1998

An analysis of primary elementary teacher opinions toward the use of instructional modifications in mathematics

Janet S. Block
University of Dayton

AN ANALYSIS OF

PRIMARY ELEMENTARY TEACHER OPINIONS

TOWARD THE USE OF INSTRUCTIONAL MODIFICATIONS

IN MATHEMATICS

MASTER'S THESIS

Submitted to the Department of Education,
University of Dayton, In partial fulfillment
of the Requirements for the Degree
Master of Science in Education

by

Janet S. Block
University of Dayton
Dayton, Ohio
May, 1998

Approved by:

[redacted]

Official Advisor

TABLE OF CONTENTS

LIST OF TABLES

Primary Teacher Opinions Toward the Use of
Instructional Modifications in Mathematics

TABLES:

DEDICATION

I would like to thank my family for their loving encouragement during my master's studies and research.

I would also like to thank Dr. Daniel Raisch, Dr. Mary Jo Scalzo, and Dr. Hugh Briggs for their professional advice and support.

CHAPTER I

INTRODUCTION TO THE PROBLEM

Purpose for the Study

If mathematics is filled with logical concepts, why do so many students have difficulties understanding mathematics? Here is a scenario: Thomas is a second grade student in Mrs. Smith's class. He is trying to complete a subtraction quiz. Thomas was pleased he could subtract one-digit numbers, and two-digit numbers without regrouping. However, even though Mrs. Smith taught the class how to regroup the tens when subtracting a one-digit number from a two-digit number, Thomas was still sadly confused and realized he still did not understand the process of regrouping. He walked over to Mrs. Smith and tearfully said he could not finish the quiz. Mrs. Smith graded the quiz in front of Thomas, marked it 5/15 and simply told him he should look up "regrouping" in his textbook again. Lasley & Matczynski (1997) stated, "Indeed, many teachers believe that once they utter the words in the classroom, the students have learned the information. Teacher talk for many teachers has been considered synonymous with student learning. Such a circumstance is regrettable!" (p.240).

In a contrasting scenario: Paul is a second grade student in Mrs. Allen's class. Paul was taking the same subtraction quiz. He, too, was able to subtract one-digit numbers, and two-digit numbers without regrouping. Paul, however, had difficulty with the regrouping section of the quiz. Paul walked over to his teacher, Mrs. Allen, and explained he was confused. Mrs. Allen said he was allowed to work out the rest of the problems on the quiz at the manipulatives table situated in the corner center in the classroom. This center was accessible to the students who had difficulties understanding that they should add 10 and not 1 when

borrowing. She had originally taught her students to create tens bundles at this center and decided to keep the center in the room to be used as the students needed it. So, Paul proceeded to work out the rest of the regrouping problems. He put the correct number of tens and ones bundles in the appropriate boxes. Then he took one bundle out of the tens box and added it to the ones box to show the regrouping. Paul completed his quiz at the manipulatives table and scored 13/15.

Both Paul and Thomas are regular education second grade students who have learning difficulties with mathematics. Thomas' experience led to more frustration and failure. However, a major reason why Paul scored better on his quiz was because his teacher, Mrs. Allen, realized many children need more multisensory techniques to help them better comprehend mathematics concepts and skills than other children (Chambers, 1996; Willoughby, 1990). Mrs. Allen's motivating and individualized instructional approach greatly enhanced Paul's academic achievement and mathematical confidence. Therefore, a strong reason for conducting this research is to analyze teachers' opinions toward the use of instructional modifications that may foster student confidence and abilities in mathematics. Stigler and Hiebert (1997) stated, "We must study directly the processes that lead to learning in the classroom, for if we do not understand the processes we will have little chance of improving them. Most other professional and industrial fields have determined that improving the quality of the processes is the surest road to improving products, but we in education have yet to learn this lesson" (p.15).

In the broad spectrum of student abilities, from the at-risk students to the highly talented and gifted students, education must be appropriately nurtured when

implementing instruction (Smutney, Walker & Meckstroth, 1997; Will, 1986). Research has shown that mathematical learning, for all students, is a hierarchy of concepts and skills. When a teacher misses the opportunity to provide appropriate accommodations to maximize student learning, this may dramatically affect the student's mathematics abilities later in his/her school career. Begley (1997) stated, "Circuits in different regions of the brain mature at different times. As a result, different circuits are most sensitive to life's experiences at different ages. Give the children the stimulation they need when they need it, and anything's possible. Stumble, and all bets are off" (p.61).

Fifty-four percent of Americans believe that in order to fully prepare students for life in the 21st century, mathematics education must address the educationally diverse learning needs of all students (Rose, Gallup, & Elam, 1997). The National Council of Teachers of Mathematics, "Standards for Selection and Implementation of Instructional Materials (1984), "Curriculum and Evaluation Standards for School Mathematics" (1989), and "Professional Standards for Teaching Mathematics" (1991) adopted 54 standards for teaching and evaluating students. The NCTM Standards stress that students: learn to value mathematics; become confident in ability to do mathematics; become mathematical problem solvers; learn to communicate mathematically; and learn to reason mathematically. It is also highly recommended by NCTM that educators use instructional modifications when planning, facilitating, and implementing lessons to maximize individual potential of all students. Therefore, it is imperative that educators provide increased opportunities for all students to become more actively involved in mathematical tasks that include applications of relevant skills and explore alternative concepts and creative

methods to solving mathematical problems (NCTM, 1991; Schifter, 1996b).

Clearly, teachers' attitudes and beliefs can stifle or enhance any instructional approach. If the improvements to mathematics education suggested by the National Council of Teachers (1989) are to be established, then teachers' beliefs and attitudes toward instructional approaches must be studied. Therefore, this study will focus on analyzing teachers' opinions toward applying instructional varieties, lesson modifications, and adjustments to meet the diverse learning needs of primary mathematics students.

Research has indicated that ".....diversity of children in today's schools is very great. The best teachers teach each individual student rather than try to gear instruction to the average of a group...They are comfortable using many different teaching techniques and can readily shift among them as needed. The best teachers enjoy and value all their students---attitudes which are visible to others as they teach" (Rogers, 1993).

Statement of the Problem

The purpose of this study is to analyze the opinions of primary mathematics teachers toward the use of instructional modifications.

Assumptions

In order to carry out this study, the writer developed a questionnaire to gather demographic data and Likert style responses to measure primary teacher attitudes toward the use of instructional modifications in mathematics. The writer assumes that the instrument is reliable because its content is based upon educational research (Isaac & Michael, 1995). In addition, the writer assumes that the teachers selected to complete the Likert style questionnaire answered in a manner which honestly reflected their personal

opinions toward the use of instructional modifications in mathematics education.

Limitations

There were several limitations to this study. One limitation to this study was the sample size of the Kindergarten through grade three mathematics teachers surveyed who were willing to spend time completing the questionnaire. Another limitation was the limited geographical area in the state of Ohio from which the sample of teachers was chosen. Another limitation was that the term "instructional modifications", though defined within the survey, may have been interpreted differently. Furthermore, the teachers' opinions may change as student populations change.

Definition of Terms

Attitudes are the teachers' negative, positive, or neutral opinions and beliefs toward a specific topic based on educational experiences and views (Battista, 1994; Karp, 1991; Stevens, 1996).

Instructional Modifications are accommodations and adjustments made by the teacher in the classroom methods of instruction, testing, materials and equipment deemed necessary by the teacher in order to maximize student achievements (Lasley & Matczynski, 1997; Willoughby, 1990).

Learning Modalities are an individual's preferred ways to learn information. The four common learning modalities are visual (rely primarily on vision for input), auditory (gain most from what is heard), tactile (learn by feeling, tasting, touching), and kinesthetic (learn by movement) (Smutney Walker & Meckstroth, 1997).

Mathematics is subject matter dealing with accuracy of quantities, symbols, numbers, number relationships, computations, and reasoning skills (Schifter, 1996b).

Multisensory Techniques are instructional approaches that utilize the auditory, visual, tactile, and/or kinesthetic modalities of learners (Smutney , Walker, &Meckstroth, 1997).

NCTM is The National Council of Teachers of Mathematics.

Primary Mathematics Curriculum is the sequence of mathematics through the grades kindergarten, first, second, and third which includes number recognitions, number relationships, patterning, simple geometry, measurement, computations, and problem-solving skills (NCTM, 1989; Willoughby, 1990).

CHAPTER II

REVIEW OF THE RELATED LITERATURE

The purpose of this chapter is to review the literature concerning primary mathematics teachers' opinions toward the use of instructional modifications. This chapter is divided into three sections. The first section discusses related literature concerning the beliefs of teachers toward the use of instructional modifications in mathematics education. The second section reviews the related literature concerning the reasons for teachers to use instructional modifications in mathematics education. The last section presents the related literature concerning recommendations for implementing instructional modifications in mathematics education.

Beliefs of Teachers Toward the Use of Instructional Modifications

The National Research Council (1989) strongly recommends that teachers develop positive beliefs toward using instructional modifications in mathematics for the purpose of accommodating all students' diverse mathematical learning styles and needs. Research indicates that "...the focus of school mathematics is shifting from a dualistic mission — minimal mathematics for the majority, advanced mathematics for a few — to a singular focus on a significant common core of mathematics for all students" (NRC p.81). The NRC suggests that teachers who promote the achievements and mathematical opportunities for all students develop effective teaching practices by "differentiating instruction with individual approach and speed, not by curricular goals; and by stimulating able students with the excitement and challenge of mathematics" (p.81).

Studies done by Emenaker (1996) and Karp (1991) indicate that classroom

mathematics teachers' beliefs towards the use of instructional modifications have a direct influence on each student's mathematical achievements. As noted by Stevens & Wenner (1996), mathematics teachers who have the willingness to make instructional decisions for each student's mathematical achievements increases the student's active involvement and application of learned skills. Karp (1991) studied mathematics teacher attitudes and noted that teachers with negative attitudes toward adapting instructional modifications actually "encouraged a learned helplessness response" (p.267) from their students. The teachers who had positive beliefs toward instructional modifications in mathematics had students who "explored and discovered interrelationships in mathematics, rather than passively receiving information" (p.268).

Stigler and Hiebert (1997) recently presented an overview of the video component of the Third International Mathematics and Science Study (TIMSS) to analyze teachers' beliefs of instructional practices in three countries: Germany, Japan, and the United States. This study focused on teachers' beliefs in facilitating and challenging every students' deductive reasoning skills. Deductive reasoning is defined as "the reasoning needed to draw logical conclusions from premises" (p.16). The National Council of Mathematics Teachers (1989, 1991) consider deductive reasoning as central to students' mathematical knowledge. In this particular study, Japanese teachers believed in implementing significantly more instructional adaptations in their classrooms than teachers in the United States. A finding of Stigler and Hiebert's overview analysis of the TIMSS video component, was that deductive reasoning was evident in 62% of Japanese lessons, 21% of the German lessons, and 0% in the U.S. Lessons. A major difference is that teachers in

the U.S. teach students how "to do" mathematics, and many times, a student's correct answer is a closure to the activity. The teachers in Japan follow up each activity and encourage each student to pursue additional higher-level thinking processes. It was noted by the researchers that the Japanese teach similarly to the recommendations of the NCTM standards and the results are that Japanese students rank third highest in mathematical achievements in comparison to 41 other countries. Although 70% of U.S. mathematics teachers responded positively to the NCTM standards and have made attempts to improve their instructional practices, Stigler and Hiebert's data suggest that "those changes have not affected the deeper cultural scripts from which teachers work" (p.19). Stigler and Hiebert's study noted that cultural differences, social and behavioral norms, have a great impact on a country's teaching beliefs. In the U.S., Stigler and Hiebert noted that the majority of teachers believe in teacher-controlled classrooms that emphasize acquisition and application of procedural skills, rather than developing students' creative reasoning powers. Stigler and Hiebert point to the significance that mathematics teachers' beliefs toward using instructional adaptations in the classroom have a direct influence on the nature and level of students' achievements in mathematical knowledge.

According to the National Research Council (1989) much of the failure in school mathematics is due to "mindless mimicry mathematics" (p.10) which is described as teachers' unfortunate implementations of instructional practices that are inappropriate and obsolete. Battista (1994) said teachers have a prevailing view that mathematics consists of set procedures that should be taught by telling students how to perform those procedures. Battista noted that current beliefs of teachers are "totally incongruent" to helping all

students learn through "sense-making efforts." Battista stressed that teachers need to have more positive beliefs toward helping students make sense of their learned skills as relevant resources, rather than blindly accepting mathematics rules and procedures from textbooks. Stigler (1989) noted that too many students are unable to relate mathematical school tasks to their daily lives. Students memorize rules in school, but rely more on high-level intuition and conceptual understandings outside of school to solve their mathematical problems.

According to Wilson, Peterson, Ball, and Cohen (1996) teachers who have positive beliefs in providing instructional adaptations and modifications to fit the needs of all students see themselves as learners. They learn from the specific needs of their students and continually refine their teaching practices to improve and challenge their students' mathematical abilities. Peterson and Barnes (1996) suggest that more teacher preparation and inservice training should focus on improving teacher attitudes and willingness toward the use of implementing strategies that increase each student's learning power. Emenaker (1996) noted that teachers may need to rethink negative beliefs about using instructional modifications in mathematics because "limiting beliefs are those seen as limiting or hindering mathematical performance" (p.75).

Reasons For Using Instructional Modifications in Mathematics

Effective mathematics education plays a crucial role in the total development of young children. It is in the primary grades that high-quality mathematical experiences extend and deepen the understanding and appreciation of mathematics (Willoughby, 1990). This lays a strong mathematical foundation for cognitive progressions and future educational

endeavors for all children. All children, however, are not a homogenous group with identical needs that can be met equally through single instructional experiences. Therefore, in order to maximize the learning achievements of educationally diverse student populations, there are substantial reasons for teachers to use instructional modifications and adaptations in mathematics to accommodate students who have varying strengths and weaknesses in general education classrooms. Many researchers (Chambers, 1996; Good & Brophy, 1991; Lasley & Matczynski, 1997; Schifter,1996; Smutney, Walker, & Meckstroth, 1997) have promoted examples of instructional modifications as strategies teachers should use to enhance instruction and adapt curriculum for the benefit of all children's learning styles and needs. Examples of instructional modifications and strategic teaching practices for the purpose of maximizing student achievements are: modeling learning skills with multisensory techniques, creating individual assignments for enrichment, creating individual assignments for remediation, limiting learning objectives, extending learning objectives, presenting additional materials and manipulatives, providing diagnostic teaching approaches, using cooperative learning groups, and increasing student-inquiry sessions that focus on problem-solving and reasoning skills.

Dossey, Mullis, Lindquist, & Chambers (1988) reflected on how teacher-controlled, mathematics classrooms have resulted in students' poor mathematical achievements, have decreased student confidence levels, and have lowered students' values of mathematics as a discipline. "Many students hold negative views for the relevance of mathematics to the future of their lives. The portrait is one of continuing traditions in which the prevailing mode of instruction is still that of teachers explaining material and working exercises on

the chalkboard"(p.64). Lasley and Matczyski (1997) also agreed that teacher-controlled classrooms that lack instructional alternatives and appropriate adaptations for individual students put up a barrier to progressive student learning.

Since classrooms are becoming increasingly more integrated settings (Lasley & Matczynski, 1997), it is imperative that teachers make use of instructional modifications in order to effectively teach concepts and skills to all students. The National Council of Teachers of Mathematics (1984, 1989, 1991) issued five general mathematics standards that effectively empower all students to learn and to apply mathematical thinking skills: 1.) Students will learn to value mathematics. 2.) Students will become confident in their ability to do mathematics. 3.) Students will become mathematical problem-solvers. 4.) Students will learn to communicate mathematically. 5.) Students will learn to reason mathematically. The standards focus specifically on infusing theories of effective mathematics education with practical classroom instructional modifications to fit the needs of all learners and create the classroom into a "community of inquiry" (National Council of Teachers of Mathematics, 1989, 1991). The standards stress the importance of implementing mathematics activities that have a purpose to help all students become actively involved in developing and understanding how to gather, discover, and create mathematical knowledge.

According to Willoughby (1990), research supports that teachers who regularly use instructional modifications in their teaching have students who want to think mathematically and have increased mathematical confidence, rather than students who tend to avoid learning more ways to use mathematics. Additionally, Acquarelli and

Mumme (1996) noted that a strong reason for teachers to use instructional modifications is because it makes students more "mathematically powerful" and motivates students to increase their comprehension of the relevance mathematics has on their daily lives, present and future.

The National Science Foundation (1997) conducted an international curriculum study and said American students and teachers are expected to cover more curricular topics in mathematics and science than are the students in other countries. As a result, mathematics teachers may not cover essential concepts in depth or with enough time to explore higher-level thinking processes. Therefore, teachers may not foster students' mathematical insights, reasonings, and problem-solving skills. Studies by Burrill (1997b) and Schifter (1996a) indicate that teachers who use instructional modifications in mathematics benefit students with the results of accelerated learning, skill development, positive student attitudes toward math, and improved communications in higher-order thinking skills for learners at all ability levels. McCarney, Wunderlich, and Bauer (1993) researched teachers who use instructional modifications in mathematics and noted their emphasis on prevention of mathematical difficulties during instruction provided necessary interventions to students as needed. In addition, many students who are highly capable should be continually challenged by teachers to meet their academically talented needs, as well. As noted by Smutney, Walker, & Meckstroth (1997) "Most programs typically don't respond to the creative and intellectual needs of gifted children. We must make special adaptations in our programs, our activities, our teaching materials, and our perspectives on these children's legitimate special needs" (p.1).

Burrill (1997a) and Hawkes, Kimmelman, & Kroeze (1997) noted that another reason for teachers to use instructional modifications and to enhance individual abilities in mathematics, is because there is substantial evidence that most mathematics curricular and instructional programs are in need of continuous reforms to strengthen students' abilities that will help keep them competitive in mathematics, science and global technology. Most technologically advanced societies prepare future generations for a fast-changing world. Every American student must also be prepared to compete in increasingly demanding workplaces and technological societies.

Good and Brophy (1987) acknowledged that traditional teaching has strengths in organized curriculum and instruction. However, teaching with a strict, sequential lock-step curriculum has endured mainly because "the approach seems to work reasonably well for students whose rates of learning and responses to commonly used instructional materials and methods are similar to those of the mythical 'average student' for their grade levels" (p.353). Consequently, because of the wide range of mathematical abilities of students in regular education classrooms, there is a great need for improved educational practices and instructional modifications so that students of diverse ability levels may benefit with increased mathematical achievements and knowledge.

Recommendations for Implementing Modifications in Mathematics Instruction

The National Research Council (1989) reported that... "most mathematics continues to be primarily a passive activity; teachers prescribe; students transcribe. Presentation and repetition help students do well on standardized tests and lower-order skills, but they are generally ineffective as teaching strategies for long-term learning, for higher-order

thinking, and for versatile problem-solving"(p.57). Schifter (1996a) recognized that mathematics curriculum in the United States does not adequately emphasize student reasoning skills. Schifter (1996b) noted that teachers must be responsible in having their students actively participate in mathematical exploration, debate various mathematical situations, and test hypotheses. The NCTM (1989, 1991) standards stress that teachers must be able to effectively meet the needs of all learners. Teachers should not simply lower the mathematical expectations for at-risk children . For the gifted, highly talented students, teachers should not simply serve them with just more drill-and-practice worksheets (Willoughby, 1990). Teachers must provide time and supportive instruction to enable all students to achieve their maximum potentials (NCTM, 1989, 1991). Danielson (1996) stated that teachers need to improve their repertoire of instructional questioning techniques to fit the needs of ever-changing classroom populations. Ball (1996) also supports the position that in order to effectively implement instructional modifications it may mean retraining teachers how to deliver mathematical strategies for each student. In trying to teach all students well "we need to understand better the difference and the similarities between learning to teach in a reform-minded way as a beginning teacher or changing and developing one's teaching as an experienced teacher" (p.507). Willoughby's research (1990) on implementing effective mathematics education that will better prepare all children for life in the 21st century is described in four steps. Children should: 1.) " derive the mathematics from their own reality, 2.) discover and use the power of abstract thought, 3.) practice, and 4). apply the mathematics to something that is of interest to them" (p.9).

Sawada (1997) reflected on how Japanese elementary schools implement the goals of higher-order thinking skills to all children. In Japan, it is common to teach mathematical concepts through problem-solving using meaningful context and concrete objects. The Japanese students are constantly questioned and encouraged to find many alternative solutions to problems. Multiple solutions are discussed, defended and compared by the students. Manipulatives are generously implemented in Japanese schools for learning concepts and skills, but also for assessing students' answers. Japanese teachers require students to use manipulatives to check the validity of their calculations, to make comparisons, and to confirm their problem-solving decisions. Another instructional practice implemented in Japanese mathematics education is for a teacher to present reasoning by making deliberate errors. The students apply their skills of discovery and reasoning to understand the function of a mathematical problem. Japanese mathematics teachers encourage students to reason the right answers, as well as reason why answers may be wrong. Japanese teachers encourage students to problem-solve with diverse and analytical ways to creatively think about mathematical solutions.

Researchers (Burrill 1997a, 1997b; Dossey, Mullis, Lindquist, & Chambers 1988; Lasley & Matczynski 1997; NCTM 1984, 1989, 1991; National Research Council 1989; Schifter 1996a, 1996b; Willoughby, 1990) strongly recommend the following principles and procedures to educators for the purpose of maximizing student achievements. Teachers should:

* relate mathematics to other subjects with real life applications of mathematical principles;

* provide instructional modifications and adaptations to develop individual thinking and reasoning skills of all students;
* use a variety of instructional approaches to accommodate learning styles, preferences, and needs;
* foster confidence and positive attitudes in all students toward mathematics;
* provide appropriate hands-on applications with manipulatives, cuisenaire rods, pattern blocks, calculators, and computer software for learning mathematical concepts and skills;
* provide a safe atmosphere which encourages all students to actively participate in mathematical risk-taking, hypothesizing, collaboration, communication, and understanding of higher-order cognitive skills; and
* develop individual thinking and reasoning skills to construct mathematical knowledge for all students.

The National Research Council (1989) strongly suggests that educators make improvements in both mathematics curricular content and instructional style by focusing on all students "seeking solutions, not just memorizing procedures; exploring patterns, not just learning formulas; and formulating conjectures, not just doing exercises" (p.84).

CHAPTER III

PROCEDURE

Subjects

The subjects selected for this study were certified kindergarten through third grade classroom teachers that represented five public school districts and ten elementary schools in southwestern Ohio. The sample consisted of 91 kindergarten through third grade teachers. Fourteen percent of the respondents had one to five years of teaching experience; 14% of the respondents had six to ten years of teaching experience; 16% of the respondents had eleven to fifteen years of teaching experience; 20% of the respondents had sixteen to twenty years of teaching experience; and 36% of the respondents had twenty-one to twenty-five plus years of teaching experience. Forty-five percent of the respondents held Bachelor degrees, 55% held Master degrees, and 0% held a Doctorate degree.

Setting

Ten elementary schools in five districts took part in this study. The schools vary in size, but are similar in composition. The majority of the students come from middle to upper class homes. The ethnic populations in the schools are predominately white, with a small number of African-American, Middle Eastern, and Asian students.

District 1:

Schools. In District 1, twenty-seven subjects from four elementary schools completed the instrument. The district enrolls 7,539 students and spending per pupil is $5,889. The

average kindergarten through grade three class size is 21-28 students. Of the 27 kindergarten through grade three teachers who completed the instrument, 41% held Bachelor degrees, and 59% held Master degrees. Of the respondents, 11% of the kindergarten through grade three teachers had one to five years of teaching experience; 22% had six to ten years of teaching experience; 4% had eleven to fifteen years of teaching experience; 22% had sixteen to twenty years of teaching experience; and 41% had twenty-one to twenty five plus years of teaching experience.

Community. This community is located in southwestern Ohio and provides opportunities for shopping, recreational and cultural experiences. The community represents a population of approximately 63,000 with a median income of $28,673.

District 2:

Schools. In District 2, twenty-four subjects from three elementary schools completed the instrument. The district enrolls 4,032 students and spending per pupil is $5,301. The average kindergarten through grade three class size is 21-28 students. Of the twenty-four kindergarten through grade three teachers who completed the instrument, 50% held Bachelor degrees and 50% held Master degrees. Of the respondents, 0% of the kindergarten through grade three teachers had one to five years of teaching experience; 4% had six to ten years of teaching experience; 21% had eleven to fifteen years of teaching experience; 21% had sixteen to twenty years of teaching experience; and 54% of the teachers had twenty-one to twenty-five plus years of teaching experience.

Community. This community is located in southwestern Ohio and provides for shopping, recreational, and cultural experiences. The community represents a population

of approximately 14,403 with a median income of $26,660.

District 3:

Schools. In District 3, seventeen subjects from two elementary schools completed the instrument. The district enrolls 4,360 students and spending per pupil is $5,623. The average kindergarten through grade three class size is 21-28 students. Of the seventeen kindergarten through grade three teachers who completed the instrument, 41% held Bachelor degrees, and 59% held Master degrees. Of the respondents, 23% of the teachers had one to five years of teaching experience; 12% had six to ten years of teaching experience; 35% had eleven to fifteen years of teaching experience; 23% had sixteen to twenty years of teaching experience; and 6% had twenty-one to twenty-five plus years of teaching experience.

Community. This community is located in southwestern Ohio and provides opportunities for shopping, recreational, and cultural experiences. The community represents a population of approximately 19,000 with a median income of $28,039.

District 4:

School. In District 4, sixteen subjects from one elementary school completed the instrument. The district enrolls 1,629 students and spending per pupil is $6,596. The average kindergarten through grade three class size is 14-20 students. Of the sixteen kindergarten through grade three teachers who completed the instrument, 44% held Bachelor degrees, and 56% held Master degrees. Of the respondents, 25% had one to five years of teaching experience; 12% had six to ten years of teaching experience; 19% had eleven to fifteen years of teaching experience; 12% had sixteen to twenty years of

teaching experience; and 31% had twenty-one to twenty-five plus years of teaching experience.

Community. This community is located in southwestern Ohio and provides opportunities for shopping, recreational, and cultural experiences. The community represents a population of 3,392 with a median income of $42,403.

District 5:

School. In District 5, seven subjects from one elementary school completed the instrument. The district enrolls 2,643 students and spending per pupil is $4,844. The average kindergarten through grade three class size is 21-28 students. Only grade three teachers responded to this instrument. Of the seven teachers, 57% held Bachelor degrees and 43% held Master degrees. Of the respondents, 28% of the third grade teachers had one to five years of teaching experience; 28% had six to ten years of teaching experience; and 43% had twenty-one to twenty-five plus years of teaching experience.

Community. This community is located in southwestern Ohio and provides opportunities for shopping, recreational, and cultural experiences. The community represents approximately 6,590 with a median income of $40,759.

Data Collection

Construction of the Data Collecting Instrument. The writer researched 34 references of which nineteen critical issues in mathematics education emerged. The writer formulated the nineteen Likert-style statements for the instrument based on the review of the literature, which established content validity (Isaac & Michael, 1995). The instrument included questions concerning the profiles of respondents, Likert-type questions

concerning primary teachers' opinions (strongly agree, agree, uncertain, disagree, strongly disagree) toward using instructional modifications in mathematics, and a comment section for teachers to list their most effective classroom instructional modifications in mathematics. The instrument was field tested by 12 colleagues of the writer who teach in kindergarten through grade three, an elementary principal, and two university professors. The instrument was field tested to take no more than ten minutes to complete. Necessary changes to the instrument were made and discussed with the team of readers. The twelve colleagues who field tested the instrument were not included in the final survey.

Administration of the Data Collection Instrument. A cover page was prepared and the instrument was hand-delivered to the ten elementary schools. One hundred-thirty one teachers were asked to complete the confidential, ten minute questionnaire within three days, and then to return the survey to their school's main office by February 20, 1998. An incentive of baked goods and appreciation card was prepared by the writer and left in the schools' faculty lounges. Of the 131 surveys distributed, 91 surveys (69%) were completed and returned. A copy of the complete instrument is included in Appendix A.

Treatment of Data. The following chapter will analyze the actual responses to the instrument and provide a summary of the results. Tables 1 through 5 represent responses of kindergarten through third grade teachers in each district 1 through 5; Table 6 represents the total responses of kindergarten through third grade teachers in all five districts; Table 7 represents responses from kindergarten through third grade teachers in all five districts who have between 1 - 15 years of teaching experience; and Table 8 represents responses from kindergarten through third grade teachers who have between

16-25+ years of teaching experience.

CHAPTER IV

RESULTS

Presentation of the Results

Chapter IV presents the results of the Likert portion of the instrument in eight tables (See Tables 1 through 8). Each table is labeled to indicate the type of data being analyzed. Each table shows the primary teachers' responses to statements related to instructional modifications in mathematics. The results of this section are presented as percents rounded to the nearest whole number.

The study was based on the perceptions of ninety-one primary education teachers from five public school districts and ten elementary schools in southwestern Ohio.

Tables 1, 2, 3, 4, and 5 represent the school districts 1, 2, 3, 4, and 5. Each table presents the districts' spending per pupil and the average number of students in classes. Generally speaking, the majority of teachers in this study responded similarly regardless of the amount the district spent per pupil and the average number of students per class. Table 6 shows the total number of primary teachers' responses in districts 1 through 5. Table 7 shows the responses of 40 primary education teachers who have 1 to 15 years of teaching experience. Table 8 shows the responses of 51 primary education teachers who have 16 to 25+ years of teaching experience.

The first column of each table contains the statements from the Likert portion of the instrument. The response choices to the statements are the following: "SA"=strongly agree; "A"=agree; "U"= uncertain; "D"=disagree; and "SD"=strongly disagree.

The "N" for each table represents the total number of respondents that returned the instrument.

Discussion of the Results

One hundred and thirty-one instruments were distributed to ten elementary schools in five school districts in southwestern Ohio. Ninety-one instruments were returned for a 69% return rate. All tables are based on this 69% return rate.

In statements 1 through 19 of the Likert portion of the instrument, teachers were asked to respond according to their level of agreement or disagreement with each statement. These total responses are summarized in Table 6.

Statement 1,"Primary mathematics teachers should use instructional modifications to accommodate the learning styles of all students", showed that the teachers overwhelmingly strongly agreed (73%) and agreed (26%) with the literature. [Research data suggest that instructional decisions that accommodate students' unique learning needs and styles facilitate on-task performance and continues to maximize student achievements (Lasley & Matczynski, 1997; NCTM, 1984, 1989, 1991).]

Statement 2, "Instructional modifications in mathematics are necessary for at-risk students", indicates results that nearly all teachers strongly agreed (76%) or agreed (23%) with this statement. It is evident that the teachers in this study believe intervention strategies and using instructional modifications are necessary for at-risk students. [Research data indicate that instructional modifications in mathematics should begin in the primary elementary grades to promote prevention of at-risk students, rather than only as remediation instruction later in a student's school career (McCarney, Wunderlich, & Bauer,

1993; Will, 1986).]

Statement 3, "Instructional modifications in mathematics are necessary for gifted, highly talented students", showed an astounding 100% of teachers strongly agreed and agreed with the statement. [Research indicates that gifted, highly talented students lack challenges in regular mathematics and, many times, have to wait for instruction because of their mastery of material before it has been presented in class. These are great problems that face the gifted student populations. Curriculum and instructional practices in regular education must meet their needs, abilities, and interests, as well (Dossey, Mullis, Lindquist, & Chambers, 1988; Smutney, Walker, & Meckstroth, 1997).]

Statement 4 dealt with teachers' levels of agreement or disagreement of whether teacher training programs at the university level place enough emphasis on how teachers can accommodate students' educationally diverse mathematical needs. At the undergraduate level, 25% of the teachers strongly agreed and agreed, 32% were uncertain, however, 43% disagreed and strongly disagreed there was enough emphasis in undergraduate teacher training on accommodating students' educationally diverse mathematical needs. At the graduate level, 35% of the teachers agreed, 35% were uncertain, and 30% disagreed and strongly disagreed there was enough emphasis in graduate training on accommodating students' mathematical needs. It appears the teachers in this study see a need for more undergraduate university training in educating and improving the potential of students with various mathematical abilities. [The literature review suggests that teacher training institutions need to offer more and better training to preservice teachers and retraining opportunities for teachers to recognize the importance of providing appropriate

mathematics instruction and support to accommodate the educationally diverse mathematical needs of all students (Battista, 1994; Emenaker, 1996; Lasley & Matczynski, 1997; NCTM, 1984, 1989, 1991).]

Statement 5 dealt with the issues of time, resources, and experience in effectively implementing instructional modifications to meet the needs of individual mathematics students. The results showed that the majority of teachers believe their main obstacle to effectively implementing instructional modifications is the "time" factor. Seventy-five percent of the teachers in this study disagreed and strongly disagreed that they had sufficient time to effectively implement instructional modifications for individual mathematics students.

A majority of teachers (64%) agreed they had enough resources, while 8% were uncertain, 28% disagreed and strongly disagreed. Research indicates that sufficient resources, such as manipulatives and appropriate use of resources increases students' mathematics performance. Fifty-eight percent of the teachers also agreed teachers have sufficient experience levels to effectively implement instructional modifications, while, as in statement 4, 22% were uncertain, and 19% disagreed and strongly disagreed. Teachers vary widely on the ways they allocate time. Perhaps, much of non-instructional time during classroom hours, such as with organizational and transition duties, is accountable for the lack of available time. [According to research, teacher preparation and inservice programs should provide teachers on how to better prioritize their time and improve attitudes that will strengthen instructional approaches to teaching content, accommodating students' academic needs, and providing quality mathematics instruction to maximize student

potentials (Ball, 1994; Karp, 1991; Schifter, 1996a; Willoughby, 1990).]

Statement 6 regarded offering options to students to demonstrate their mathematical knowledge by using various modes of visual, auditory, and kinesthetic styles of learning. Ninety-seven percent of teachers strongly agreed and agreed that a variety of learning modes should be offered to help students demonstrate their mathematical knowledge. [Significant research supports that when variations of learning modes are offered, students increase their daily classroom participations and on-task performance. Many learners need these options in order to successfully and independently progress in mathematical achievement (Begley, 1996; Chambers,1996).]

In statement 7, "Some instructional modifications could worsen a student's mathematical learning difficulties", 33% of teachers strongly agreed and agreed, 38% were uncertain, while 28% disagreed and strongly disagreed. It appears that at least one-third (33%) of the teachers in this study realize instructional modifications must be individually appropriate to fit specific student needs. [Researchers examined the effects of how inappropriate instructional modifications for individual mathematics students could be detrimental to their performance levels. Each individual student has strengths, as well as weaknesses, that must be carefully identified before implementations of instructional modifications are considered educationally appropriate (Chambers, 1996; Lasley & Matczynski, 1997; Smutney, Walker, & Meckstroth, 1997).]

In statement 8, "Students must learn to generalize and apply skills to relevant, daily mathematics situations) 96% of teachers strongly agreed and agreed, while 2% were uncertain, and 1% disagreed. [Research has indicated that too often mathematics is taught

in rote fashion, with not enough emphasis on understanding and applying mathematics to real life situations. Making mathematics more relevant to daily life situations will increase positive student attitudes, confidence levels, and encourage more mathematics involvement and active participation by students (Dossey, Mullis, Lindquist, & Chambers, 1988; Good & Brophy, 1991; NCTM, 1984, 1989, 1991; Schifter, 1996a; Stigler & Hiebert, 1997).]

Statements 9 through 15 requested all teachers to respond to the statements in reference to four grade levels: kindergarten, grade 1, grade 2, and grade 3.

Statement 9 regarded teachers' levels of agreement or disagreement that students should spend less time on repetitive drill and practice worksheets. For the kindergarten level, the teachers responded with 66% strongly agreed and agreed, 15% were uncertain, and 18% disagreed and strongly disagreed. For grade 1, 39% of the teachers disagreed to spending less time on drill and practice worksheets, 49% agreed and strongly agreed and 12% were uncertain. For grades 2 and 3, 48% and 45% of the teachers disagreed that students should spend less time on drill and practice worksheets. [Drill and practice are quite common instructional approaches for grades 1, 2, and 3. The National Research Council (1989) strongly suggests that these practices must be augmented with real-life applications so that drill and practice is not merely memorizing formulas and procedures. Additional practice in computation must always involve the use of arithmetic in applied situations. Problem-solving abilities must be the end-result of computational proficiency (Ball, 1996; Battista, 1994; Stigler & Hiebert, 1997; NRC, 1989; Willoughby, 1990).]

In statement 10, "Students should spend more time actively participating in discovery of high-order problem solving in kindergarten through grade three", teachers responded

with almost 70% in agreement that all four grade levels should encourage more active participation in higher-order problem-solving. [The literature supports that mathematical applications should emphasize more problem-solving techniques that further students' individual mathematical knowledge and encourage divergent, creative thinking skills (Begley, 1996; Burrill, 1997b; NCTM, 1984, 1989, 1991; Sawada, 1997; Stigler & Hiebert, 1997).]

Statement 11, "Mathematics students should be limited in discussing alternative problem-solving because it alters lesson plans in kindergarten, grade 1, grade 2, and grade 3", received similar responses from the teachers for all four grade levels. Ninety-three percent of the teachers disagreed and strongly disagreed that students should be limited in discussing alternative problem solving because it alters lesson plans. [The National Council of Teachers of Mathematics (1984, 1989, 1991) recommends that effective mathematics instruction should have goals and objectives that foster the use of high-level thinking skills. Students must be provided a rich variety of mathematical experiences that promote and facilitate creative problem-solving.]

Statement 12,"High-ability mathematics students should receive more teacher time than low-ability mathematics students in kindergarten, grade 1, grade 2, and grade 3", showed 93% of teachers disagreed and strongly disagreed with this statement. [Research indicates that as teachers adjust instruction for specific student needs, teachers are challenged to responsibly work with all students in the classroom. Cooperative learning approaches and differentiated assignments should be used to provide for all students' mathematical learning needs (Lasley & Matczynski, 1997; Sawada, 1997; Schifter, 1996a, 1996b).]

Statement 13, "High-ability mathematics students should receive more process-oriented questions than low-ability mathematics students in kindergarten, grade 1, grade 2, and grade 3", showed some ambiguity among the teachers. A majority of the teachers disagreed, but 22% to 37% of the teachers agreed that high-ability mathematics students should receive more process-oriented questions than low-ability mathematics students in kindergarten, grade 1, grade 2, and grade 3. [It is important to note that in order to most effectively serve students with gifted potentials in mathematics, research indicates that higher-level process skills, content that is appropriately complex, and individual learning alternatives should be offered to maximize the potentials of gifted mathematics students (Hawkes, Kimmelman, & Koeze, 1997; Smutney, Walker, & Meckstroth, 1997).]

Statement 14, "It is effective instructional practice to track mathematics students into high, medium, and low groups based on ability levels in kindergarten, grade 1, grade 2, and grade 3", there was some ambiguity among these responses. For kindergarten and grade 1, 20% of the teachers strongly agreed and agreed, 17% were uncertain, and 62% disagreed and strongly disagreed with the statement. It is significant that for grades 2 and 3, about 30% of the teachers strongly agreed ability tracking is effective instructional practice, about 28% were uncertain, and about 40% disagreed or strongly agreed. It is common practice to track students into ability groups. It is also common that each group may have different mathematics content and curriculum. In the writer's opinion, for some low-ability students, the process offers fewer opportunities to study mathematics beyond rote memorization or computation. [Research shows the use of tracking is being debated. Many teachers in this study believe students should be placed in academic tracks. Others argue that mathematics

students should not be tracked so that students of all ability levels can cooperatively work and learn together. Many classroom teachers have large class sizes and significant number of students with special needs. This makes some teachers prefer cluster groupings which better enables them to meet their students' needs. Cooperative learning strategies can be an effective alternative to tracking students. (Lasley & Matczynski, 1997; Smutney, Walker, & Meckstroth, 1997).]

Statement 15, "It is important to integrate mathematics into other subject areas in kindergarten, grade 1, grade 2, and grade 3", showed the majority of teachers strongly agreed and agreed mathematics should be integrated into other subject areas in all four grade levels. These percentages show that teachers agree with the research that mathematics principles should emphasize real-life applications in all subject areas. [This fosters confidence and positive attitudes about the relevancy of mathematics for all students (Dossey, Mullis, Lindquist & Chambers, 1988; Lasley & Matczynski, 1997; NCTM, 1984, 1989, 1991; Willoughby, 1990).]

In statement 16, "Student performance is significantly influenced by how mathematics is taught", resulted in 89% of teachers who agreed and strongly agreed with this statement. [Research indicates that the content of mathematics curriculum and how mathematics is taught greatly influences student performance at all grade levels. Student performance is directly related to the preparation of teachers. Recent studies show there is a growing shortage of qualified teachers of mathematics in the U.S. which has placed the quality of mathematics instruction for our youth in jeopardy. In 1995, Americans scored below the international average in the Third International Mathematics and Science Study. The

current national concern over U.S. mathematics education has provided impetus for new reforms in mathematics education (Hawkes, Kimmelman, & Kroeze, 1997; NCTM, 1991; NRC, 1989; Stigler & Hiebert, 1997; Willoughby, 1990).]

In statement 17, "Student performance is significantly influenced by how mathematics is assessed", showed 68% of the teachers in this study agreed and strongly agreed, 16% were uncertain, while 15% disagreed. [The literature review indicates that evaluations of student performance influences what is taught, how it is studied, and how it is applied. Assessments should reflect the priorities identified for mathematics teaching and learning (Dossey, Mullis, Lindquist, & Chambers, 1988).]

Statement 18, "Manipulatives are essential tools for teaching concepts in mathematics", showed 100% of the teachers strongly agreed and agreed. [Research indicates that students who learn math with the help of manipulatives score significantly higher on achievement tests than those students who do not use manipulatives in their instruction. The use of manipulatives have been found to improve learning and retention, as well as applications to problem-solving situations (Burrill, 1997a; Chambers, 1996; McCarney, Wunderlich, & Bauer, 1993; NCTM, 1989, 1991; Sawada, 1997; Schifter, 1996b; Willoughby, 1990).]

In statement 19, "Technology is an essential tool for teaching concepts in mathematics", it appears that slightly more than half (59%) of the teachers strongly agreed and agreed that technology is useful instructional strategy. Twenty-six percent were uncertain and 15% disagreed with the statement. [Research indicates that technology instruction is becoming more essential for this and future generations than ever before. Computers have

increased the amount of mathematical knowledge. The NCTM (!991) points out that mathematics curriculum, instructional methods, and teacher preparations are being completely reshaped by computers, calculators, and other electronic technology (Burrill, 1997a; Dossey, Mullis, Lindquist, & Chambers, 1988; Hawkes, Kimmelman, & Kroeze, 1997; Lasley & Matczynski, 1997; NCTM, 1991; NRC, 1989; Sawada, 1997; Willoughby, 1990).]

Statement 20 requested teachers to write their most effective instructional modifications used in their mathematics programs. Out of 91 teachers in this study, 47 (52%) of the teachers responded to this statement. The majority of their answers were: "cooperative learning strategies" and "using a variety of manipulatives during instruction". As discussed in statement 18, manipulatives are an essential and widely accepted instructional approach to teaching mathematics. Cooperative learning practices stress small group participation in order to help each pupil become actively involved in the learning process. This instructional strategy encourages cooperative effort, rather than competitive learning. [Research data indicates cooperative learning increases student achievements, develops self- esteem, and communication skills (Lasley & Matczynski, 1997).]

Table 7 represents responses from kindergarten through third grade teachers from all five districts who have 1-15 years of teaching experience. Table 8 represents responses from kindergarten through third grade teachers from all five districts who have 16-25+ years of teaching experience. The results of Table 6 also support the findings in Tables 7 and 8.

Generally speaking, the two groups of teachers strongly agreed and agreed that

instructional modifications in mathematics are necessary in order to accommodate learning styles of all students, including at-risk students, average ability students, and highly-gifted students. In statement 4, however, it is interesting to note that 30% of each group disagreed that teacher training programs at the university level placed enough emphasis on educating teachers to accommodate students' various learning needs in mathematics. Statement 5 demonstrates both groups strongly agreed they do not have sufficient time to effectively implement instructional modifications for individual students' needs.

In statement 9, it is also interesting to note that 40% of teachers from both groups believe drill and practice in mathematics is increasingly important for students in grades 2 and 3. In statements 10 through 12, which expound on higher- order mathematics, both groups again generally agreed all ability levels should be taught critical thinking skills and include alternative problem-solving discussions in mathematics.

In statement 13, "High-ability mathematics students should receive more process-oriented questions than low-ability mathematics students in grades kindergarten through grade 3", 40%-50% of the teachers with 1-15 years of teaching experience strongly disagreed or disagreed with the statement. It appears that slightly more teachers of 16-25+ years of teaching experience agreed that high ability math students should receive more process-oriented questions than low-ability mathematics students. It appears that the majority of teachers with more experience have the opinion that high-ability students must be supported with more process-oriented questions in order to meet their needs for mathematical knowledge and challenge.

The results of the study in statements 1-20 support the findings in the review of

literature regarding the benefits of instructional modifications in mathematics. The vast majority of the 91 elementary teachers in this study have positive opinions toward the use of instructional modifications in order to maximize all students' achievements in mathematics.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to analyze the opinions of primary mathematics teachers toward the use of instructional modifications in mathematics. It is evident that all students do not progress through mathematics curriculum at the same pace or master new skills with the same proficiency. In order for all students to improve their mathematical performances, teachers must deliver appropriate instructional approaches to accommodate individual students of all ability levels and unique mathematical learning needs. The overall opinion of the teachers in this study was overwhelmingly positive toward the use of instructional modifications in mathematics. It is the belief of the writer that this indicates the majority of teachers in this study have the willingness to take responsibility to increase mathematical achievements for all students. The following procedures were conducted in order to complete this study.

The writer surveyed a total of 91 certified kindergarten through grade three public school teachers representing five public school districts and ten elementary schools in southwestern Ohio. A 69% return rate was calculated. The instrument consisted of a combination of respondent profiles, Likert-type statements, and addressed the concept of instructional modifications in mathematics. The instruments were delivered to the ten schools with a cover page. Ninety-one teachers completed the anonymous, ten minute questionnaire. The writer analyzed the data and compiled the results.

The results indicated that the majority of the teachers in this study had positive

opinions toward instructional modifications in mathematics for the purpose of accommodating students' mathematical learning needs. It is important to note that the location of this study was in southwestern Ohio. Ohio is one of three states (Ohio, California, and North Carolina) to have recently won national recognition for high standards in mathematics curriculum. The primary reason Ohio received recognition from the Thomas B. Fordham Foundation (1998), is because Ohio has specific, concrete goals for each grade level in mathematics that go beyond a focus of rote memorization, which stresses advanced mathematics, and higher-order thinking skills for all students.

In addition, however, although this study results in positive teacher opinions toward the use of instructional modifications in mathematics, much of the related literature confirms that the structure and emphasis of the majority of American mathematics curriculum and instructional strategies are not adequate. As mentioned in Chapter II, results from The Third International Mathematics Study (1997) places American students far below students from other international countries. In international comparison, the American student populations are not sufficiently achieving mathematics at globally, advanced levels. The related literature suggests that American mathematics educators must be prepared to improve curricula content, instructional approaches, and adaptive strategies in order to increase all students' mathematical achievements.

Conclusions

The writer concludes that a strong relationship exists between mathematical achievements and instruction that is appropriately based on students' mathematical learning styles and abilities. The writer also concludes that the teachers in this study

appear to have positive opinions toward instructional modifications in mathematics. The majority of the teachers in this study agree with the research that : 1.) appropriate instructional modifications are necessary teaching strategies and lead to improved mathematics performance for an increasingly diverse population of students; 2.) mathematics content needs to emphasize relevant mathematical skills and concepts to daily learning experiences; 3.) students should be active participants in mathematical experiences; 4.) mathematics should be integrated into other subject areas ; and 5.) instruction should emphasize problem-solving and higher-order thinking skills for students of all ability levels.

Recommendations

Based on the findings from this study and the literature review, the writer recommends that in order to enable all students to develop and apply their mathematical potentials, educators must:

*broaden their view of basic mathematics for all students;

*address students' unique mathematical learning needs;

*provide students with individualized mathematical support;

*provide students with individualized mathematical challenges;

*be knowledgeable on how to appropriately analyze and adapt mathematics curricula; and

*create relevant learning environments whereby raised expectations and individualized objectives maximize all students' mathematical achievements.

Recommendations for Further Study

The writer also suggests that further study of instructional modifications in

mathematics could be enhanced by:

*comparing teachers' opinions toward instructional modifications with actual classroom observations and monitoring of instructional accommodations to meet student needs; and

*evaluating the effectiveness of instructional modifications on students' mathematical achievements.

APPENDICES

APPENDIX A

TABLE 1

Primary Teachers' Opinions Toward the Use of Instructional Modifications in Mathematics
District 1: Spending per pupil $5,889 Average class size 21-28 students
N=27 K-3 teachers
N=number of respondents, SA=strongly agree, A=agree, U=uncertain, D=disagree, SD=strongly disagree

Statements	SA	A	U	D	SD
1. Primary mathematics teachers should use instructional modifications to accommodate the learning styles of all students.	93	7	0	0	0
2. Instructional modifications in mathematics are necessary for at-risk students.	89	11	0	0	0
3. Instructional modifications in mathematics are necessary for gifted, highly talented students.	74	26	0	0	0
4. Teacher training programs at the university level place enough emphasis on how teachers can accommodate students' individual mathematics need - at the undergraduate level:	0	22	30	26	22
- at the graduate level :	0	37	26	11	26
5. Teachers have sufficient time:	7	15	7	52	19
resources:	15	52	7	15	11
experience:	11	52	22	11	4
to effectively implement instructional modifications to meet the needs of individual mathematics students.					
6. Students should be offered several options to demonstrate their mathematical knowledge by using various modes of visual, auditory, and kinesthetic styles of learning.	81	15	4	0	0
7. Some instructional modifications could worsen a student's mathematical learning difficulties.	0	26	33	22	19
8. Students must learn to generalize and apply skills to relevant, daily mathematics situations.	59	30	7	4	0
9. Students should spend less time on repetitive drill and practice sheets in Kindergarten:	37	37	11	7	7
Grade 1 :	33	33	0	30	4
Grade 2 :	7	37	4	44	7
Grade 3 :	7	33	15	37	7
10. Students should spend more time actively participating in discovery of high-order problem solving in Kindergarten:	37	37	11	7	7
Grade 1:	33	33	0	30	4
Grade 2:	44	30	26	0	0
Grade 3:	48	33	19	0	0

	SA	A	U	D	SD
11. Mathematics students should be limited in discussing alternative problem-solving because it alters lesson plans in Kindergarten:	0	0	0	74	26
Grade 1 :	0	0	0	70	30
Grade 2 :	0	0	0	70	30
Grade 3 :	0	0	0	70	30
12. High-ability mathematics students should receive more teacher time than low-ability mathematics students in Kindergarten:	0	0	0	74	26
Grade 1 :	0	0	0	74	26
Grade 2 :	0	0	0	74	26
Grade 3 :	0	0	0	74	26
13. High-ability mathematics students should receive more process-oriented questions than low ability mathematics students in Kindergarten:	0	30	7	44	19
Grade 1 :	0	41	0	37	22
Grade 2:	0	41	0	37	22
Grade 3 :	0	41	0	37	22
14. It is effective instructional practice to track mathematics students into high, medium, and low groups based on ability levels in Kindergarten:	0	15	37	33	15
Grade 1 :	0	7	41	41	11
Grade 2 :	0	11	48	30	11
Grade 3:	4	7	48	30	11
15. It is important to integrate mathematics into other subjects areas in Kindergarten:	48	44	7	0	0
Grade 1 :	48	44	7	0	0
Grade 2 :	48	44	7	0	0
Grade 3 :	48	52	0	0	0
16. Student performance is significantly influenced by how mathematics is taught.	44	44	11	0	0
17 Student performance is significantly influenced by how mathematics is assessed.	19	63	11	7	0
18. Manipulatives are essential tools for teaching concepts in mathematics.	89	11	0	0	0
19. Technology is an essential tool for teaching concepts in mathematics.	30	44	19	7	0

20. Please list examples of the most effective instructional modifications used in your mathematics program.

Most often listed by K-3 teachers,
* cooperative learning
* variety of manipulatives

Note: Responses are expressed as percents rounded to the nearest whole number

TABLE 2

Primary Teachers' Opinions Toward the Use of Instructional Modifications in Mathematics
DISTRICT 2 : Spending per pupil $5,301 Average class size 21-28 students
N=24 K-3 teachers
N=number of respondents, SA=strongly agree, A=agree, U=uncertain, D=disagree, SD=strongly disagree

Statements	SA	A	U	D	SD
1. Primary mathematics teachers should use instructional modifications to accommodate the learning styles of all students.	54	46	0	0	0
2. Instructional modifications in mathematics are necessary for at-risk students.	58	42	0	0	0
3. Instructional modifications in mathematics are necessary for gifted, highly talented students.	46	54	0	0	0
4. Teacher training programs at the university level place enough emphasis on how teachers can accommodate students' individual mathematics need - at the undergraduate level:	0	12	33	54	0
- at the graduate level :	0	29	37	33	0
5. Teachers have sufficient time:	0	16	16	42	25
resources:	0	75	4	21	0
experience:	0	75	8	16	0
to effectively implement instructional modifications to meet the needs of individual mathematics students.					
6. Students should be offered several options to demonstrate their mathematical knowledge by using various modes of visual, auditory, and kinesthetic styles of learning.	42	58	0	0	0
7. Some instructional modifications could worsen a student's mathematical learning difficulties.	29	21	42	4	4
8. Students must learn to generalize and apply skills to relevant, daily mathematics situations.	37	62	0	0	0
9. Students should spend less time on repetitive drill and practice sheets in Kindergarten:	21	58	12	8	0
Grade 1:	4	21	21	42	12
Grade 2:	4	29	12	42	12
Grade 3:	0	42	12	37	8
10. Students should spend more time actively participating in discovery of high-order problem solving in Kindergarten:	21	58	0	0	16
Grade 1 :	21	58	0	21	0
Grade 2 :	21	66	8	4	0
Grade 3 :	33	62	0	4	0

Item	SA	A	U	D	SD
11. Mathematics students should be limited in discussing alternative problem-solving because it alters lesson plans in Kindergarten:	0	16	0	42	42
Grade 1 :	0	21	0	42	37
Grade 2 :	0	16	0	46	37
Grade 3 :	4	8	0	37	54
12. High-ability mathematics students should receive more teacher time than low-ability mathematics students in Kindergarten:	0	0	0	54	46
Grade 1 :	0	0	0	58	42
Grade 2 :	0	4	0	50	46
Grade 3 :	0	4	0	50	46
13. High-ability mathematics students should receive more process-oriented questions than low-ability mathematics students in Kindergarten:	0	12	0	71	16
Grade 1 :	0	12	0	66	21
Grade 2:	0	33	0	46	21
Grade 3 :	0	33	0	46	21
14. It is effective instructional practice to track mathematics students into high, medium, and low groups based on ability levels in Kindergarten:	8	25	0	37	29
Grade 1 :	8	25	0	54	12
Grade 2 :	25	42	12	16	4
Grade 3:	25	46	12	12	4
15. It is important to integrate mathematics into other subjects areas in Kindergarten:	42	58	0	0	0
Grade 1 :	42	58	0	0	0
Grade 2 :	42	58	0	0	0
Grade 3 :	42	58	0	0	0
16. Student performance is significantly influenced by how mathematics is taught.	25	62	0	12	0
17 Student performance is significantly influenced by how mathematics is assessed.	8	50	21	21	0
18. Manipulatives are essential tools for teaching concepts in mathematics.	83	16	0	0	0
19. Technology is an essential tool for teaching concepts in mathematics.	16	42	37	4	0

20. Please list examples of the most effective instructional modifications used in your mathematics program.

Most often listed by K-3 teachers, District 2:
*Ability grouping
*Cooperative groups
*Modeling concepts in various ways

Note: Responses are expressed as percents rounded to the nearest whole number

TABLE 3

Primary Teachers' Opinions Toward the Use of Instructional Modifications in Mathematics

DISTRICT 3 : Spending per pupil $5,623 Average class size 21-28 students
N=17 K-3 teachers

N=number of respondents, SA=strongly agree, A=agree, U=uncertain, D=disagree, SD=strongly disagree

Statements	SA	A	U	D	SD
1. Primary mathematics teachers should use instructional modifications to accommodate the learning styles of all students.	59	35	6	0	0
2. Instructional modifications in mathematics are necessary for at-risk students.	53	41	6	0	0
3. Instructional modifications in mathematics are necessary for gifted, highly talented students.	47	53	0	0	0
4. Teacher training programs at the university level place enough emphasis on how teachers can accommodate students' individual mathematics need - at the undergraduate level:	0	23	30	35	12
- at the graduate level :	0	30	30	17	23
5. Teachers have sufficient time:	0	12	12	47	30
resources:	0	47	12	17	23
experience:	0	35	30	17	17
to effectively implement instructional modifications to meet the needs of individual mathematics students.					
6. Students should be offered several options to demonstrate their mathematical knowledge by using various modes of visual, auditory, and kinesthetic styles of learning.	71	23	0	6	0
7. Some instructional modifications could worsen a student's mathematical learning difficulties.	41	6	53	30	0
8. Students must learn to generalize and apply skills to relevant, daily mathematics situations.	47	53	0	0	0
9. Students should spend less time on repetitive drill and practice sheets in Kindergarten:	35	12	30	23	0
Grade 1:	23	30	12	35	0
Grade 2:	0	23	30	47	0
Grade 3:	12	12	23	53	0
10. Students should spend more time actively participating in discovery of high-order problem solving in Kindergarten:	12	59	12	17	0
Grade 1 :	12	53	12	23	0
Grade 2 :	23	47	6	23	0
Grade 3 :	23	59	6	12	0

	SA	A	U	D	SD
11. Mathematics students should be limited in discussing alternative problem-solving because it alters lesson plans in Kindergarten:	0	17	17	35	30
Grade 1 :	0	17	6	47	30
Grade 2 :	0	17	6	47	30
Grade 3 :	0	17	6	47	30
12. High-ability mathematics students should receive more teacher time than low-ability mathematics students in Kindergarten:	0	0	12	59	30
Grade 1 :	0	0	12	59	30
Grade 2 :	0	0	12	53	35
Grade 3 :	0	0	12	53	35
13. High-ability mathematics students should receive more process-oriented questions than low-ability mathematics students in Kindergarten:	0	23	30	47	0
Grade 1 :	0	23	30	47	0
Grade 2:	0	41	17	41	0
Grade 3 :	0	41	17	30	12
14. It is effective instructional practice to track mathematics students into high, medium, and low groups based on ability levels in Kindergarten:	12	17	12	30	30
Grade 1 :	12	30	0	30	30
Grade 2 :	12	30	12	30	17
Grade 3:	12	17	23	30	17
15. It is important to integrate mathematics into other subjects areas in Kindergarten:	59	41	0	0	0
Grade 1 :	65	35	0	0	0
Grade 2 :	65	35	0	0	0
Grade 3 :	65	35	0	0	0
16. Student performance is significantly influenced by how mathematics is taught.	30	65	6	0	0
17 Student performance is significantly influenced by how mathematics is assessed.	23	35	23	17	0
18. Manipulatives are essential tools for teaching concepts in mathematics.	59	41	0	0	0
19. Technology is an essential tool for teaching concepts in mathematics.	12	30	30	30	0
20. Please list examples of the most effective instructional modifications used in your mathematics program.	Most often listed by K-3 teachers, District 3: *Peer tutors *Cooperative learning *Variety of manipulatives				

Note: Responses are expressed as percents rounded to the nearest whole number

Table 4

Primary Teachers' Opinions Toward the Use of Instructional Modifications in Mathematics

District 4: Spending per pupil $6,909 Average class size 15-20 students

N=16 K-3 teachers

N=number of respondents, SA=strongly agree, A=agree, U=uncertain, D=disagree, SD=strongly disagree

Statements	SA	A	U	D	SD
1. Primary mathematics teachers should use instructional modifications to accommodate the learning styles of all students.	81	19	0	0	0
2. Instructional modifications in mathematics are necessary for at-risk students.	94	6	0	0	0
3. Instructional modifications in mathematics are necessary for gifted, highly talented students.	75	25	0	0	0
4. Teacher training programs at the university level place enough emphasis on how teachers can accommodate students' individual mathematics need - at the undergraduate level:	25	25	31	13	6
- at the graduate level :	31	13	50	6	0
5. Teachers have sufficient time:	0	13	0	69	18
resources:	13	56	6	25	0
experience:	0	56	19	25	0
to effectively implement instructional modifications to meet the needs of individual mathematics students.					
6. Students should be offered several options to demonstrate their mathematical knowledge by using various modes of visual, auditory, and kinesthetic styles of learning.	69	31	0	0	0
7. Some instructional modifications could worsen a student's mathematical learning difficulties.	0	25	31	38	6
8. Students must learn to generalize and apply skills to relevant, daily mathematics situations.	63	37	0	0	0
9. Students should spend less time on repetitive drill and practice sheets in Kindergarten:	44	31	19	0	6
Grade 1:	19	50	19	6	6
Grade 2:	0	63	12	19	6
Grade 3:	0	56	19	19	6
10. Students should spend more time actively participating in discovery of high-order problem solving in Kindergarten:	50	50	0	0	0
Grade 1 :	56	44	0	0	0
Grade 2 :	69	31	0	0	0
Grade 3 :	62	38	0	0	0

	SA	A	U	D	SD
11. Mathematics students should be limited in discussing alternative problem-solving because it alters lesson plans in Kindergarten:	0	0	19	43	38
Grade 1 :	0	0	12	50	38
Grade 2 :	0	0	12	44	44
Grade 3 :	0	0	19	38	43
12. High-ability mathematics students should receive more teacher time than low-ability mathematics students in Kindergarten:	0	0	31	44	25
Grade 1 :	0	0	25	56	19
Grade 2 :	0	0	25	44	31
Grade 3 :	0	0	25	44	31
13. High-ability mathematics students should receive more process-oriented questions than low-ability mathematics students in Kindergarten:	0	12	31	44	13
Grade 1 :	0	12	31	44	13
Grade 2:	0	19	25	44	12
Grade 3 :	0	25	19	44	12
14. It is effective instructional practice to track mathematics students into high, medium, and low groups based on ability levels in Kindergarten:	0	0	19	56	25
Grade 1:	0	0	19	56	25
Grade 2 :	0	0	31	44	25
Grade 3:	0	6	38	37	19
15. It is important to integrate mathematics into other subject areas in Kindergarten:	81	12	6	0	0
Grade 1 :	81	12	6	0	0
Grade 2 :	69	31	0	0	0
Grade 3 :	75	25	0	0	0
16. Student performance is significantly influenced by how mathematics is taught.	56	38	6	0	0
17 Student performance is significantly influenced by how mathematics is assessed.	25	50	13	12	0
18. Manipulatives are essential tools for teaching concepts in mathematics.	88	12	0	0	0
19. Technology is an essential tool for teaching concepts in mathematics.	6	44	19	31	0
20. Please list examples of the most effective instructional modifications used in your mathematics program.	Most often listed by K-3 teachers, District 4: *cooperative learning *modeling concepts in variety of ways *manipulatives				

Note: Responses are expressed as percents rounded to the nearest whole number.

TABLE 5

Primary Teachers' Opinions Toward the Use of Instructional Modifications in Mathematics

District 5: Spending per pupil $4,844 Average class size 21-28 students

N=7 Grade 3 teachers

N=number of respondents, SA=strongly agree, A=agree, U=uncertain, D=disagree, SD=strongly disagree

Statements	SA	A	U	D	SD
1. Primary mathematics teachers should use instructional modifications to accommodate the learning styles of all students.	71	28	0	0	0
2. Instructional modifications in mathematics are necessary for at-risk students.	100	0	0	0	0
3. Instructional modifications in mathematics are necessary for gifted, highly talented students.	57	43	0	0	0
4. Teacher training programs at the university level place enough emphasis on how teachers can accommodate students' individual mathematics need - at the undergraduate level:	14	14	43	29	0
- at the graduate level :	14	29	43	14	0
5. Teachers have sufficient time:	0	14	0	86	0
resources:	0	57	14	29	0
experience:	0	43	57	0	0
to effectively implement instructional modifications to meet the needs of individual mathematics students.					
6. Students should be offered several options to demonstrate their mathematical knowledge by using various modes of visual, auditory, and kinesthetic styles of learning.	43	43	14	0	0
7. Some instructional modifications could worsen a student's mathematical learning difficulties.	0	14	43	43	0
8. Students must learn to generalize and apply skills to relevant, daily mathematics situations.	14	86	0	0	0
9. Students should spend less time on repetitive drill and practice sheets in Kindergarten:	14	0	0	86	0
Grade 1:	14	0	14	71	0
Grade 2:	0	0	29	71	0
Grade 3:	0	29	0	71	0
10. Students should spend more time actively participating in discovery of high-order problem solving in Kindergarten:	0	43	57	0	0
Grade 1 :	0	43	57	0	0
Grade 2 :	0	71	29	0	0
Grade 3 :	0	71	29	0	0

Item	SA	A	U	D	SD
11. Mathematics students should be limited in discussing alternative problem-solving because it alters lesson plans in Kindergarten:	0	0	14	86	0
Grade 1 :	0	0	14	86	0
Grade 2 :	0	0	14	86	0
Grade 3 :	0	0	14	86	0
12. High-ability mathematics students should receive more teacher time than low-ability mathematics students in Kindergarten:	0	0	14	71	14
Grade 1 :	0	0	0	86	14
Grade 2 :	0	0	0	86	14
Grade 3 :	0	0	0	86	14
13. High-ability mathematics students should receive more process-oriented questions than low-ability mathematics students in Kindergarten:	0	43	14	43	0
Grade 1 :	0	57	0	43	0
Grade 2:	0	57	0	43	0
Grade 3 :	0	57	0	43	0
14. It is effective instructional practice to track mathematics students into high, medium, and low groups based on ability levels in Kindergarten:	0	29	14	43	14
Grade 1 :	0	29	29	29	14
Grade 2 :	0	29	29	29	14
Grade 3:	0	43	14	29	14
15. It is important to integrate mathematics into other subjects areas in Kindergarten:	0	86	14	0	0
Grade 1 :	0	86	14	0	0
Grade 2 :	0	86	14	0	0
Grade 3 :	0	86	14	0	0
16. Student performance is significantly influenced by how mathematics is taught.	14	57	0	29	0
17 Student performance is significantly influenced by how mathematics is assessed.	0	57	14	29	0
18. Manipulatives are essential tools for teaching concepts in mathematics.	43	57	0	0	0
19. Technology is an essential tool for teaching concepts in mathematics.	14	43	29	14	0

20. Please list examples of the most effective instructional modifications used in your mathematics program.

Most often listed by grade 3 teachers, District 5
*technology
*cooperative learning groups

Note: Responses are expressed as percents rounded to the nearest whole number.

APPENDIX B

TABLE 6

Total Responses of Primary Teachers' Opinions Toward the Use of Instructional Modifications in Mathematics N= 91 Districts 1, 2, 3, 4, and 5 kindergarten through third grade teachers

N=number of respondents, SA=strongly agree, A=agree, U=uncertain, D=disagree, SD=strongly disagree

Statements	SA	A	U	D	SD
1. Primary mathematics teachers should use instructional modifications to accommodate the learning styles of all students.	73	26	1	0	0
2. Instructional modifications in mathematics are necessary for at-risk students.	76	23	0	0	0
3. Instructional modifications in mathematics are necessary for gifted, highly talented students.	60	40	0	0	0
4. Teacher training programs at the university level place enough emphasis on how teachers can accommodate students' individual mathematics need - at the undergraduate level:	5	20	32	33	10
- at the graduate level :	7	28	35	18	12
5. Teachers have sufficient time:	2	14	9	54	21
resources:	7	57	8	20	8
experience:	3	55	22	15	4
to effectively implement instructional modifications to meet the needs of individual mathematics students.					
6. Students should be offered several options to demonstrate their mathematical knowledge by using various modes of visual, auditory, and kinesthetic styles of learning.	64	33	2	1	0
7. Some instructional modifications could worsen a student's mathematical learning difficulties.	13	20	38	21	7
8. Students must learn to generalize and apply skills to relevant, daily mathematics situations.	48	48	2	1	1
9. Students should spend less time on repetitive drill and practice sheets in Kindergarten:	32	34	15	15	3
Grade 1:	19	30	12	33	6
Grade 2:	3	34	14	42	6
Grade 3:	4	35	15	40	5
10. Students should spend more time actively participating in discovery of high-order problem solving in Kindergarten:	28	46	15	6	4
Grade 1 :	29	45	14	8	4
Grade 2 :	35	46	13	6	0
Grade 3 :	38	50	9	3	0

	SA	A	U	D	SD
11. Mathematics students should be limited in discussing alternative problem-solving because it alters lesson plans in Kindergarten:	0	8	8	53	31
Grade 1 :	0	9	4	56	31
Grade 2 :	0	8	4	56	32
Grade 3 :	1	5	5	53	35
12. High-ability mathematics students should receive more teacher time than low-ability mathematics students in Kindergarten:	0	0	9	60	31
Grade 1 :	0	0	6	65	29
Grade 2 :	0	1	6	60	33
Grade 3 :	0	1	6	60	33
13. High-ability mathematics students should receive more process-oriented questions than low-ability mathematics students in Kindergarten:	0	22	14	52	12
Grade 1 :	0	26	11	49	14
Grade 2:	0	36	7	42	14
Grade 3 :	0	37	6	40	16
14. It is effective instructional practice to track mathematics students into high, medium, and low groups based on ability levels in Kindergarten:	4	16	17	39	23
Grade 1 :	4	16	17	44	18
Grade 2 :	8	22	27	29	13
Grade 3:	10	22	30	26	12
15. It is important to integrate mathematics into other subjects areas in Kindergarten:	51	45	4	0	0
Grade 1 :	52	44	4	0	0
Grade 2 :	49	48	3	0	0
Grade 3 :	51	49	0	0	0
16. Student performance is significantly influenced by how mathematics is taught.	36	53	5	5	0
17 Student performance is significantly influenced by how mathematics is assessed.	16	52	16	15	0
18. Manipulatives are essential tools for teaching concepts in mathematics.	78	22	0	0	0
19. Technology is an essential tool for teaching concepts in mathematics.	18	41	26	15	0

20. Please list examples of the most effective instructional modifications used in your mathematics program.

Most often listed by kindergarten grade 3 teachers in five districts:
* cooperative learning groups
* variety of manipulatives

Note: Responses are expressed as percents rounded to the nearest whole number.

TABLE 7

Primary Teachers' Opinions Toward the Use of Instructional Modifications in Mathematics

Districts 1, 2, 3, 4, and 5 kindergarten through third grade teachers who have 1 - 15 years of teaching experience

N=40

N=number of respondents, SA=strongly agree, A=agree, U=uncertain, D=disagree, SD=strongly disagree

Statements	SA	A	U	D	SD
1. Primary mathematics teachers should use instructional modifications to accommodate the learning styles of all students.	75	25	0	0	0
2. Instructional modifications in mathematics are necessary for at-risk students.	75	25	0	0	0
3. Instructional modifications in mathematics are necessary for gifted, highly talented students.	62	38	0	0	0
4. Teacher training programs at the university level place enough emphasis on how teachers can accommodate students' individual mathematics need - at the undergraduate level:	8	23	30	35	3
- at the graduate level :	8	23	38	23	10
5. Teachers have sufficient time:	0	13	30	42	15
resources:	1	53	1	25	20
experience:	1	45	30	20	3
to effectively implement instructional modifications to meet the needs of individual mathematics students.					
6. Students should be offered several options to demonstrate their mathematical knowledge by using various modes of visual, auditory, and kinesthetic styles of learning.	68	30	0	2	0
7. Some instructional modifications could worsen a student's mathematical learning difficulties.	7	15	42	28	7
8. Students must learn to generalize and apply skills to relevant, daily mathematics situations.	65	33	1	0	0
9. Students should spend less time on repetitive drill and practice sheets in Kindergarten:	38	15	30	10	7
Grade 1:	20	25	17	30	7
Grade 2:	0	27	25	37	10
Grade 3:	1	23	30	38	7
10. Students should spend more time actively participating in discovery of high-order problem solving in Kindergarten:	27	53	15	1	4
Grade 1 :	27	47	13	13	0
Grade 2 :	37	45	10	7	0
Grade 3 :	37	55	7	0	0

Item	SA	A	U	D	SD
11. Mathematics students should be limited in discussing alternative problem-solving because it alters lesson plans in Kindergarten:	0	4	20	48	28
Grade 1 :	0	4	10	58	28
Grade 2 :	0	1	10	58	30
Grade 3 :	0	1	13	55	30
12. High-ability mathematics students should receive more teacher time than low-ability mathematics students in Kindergarten:	0	0	10	57	33
Grade 1 :	0	0	7	60	33
Grade 2 :	0	4	7	55	33
Grade 3 :	0	4	7	55	33
13. High-ability mathematics students should receive more process-oriented questions than low-ability mathematics students in Kindergarten:	0	10	28	50	12
Grade 1 :	0	15	23	50	12
Grade 2:	1	30	15	40	13
Grade 3 :	1	32	15	37	15
14. It is effective instructional practice to track mathematics students into high, medium, and low groups based on ability levels in Kindergarten:	0	18	27	37	18
Grade 1 :	0	18	25	45	12
Grade 2 :	7	23	25	33	12
Grade 3:	7	18	32	30	13
15. It is important to integrate mathematics into other subjects areas in Kindergarten:	48	48	4	0	0
Grade 1 :	48	48	4	0	0
Grade 2 :	45	53	1	0	0
Grade 3 :	50	50	0	0	0
16. Student performance is significantly influenced by how mathematics is taught.	30	55	12	3	0
17 Student performance is significantly influenced by how mathematics is assessed.	15	48	25	12	0
18. Manipulatives are essential tools for teaching concepts in mathematics.	78	22	0	0	0
19. Technology is an essential tool for teaching concepts in mathematics.	10	38	32	20	0
20. Please list examples of the most effective instructional modifications used in your mathematics program.	Most often listed by K-3 teachers who have 1 - 15 years of teaching experience: * variety of manipulatives * cooperative learning strategies				

Note: Responses are expressed as percents rounded to the nearest whole number.

TABLE 8

Primary Teachers' Opinions Toward the Use of Instructional Modifications in Mathematics

Districts 1, 2, 3, 4, and 5 kindergarten through third grade teachers who have 16 - 25+ years of teaching experience

N=51

N=number of respondents, SA=strongly agree, A=agree, U=uncertain, D=disagree, SD=strongly disagree

Statements	SA	A	U	D	SD
1. Primary mathematics teachers should use instructional modifications to accommodate the learning styles of all students.	73	27	0	0	0
2. Instructional modifications in mathematics are necessary for at-risk students.	78	22	0	0	0
3. Instructional modifications in mathematics are necessary for gifted, highly talented students.	63	37	1	0	0
4. Teacher training programs at the university level place enough emphasis on how teachers can accommodate students' individual mathematics need - at the undergraduate level:	3	23	33	29	11
- at the graduate level :	5	27	39	19	9
5. Teachers have sufficient time:	5	19	7	41	27
resources:	9	65	3	11	11
experience:	3	51	15	23	7
to effectively implement instructional modifications to meet the needs of individual mathematics students.					
6. Students should be offered several options to demonstrate their mathematical knowledge by using various modes of visual, auditory, and kinesthetic styles of learning.	57	39	3	0	0
7. Some instructional modifications could worsen a student's mathematical learning difficulties.	1	21	43	23	11
8. Students must learn to generalize and apply skills to relevant, daily mathematics situations.	37	61	1	1	0
9. Students should spend less time on repetitive drill and practice sheets in Kindergarten:	33	47	3	17	0
Grade 1:	19	37	5	37	1
Grade 2:	3	41	7	45	3
Grade 3:	5	43	3	43	5
10. Students should spend more time actively participating in discovery of high-order problem solving in Kindergarten:	31	47	13	5	3
Grade 1 :	31	47	13	9	0
Grade 2 :	35	47	13	5	0
Grade 3 :	39	49	7	5	0

Item	SA	A	U	D	SD
11. Mathematics students should be limited in discussing alternative problem-solving because it alters lesson plans in Kindergarten:	0	3	0	59	37
Grade 1 :	0	3	0	59	37
Grade 2 :	0	3	0	59	37
Grade 3 :	0	3	0	59	37
12. High-ability mathematics students should receive more teacher time than low-ability mathematics students in Kindergarten:	0	0	0	69	31
Grade 1 :	0	0	0	69	31
Grade 2 :	0	0	0	69	31
Grade 3 :	0	0	0	69	31
13. High-ability mathematics students should receive more process-oriented questions than low-ability mathematics students in Kindergarten:	0	33	5	51	11
Grade 1 :	0	39	3	51	7
Grade 2:	0	43	3	43	11
Grade 3 :	0	39	3	41	17
14. It is effective instructional practice to track mathematics students into high, medium, and low groups based on ability levels in Kindergarten:	7	15	13	33	31
Grade 1 :	7	15	15	35	29
Grade 2 :	9	21	29	23	19
Grade 3:	13	23	29	23	12
15. It is important to integrate mathematics into other subjects areas in Kindergarten:	49	39	12	0	0
Grade 1 :	49	39	12	0	0
Grade 2 :	49	39	12	0	0
Grade 3 :	51	43	6	0	0
16. Student performance is significantly influenced by how mathematics is taught.	41	49	3	7	0
17 Student performance is significantly influenced by how mathematics is assessed.	15	51	15	19	0
18. Manipulatives are essential tools for teaching concepts in mathematics.	80	19	0	0	0
19. Technology is an essential tool for teaching concepts in mathematics.	23	39	21	17	0

20. Please list examples of the most effective instructional modifications used in your mathematics program.

Most often listed by K-3 teachers who have 16-25+ years of teaching:
*cooperative learning strategies
*variety of manipulatives

Note: Responses are expressed as percents rounded to the nearest number.

APPENDIX C

Janet Block
5759 Wilcke Way
Dayton, Ohio 45459

February 13, 1998

Dear Teacher:

Attached is a survey that will be used to examine the opinions of primary mathematics teachers toward the use of instructional modifications. Your professional opinions will be a significant contribution to this study. I realize teachers' time is very valuable. Therefore, this confidential questionnaire should take less than 10 minutes.

Please complete this survey by Friday, February 20, 1998 and return it to the envelope provided in your school's office. Following the completion of the study, I will be sending out a summary of the results for your information.

Thank you in advance for your cooperation.

Sincerely,

Janet Block

SURVEY

INSTRUCTIONAL MODIFICATIONS IN MATHEMATICS EDUCATION

Please circle the appropriate answers.

1. Current grade level that you teach: Kindergarten Grade 1 Grade 2 Grade 3

2. Number of students currently in your class: 14-20 students 21-28 students 29 or more students

3. Years of teaching experience: 1-5 years 6-10 years 11-15 years 16-20 years 21-25 + years

4. Educational background: Bachelor's Master's Doctorate

5. Certificate(s) held: Regular Elementary Education K-8 or 1-8 Special Education Secondary Education Concentration in Mathematics Other________________________

6. Number of minutes per day teaching mathematics:
20 minutes or less 21 - 30 minutes 31 - 40 minutes 41 minutes or more

For this survey the term instructional modifications in mathematics refers to any accommodations and adaptations in the classroom methods of instruction, testing, materials, and equipment deemed necessary by the teacher for the purpose of maximizing student achievement. Examples of instructional modifications are:

*** modeling skills in several ways**
*** creating individual assignments**
*** limiting learning objectives**
*** extending learning objectives**
*** presenting additional resources and materials**
*** providing diagnostic teaching approach**
*** using cooperative learning groups/ student-centered activities**
*** providing enrichment activities**

Please circle your level of agreement / disagreement.
SA=Strongly Agree A=Agree U=Uncertain D=Disagree
SD=Strongly Disagree

1. Primary mathematics teachers should use instructional modifications to accommodate the learning styles of all students.
   SA A U D SD

2. Instructional modifications in mathematics are necessary for at-risk students.
   SA A U D SD

3. Instructional modifications in mathematics are necessary for gifted, highly talented students.
   SA A U D SD

4. Teacher training programs at the university level place enough emphasis on how teachers can accommodate students' individual mathematics needs.

Undergraduate level	SA	A	U	D	SD
Graduate level	SA	A	U	D	SD

5. Teachers have sufficient

time	SA	A	U	D	SD
" " " resources	SA	A	U	D	SD
experience	SA	A	U	D	SD

to effectively implement instructional modifications to meet the needs of individual mathematics students.

6. Students should be offered several options to demonstrate their mathematical knowledge by using various modes of visual, auditory, and kinesthetic styles of learning.
   SA A U D SD

7. Some instructional modifications could worsen a student's mathematics learning difficulties.
   SA A U D SD

8. Students must learn to generalize and apply skills to relevant, daily mathematics situations. SA A U D SD

9. Students should spend less time on repetitive drill and practice sheets in :

Kindergarten	SA	A	U	D	SD
Grade 1	SA	A	U	D	SD
Grade 2	SA	A	U	D	SD
Grade 3	SA	A	U	D	SD

10. Students should spend more time actively participating in discovery of high-order problem solving in:

Kindergarten	SA	A	U	D	SD
Grade 1	SA	A	U	D	SD
Grade 2	SA	A	U	D	SD
Grade 3	SA	A	U	D	SD

11. Mathematics students should be limited in discussing alternative problem-solving because it alters lesson plans in:

Kindergarten	SA	A	U	D	SD
Grade 1	SA	A	U	D	SD
Grade 2	SA	A	U	D	SD
Grade 3	SA	A	U	D	SD

12. High-ability mathematics students should receive more teacher time than low-ability mathematics students in:

Kindergarten	SA	A	U	D	SD
Grade 1	SA	A	U	D	SD
Grade 2	SA	A	U	D	SD
Grade 3	SA	A	U	D	SD

13 . High- ability mathematics students should receive more process-oriented questions than low- ability mathematics students.

Kindergarten	SA	A	U	D	SD
Grade 1	SA	A	U	D	SD
Grade 2	SA	A	U	D	SD
Grade 3	SA	A	U	D	SD

14. It is effective instructional practice to track mathematics students into high, medium, and low groups based on ability levels in:

Kindergarten	SA	A	U	D	SD
Grade 1	SA	A	U	D	SD
Grade 2	SA	A	U	D	SD
Grade 3	SA	A	U	D	SD

15. It is important to integrate mathematics into other subject areas in:

Kindergarten	SA	A	U	D	SD
Grade 1	SA	A	U	D	SD
Grade 2	SA	A	U	D	SD
Grade 3	SA	A	U	D	SD

16. Student performance is significantly influenced by how mathematics is taught.

SA A U D SD

17. Student performance is significantly influenced by how mathematics is assessed.
    SA A U D SD
18. Manipulatives are essential tools for teaching concepts in mathematics.
    SA A U D SD
19. Technology is an essential tool for teaching concepts in mathematics.
    SA A U D SD
20. Please list examples of the most effective instructional modifications used in your mathematics program.

    ____

    ____

    ____

    ____

Thank you for completing this survey. Please return this form to your school's office by Friday, February 20, 1998. There is an envelope provided for your convenience.

REFERENCES

Acquarelli, K. & Mumme, J. (1996). A renaissance in mathematics education reform. Phi Delta Kappan, 77, 478-484.

Ball, D. (1996). Teacher learning and the mathematics reforms: What we think we know, and what we need to learn. Phi Delta Kappan, 77, 500-507.

Battista, M. (1994). Teacher beliefs and the reform movement in mathematics education. Phi Delta Kappan, 75, 462-470.

Begley, S. (1996, Feb,19). Your child's brain. Newsweek, 127, 55-61.

Burrill, G. (1997a). The NCTM standards: eight years later. School Science and Mathematics, 97(6), 335-339.

Burrill, G. (1997b). Choices and challenges. Teaching Children Mathematics, 4, 58-63.

Chambers, D. (1996). Direct modeling and invented procedures; Building on students' informal strategies. Teaching Children Mathematics, 3, 92-96.

Danielson, C. (1996). Enhancing professional practice: A framework for teaching. Alexandria, Va.:ASCD.

Dossey, J., Mullis I., Lindquist, M., & Chambers, D. (1988). The mathematics report card: Are we measuring up? National Assessment of Educational Progress. Princeton, N.J.: Educational Testing Service.

Emenaker, C. (1996). A problem-solving based mathematics course and elementary teachers' beliefs. School Science and Mathematics, 96 (2), 75-84.

Fordham, T. (1998). The Thomas B. Fordham Foundation for Standards in Mathematics and Science. Washington, D.C.

Good, T. & Brophy, J. (1991). Looking in classrooms, (5th ed.). New York: Harper Collins Publishers, Inc.

Hawkes, M., Kimmelman, P., & Kroeze, D. (1997). Becoming first in the world in math and science. Phi Delta Kappan, 79, 30-33.

Isaac, S. & Michael, W. (1995). Handbook in research and evaluation. (3rd ed.). San

Diego, CA: Educational and Industrial Testing Services.

Karp, K. (1991). Elementary school teachers' attitudes toward mathematics: The impact on students' autonomous learning skills. School Science and Mathematics, 91(6), 265-269.

Lasley, T. & Matczynski, T. (1997). Strategies for teaching in a diverse society. Belmont, California: Wadsworth Publishing Company.

McCarney, S., Wunderlich, K., & Bauer, A. (1993). The Pre-referral intervention manual. (2nd ed.). Columbia, MO: Hawthorne Educational Services, Inc., 160-169.

National Council of Teachers of Mathematics. (1984). Standards for selection and implementation of instructional materials. Reston, VA: The Council.

National Council of Teachers of Mathematics. (1989). Curriculum and evaluation standards for school mathematics. Reston, VA: The Council..

National Council of Teachers of Mathematics. (1991). Professional standards for teaching mathematics. Reston, VA: The Council.

National Research Council. (1989). Everybody counts: A report to the nation on the future of mathematics education. Washington, D.C.: National Academy Press.

National Science Foundation. (1997, February) . Frontiers, The Electronic Newsletter: The Science Foundation., 1.

Peterson, P. & Barnes, C. (1996). Learning together the challenge of mathematics, equity, and leadership. Phi Delta Kappan, 77, 485-491.

Rogers, J. (1993). The inclusion revolution. Phi Delta Kappan, 11, 1-6.

Rose, L., Gallup, A., & Elam, S. (1997). Of the public's attitudes toward the public schools. Phi Delta Kappan, 79, 41-56.

Sawada, D. (1997, September). NCTM's standards in Japanese elementary schools. Teaching Children Mathematics, 20-22.

Schifter, D. (1996a). A constructivist perspective on teaching and learning mathematics. Phi Delta Kappan, 77, 492-499.

Schifter, D. (1996b). What's happening in math class? New York: Teachers College Press.

Smutney, J., Walker, S., & Meckstroth, E. (1997). Teaching young gifted children in the regular classroom. Minneapolis, MN: Free Spirit Publications, 101-109.

Stevens, C., & Wenner G. (1996). Elementary preservice teachers' knowledge and beliefs regarding science and mathematics. School Science and Mathematics, 96(1), 2-9.

Stigler, J. (1989, March). The struggle to link written symbols with understanding. Arithmetic Teacher, 39.

Stigler, J. & Hiebert, J. (1997). Understanding and improving classroom mathematics instruction. Phi Delta Kappan, 79, 14-21.

Will, M.C. (1986). Educating students with learning problems: A shared responsibility. Washington, D.C.

Willoughby, S. (1990). Mathematics education for a changing world. Alexandria, Virginia: Association for Supervision and Curriculum Development, 1-100.

Wilson, S., Peterson, P., Ball, D., & Cohen, D. (1996). Learning by all. Phi Delta Kappan, 77, 468-476.

R0025 81957