory A *Children tell how they feel about their mathematics class. You might use this master for parent/teacher communication.* *See page 44.*