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A study of the effects of teachers' mathematics anxiety and mathematics teaching confidence level on their attitudes toward manipulative use

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A STUDY OF THE EFFECTS OF TEACHERS' MATHEMATICS ANXIETY AND MATHEMATICS TEACHING CONFIDENCE LEVEL ON THEIR ATTITUDES TOWARD MANIPULATIVE USE

by
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A THESIS

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Approved by _____
Dr. Louis Molinari

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Abstract

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The purpose of this thesis was to determine the effect of teachers' mathematics anxiety and their mathematics teaching confidence level on their attitudes towards manipulative use. To investigate this, a survey was developed and distributed to all of the mathematics teachers in the eight elementary schools in Atlantic City, New Jersey.

The survey was composed of fifty-five statements. These statements were rated on a five point Likert type scale. Thirteen of the statements researched mathematics anxiety in the sample teachers. Twelve of the statements investigated the confidence level of teachers as they instructed their students in the subject of mathematics. The remaining thirty statements referred to the teachers attitudes towards manipulatives and the amount of time they spent using them in their classrooms. There was a sixty-two response rate which allowed the data to be analyzed and evaluated to determine if statistically significant differences existed between the three major components of the survey.

The data from this thesis supported the need for grade level workshops on the benefits of manipulatives as well as specific planning for time allotment for their use in kindergarten through sixth grades.

Mini-Abstract

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The survey was composed of fifty-five statements relating to mathematics anxiety in teachers, their confidence level of teaching mathematics and their attitudes towards manipulatives and their use. The data was analyzed and evaluated to determine if statistically significant differences existed between the three sections of the survey.

This thesis determined the need for workshops on the benefits of manipulatives as well as the planning and time allotments for manipulative use in kindergarten through sixth grades.

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Chapter One

Significance of the Study

If children are helped to perceive an environment from a mathematical point of view and are asked to examine the relationships between and among things in the environment, causing the child to personalize the experience, then the benefits can be numerous. Manipulatives are things that teachers can use to clearly demonstrate relationships between and among things. If manipulatives are conscientiously used in this relational way, they will give children the opportunity to personalize experiences.

Dewey is known for his theories that promote hands-on activities which use the discovery method of learning. These activities enhance the child's interaction with the environment and foster more concrete learning. Dewey believed that children learn by doing, by being active participants in their learning. He also believed that the more concrete the experiences the greater the chance that students would internalize the learning. His contemporary, Montessori believed that children need to be directed in their learning using materials that are "preplanned" to develop specific relationships. Many of her created materials have children "do" an activity which promotes greater understanding.

Comenius, Pestalozzi, and Piaget not only believed in the "doing" of an activity but also said that the developmental stage of

the individual can be linked to the complexity of the "doing". Comenius' method of instruction utilized concrete objects.

Pestalozzi, Piaget and Skemp (Kennedy, 1986) believed that students develop cognitively in stages. Piaget (1952) concluded that the learner passes through four distinct stages of cognitive development. At each stage the child attempts to explain the world around him using a uniquely different logic at each stage of development. In common to all of these stages is the constructing of mental schema which represents perceived relationships. In the first three stages the schema is influenced primarily by experiences the child has in the concrete world.

These ideas are well accepted today and serve as the basis for the new curricula developing in mathematics education. In these curricula hands-on experiencing is an essential element. It stands to reason that the logic of the environment will be expressed in the combination and manipulation of materials, thus influencing the child's construction of concepts and relationships.

This background information is pertinent because the use of concrete manipulative objects is not a new practice. This approach to learning has been around since the 1800's and shows no sign of being eradicated. Research studies are constantly being done that document, support and update the enormous benefits of using manipulatives effectively in the teaching of elementary mathematics and science.

Kennedy (1986) stated that "manipulatives help children understand both the meanings of mathematical ideas and the applications of these ideas to real-world situations." Brownell had

a basic belief that children must understand the basic concepts that underlie what they are learning if learning is to be permanent.

Many authors (Gilbert and Bush, 1986; Suydam, 1984; and National Council of Teachers of Mathematics [NCTM], 1980) have documented the positive effects of using manipulatives through their writings in articles and research papers. There are many ramifications of these studies.

Major strategic changes in the teaching of mathematics with emphasis being placed on the use of concrete manipulatives came about with the development of mathematics standards by The National Council of Teachers of Mathematics in the latter 1980's. It appeared that the National Council of Teachers of Mathematics (NCTM) predicted the call of President George Bush for our educational systems to educate and produce students who would be first in world competitiveness in science and mathematics by the year 2000.

The recommendations derived from the writing of the standards have been used throughout this country to develop or revise mathematics curricula. The revisions and developments were seemingly not effected by specific population and area designation.

The standards' primary goals are to uniformly create students who 1) value mathematics, 2) are confident in their ability to do mathematics, 3) are mathematics problem solvers, 4) are able to communicate mathematically and 5) can reason mathematically. Manipulatives are being credited with having positive influences on these goals.

The standards also recommend changes in the way the subject of mathematics is presented to students in order to promote these five educational goals. Some noted changes stated by the NCTM were: less emphasis on textbooks, drill and practice and rote memory skills giving way to more hands-on activities with students actively involved in the development of their own understanding of the concepts being taught. The use of manipulatives is seen as a way to help students examine relationships in mathematics and other subjects. In many curriculums the use of manipulatives play a prominent role in skill development and retention.

If we connect data that documents the positive benefits of manipulative use with the realization that teachers have extensive influence over the academic development of their students, we begin to see a clear relationship between teacher attitudes and professional preparation in regard to manipulatives and the implementation of our newly revised mathematics curriculums.

Schofield (1981) stated that, "elementary teachers have been found to play an important role in the development of a mathematical environment for students. "Elementary teachers must possess sound mathematical competency, as well as positive attitudes toward the subject, in order to be effective teachers", Schofield (1981). Educators like Bulmahn and Young (1982) and Kelly and Tomhave (1985) discuss mathematics anxieties being transmitted from teachers to students.

A study that examines teachers' attitudes towards manipulatives and that investigates relationships between mathematics anxiety, professional training and the use of proven

strategies in teaching (manipulatives) would be invaluable to colleges and universities as well as local school districts in the planning of courses and inservice training sessions.

Teachers' attitudes about rapidly changing mathematical techniques and equipment would also help in training our educators for the enormous task of providing our students with the ability to interact and learn in the 21st century. In 1989 the National Council of Teachers of Mathematics said, "Prospective teachers must be taught in a manner similar to how they are to teach--by exploring, conjecturing, communicating, reasoning and so forth."

As Glennon stated in 1949, "even the experience of teaching mathematics is no guarantee that the teacher will grow in the understanding of mathematics." Examination of this quote leads to the realization that more experienced teachers are not assured of being prepared for educating our future generations any better than their less experienced co-workers. This could provide strong motive for districts to be concerned about the outcomes of research designed to study the different relationships outlined here.

Statement of the Problem

Could it be that teachers with high mathematics anxiety levels will also have negative attitudes towards mathematics and the use of manipulatives?

The Purpose of the Study

The main purpose of this study is to investigate the use and helpfulness of the revised Atlantic City Mathematics Curriculum, based on the National Council of Teachers of Mathematics Standards, to kindergarten through sixth grade educators in the district. Although the use of this curriculum has been mandated, it is essential to future planning and revision teams that it's effectiveness be measured. In order to help the students in the Atlantic City school district realize the general purpose of education, the fullest possible development of the individual within the framework of our present industrialized democratic society, it is imperative that all educators understand the radical changes that have taken place in the realm of mathematics education as well as other subjects. This understanding will assist elementary educators in providing their students numerous opportunities to achieve the outlined six major goals of education.

This study will further attempt to draw correlations between four variables in mathematics education. These are 1) the level of mathematics anxiety in teachers, 2) the amount of manipulative use in kindergarten through sixth grades, 3) teacher attitudes towards using manipulatives in grades kindergarten through sixth grades and 4) the level of conceptual understanding of the relationships in mathematics by the educator.

The study will also examine the perceived relationship between grade levels and the amount of manipulative use as well as the diversity in manipulatives used.

Specific Hypotheses

1. There will be no significant differences between the level of mathematics anxiety in teachers between kindergarten through third grades and fourth through sixth grades.

2. There will be no significant differences between the level of mathematics teaching confidence in Primary and Intermediate teachers.

3. There will be no significant difference between kindergarten through third grade teachers (Primary) and fourth through sixth grade teachers (Intermediate) in their attitudes towards using manipulatives to teach mathematics concepts at their present grade level.

4. There will be no significant difference between the use of manipulatives to teach the Atlantic City districtwide curriculum between kindergarten through third grades and fourth through sixth grades.

Method of Study

This study will be done using a survey composed of fifty-five (55) questions that will measure teacher mathematics anxiety, teacher confidence in communicating skills, concepts and relationships in mathematics and teacher attitudes toward manipulative use.

The survey will be composed of four (4) sections. The first part of the survey will ask basic informational type questions which will be used to determine grade level taught, number years of teaching experience, preferred grade to teach, and most current completion date of the last post-graduate mathematics course or workshop taken. The second part of the survey will be formulated using items that will measure teacher mathematics anxiety. The third section will measure teachers' confidence in their abilities to understand mathematical concepts and relationships and to communicate this understanding to their students. Section four will measure teacher attitudes toward the use of manipulatives to teach mathematics on their grade level and on other (lower) grade levels. The survey questions will be answered using a Likert type scale of (SA) - strongly agree, five (5) points to strongly disagree (SD), one point (1). The surveys will be scored using a computerized program designed for this task.

Definition of Terms

Manipulatives - objects which represent mathematical ideas that can be abstracted through physical involvement with the objects

Primary - kindergarten through third grades

Intermediate - fourth through sixth grades

Limitations of the Study

This study is a survey of all those educators who teach mathematics to students who are currently enrolled in grades kindergarten through sixth in the Atlantic City Public School District. The survey will be distributed throughout the district after it has been submitted to and approved by Dr. R. Mark Harris, the superintendent of schools. The study is being done in an urban school district comprised of only seven (7) elementary schools with approximately 157 teachers to be surveyed. A generalization of the findings may not be possible for other populations and districts of different sizes and types.

The surveys will be distributed via the district's school mail and relies heavily on the mail persons, principals or secretaries in each building to deliver them to the correct teachers.

The survey is being administered on a voluntary basis, there is no reward or consequence for participating or not participating in the study. The teachers are not asked to give their names or any identifying information, so that another limitation of the study is not being able to determine who did or did not return their survey. The researcher has no control over this limitation and can not force participation. The researcher also has no control over the truthfulness of the responses given.

Since the number of teachers per grade level who participate is another limitation of the study, the statistical measures will be derived from the number of surveys returned not from those distributed.

Organization of the Study

Chapter One defined the problem and stated the significance of the study. The hyptheses were given as well as the limitations of the study, definition of terms and a bibliography of research used.

Chapter Two followed with a review of current research and literature relevant to teachers and mathematics anxiety, math anxiety in preservice teachers and the role of manipulatives in understanding relationships in elementary school mathematics.

Chapter Three described the method of the study. Included in this chapter were the grade levels, schools and district in which the study was researched. The method of gathering the information for the study and the specifics of the survey designed and developed regarding mathematics anxiety, level of teaching confidence and

attitudes towards manipulatives and their use was discussed in detail.

Chapter Four was an analysis of the data collected through the surveys discussed in Chapter Three. This chapter reported the findings that were related to mathematics anxiety in teachers, confidence levels in mathematics instruction and attitudes towards manipulatives and their use in the elementary grades.

Chapter Five included a summary of the findings received and recommendations for future studies in respect to teachers' mathematics anxiety and it's effect on their use of manipulatives for instruction.

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Chapter Two

Review of the Literature

Introduction

Recent studies have shown that manipulative use in the elementary mathematics classroom, woven into the fabric of the instructional plan, can have an overwhelmingly positive effect on student achievement in the development of mathematics understandings.

Concern about the effectiveness of mathematics programs and the academic achievement of levels of students in mathematics has resulted in a renewed interest in education research dealing with effective use of manipulatives in the elementary classroom. However, any tool no matter how good it can be will not be useful unless the user is comfortable with it and sees its value. This study will attempt to assess the attitudes of teachers toward the use of manipulatives as a viable approach to the teaching of mathematics in the elementary classroom.

Attitudes are often related to anxiety. Consequently, a positive attitude towards mathematics usually correlates with low

anxiety, whereas a negative attitude toward mathematics usually correlates with high anxiety levels toward mathematics. If it can be shown that high math anxiety correlates with low use of manipulatives in the classroom, and if it is believed, as research seems to support, that manipulatives can be effective tools in the teaching and learning activities of mathematics, then an inroad will have been discovered to encourage the use of manipulatives if the anxiety can be diminished.

For the purpose of clarity, in this study mathematics anxiety is being defined as an uneasiness or apprehension regarding mathematics (Widmer and Chavez, 1982). Mathematics manipulatives are defined in this study as, concrete objects which lend themselves to physical manipulation and that allow the learner the necessary exploration into the realm of abstract mathematical ideas.

In the nineteenth century Pestalozzi realized the benefit of manipulatives in teaching. He believed that they gave the teacher opportunities to explain and explore specific relationships with children. Certainly educators have been aware of their importance for many years. Worth states that in 1946 NCTM's Eighteenth Yearbook it was reported that multi-sensory aids in the teaching of mathematics was being supported. In 1961 the use of manipulatives was again emphasized in the NCTM's Twenty-fifth Yearbook. In 1963 the Cambridge Conference stressed the use of manipulatives for every student. Further support for using manipulatives was evident in the 1973 NCTM's Thirty-fourth Yearbook and in their 1980 An Agenda for Action. These sources supported the use of concrete

models for all grade levels. That endorsement still prevails in the Curriculum and Evaluation Standards and in the Professional Standards introduced in 1989.

Piaget, Burner, Van Hiele and Dienes to name a few, believe that mathematics evolves from experience with real things and that children learn to think constructively before they are able to think symbolically. They believe that learning occurs as students actively assimilate new information and experiences and construct their own meanings.

Many students seem to have difficulty in mathematics because the level of presentation they receive in schools is above their level of conceptualization. Maniupulatives can be an effective tool to help students bridge the gap between concrete learning and symbolic processing. Teachers who use such tools effectively will be the catalyst that will allow mathematics to become the powerful thinking tool it has the potential to be for all people. In recognition of the sustained significance manipulatives have in the constructive classroom, it is imperative that teachers be helped to take advantage of these tools. The use of manipulatives in mathematics teaching is essential if educators are to reach the goals set down by the NCTM in their Curriculum and Evaluation Standards.

Current Literature

Teachers and Mathematics Anxiety

The case for the necessity of being able to recognize, document and then reduce mathematics anxiety has already been made. Research further reports that math anxiety is transmitted from too many teachers to their students. Bulmahn and Young (1982) report that the exact transmission process of mathematics anxiety from teacher to student is difficult to pinpoint. However, Mathison (1977) and Schofield (1981) state that this transmission between teacher and student is cyclical in nature and self perpetuating. The development of a student's spatial ability, mathematics achievement, concrete learning and pictorial embodiments with mathematical ideas are also related to their math anxiety (Battista, 1986). Fennema states that students do develop spatial abilities as they mature but adds that these changes happen as math becomes more challenging. She emphasized that a student's gender does not play an important part in the development of math anxiety during the elementary school years. Math anxiety results in math avoidance and produces severe limitations to an individual's educational and occupational choices.

Widmer and Chavez (1982) state that a supportive teacher who fosters a positive attitude towards mathematics and teaches for understanding will help to minimize the levels of mathematics anxiety in their students. Positive encouragement and rewards can be productive methods of stimulating student interest in math and

eliminating the fear of the subject. Mathematics anxiety in students can also be reduced by helping them a) to draw relationship between mathematics and other subjects, b) to develop self confidence in doing mathematics and c) to see the usefulness of mathematics in their personal lives (Battista, 1986; Benton, 1979; Brush, 1979; Sherard, 1981; Tobias & Weissbrod, 1980). Authors and researchers have offered other suggestions for the reduction of math anxiety in our schools and students. These suggestions began with having math specialist in every elementary school. These specialist would have job descriptions determined by each districts' needs, but the specialist main goal would be to help students develop relationships while investigating math and real life. A quote by Bulmahn and Young (1982), sums up the importance of eradicating math anxiety in our future generations, "The job must be done, the consequences of inaction are too great". Other researchers suggest that professional assistance be given to educators for the purpose of helping them break the cycle of mathematics anxiety and poor attitudes towards mathematics. It was suggested that this be done by demonstrating through workshops ways that teachers could use games, cards and other manipulatives to help their students overcome their math anxieties.

The importance of a person's environment on his ability to learn and perform mathematically has also been repeatedly debated. Bulmahn and Young (1982) stated in their research that "nearly all research studies recognize that a person's environment has some effect on his or her mathematical ability and interest."

Elementary teachers affect both achievement and attitude of students in mathematics (Schofield, 1981). All people can be said to be made up of their accumulated experiences, interactions and relationships with others as they grow. These interactions and relationships are developed in a large part during the formative years of each child's existence. From the ages of three (preschool) or five (N.J. state law for admittance into kindergarten) teachers are said to have as much if not more contact with their students on a daily basis than any other adult. It stands to reason that they would have major influence over their students' academic growth or the lack of it.

Elementary teachers must possess sound mathematics competency as well as have positive attitudes towards the subject in order to be effective teachers (Schofield, 1981). Keeping this in mind we must then investigate the outcomes of studies that deal with our teachers and their attitudes towards the teaching and learning process. We must investigate why teachers decide on certain choices in the methods they use throughout the process of instructing, evaluating and replanning.

Bulmahn and Young (1982) state that "for many elementary school teachers mathematics is at best a necessary evil." They also state that "those drawn to elementary education as a career are not guaranteed to enjoy math in the broad sense." They believe that this does not demean the academic ability of teachers or would be teachers. Zambo (1990) argues that the teachers he surveyed felt confident about mathematics instruction. He states in his study that teachers awarded themselves a grade of "B" for their

mathematical problem solving abilities, the motivation of their students and the subsequent mathematics instruction.

Widmer and Chavez (1982) state in their study that elementary teachers generally have a positive attitude towards teaching mathematics. They state that teachers feel secure in their math teaching even though many of them had developed negative attitude towards mathematics while they were students. In a study by Hendel (1976) at the University of Minnesota, elementary education majors noted that past experiences with teachers who fostered negative attitudes towards math, lead to their personal development of math anxiety. Many preservice teachers understand the necessity of changing these feeling towards mathematics before they enter the elementary mathematics classroom.

Math Anxiety in Preservice Teachers.

Many classroom teachers believe that developing positive attitudes toward mathematics in preservice teachers would stop the transference of math anxiety. They felt that this should be a major goal of both mathematicians and professors of mathematics courses in our nations' colleges and universities (Battista, 1986).

Rech, Hartzell and Stephens (1993) reviewed the literature on preparing successful teachers. Their study, Comparisons of Mathematical Competencies and Attitudes of Elementary Education Majors with Established Norms of a General College Population, states that "the aquisition of mathematical skills and knowledge

begins in elementary schools and that the teaching of mathematics at this point is crucial to the success of the student." They refer to Glennon's (1949) study which states that elementary education majors understood one half of the computational processes generally taught to students between grades 1 and 6 and that their achievement in basic mathematics did not improve during their four years in the teacher education program. Glennon seems to stress the need for preservice teachers to learn how to communicate math skills to their students and to develop for themselves a better understanding of mathematics prior to beginning their professional service.

Rech, Hartzell and Stephens' study found that the elementary education majors in their study had lower scores in the 10 sub-categories of the competency instrument used when compared to the general college population. These elementary education majors also showed slightly higher levels of negative attitudes towards mathematics. They recommended additional mathematics course requirements for elementary education majors. This recommendation was also presented by other researchers (Burger, W. F., Jenkins, L., Moore, M. L., Musser, G. L., & Smith, K. C., 1983; Dossey, 1984; & Leitzel, 1990) in their call for increased prerequisites in mathematics for high school students who wished to attend college. Many researchers specifically recommended the inclusion of a second year algebra course.

Bulmahn and Young (1982) prepared a study to investigate the attitudes of college students toward mathematics. It involved two hundred students of which about one-half were elementary education

majors. The students were asked to complete a forty item questionnaire on attitudes towards mathematics.

The main points found were a) students favored subjects that were easier for them, b) preference toward math and science or language arts and social studies, c) the saying, "math has always been my worst subject" was stated by many of the participants, d) career options were limited by students' mathematical abilities, e) there was a real fear of word problems for many high scorers in elementary school, f) many education students stated their belief that teachers did not have to be proficient in math above computation because the teacher's manual was always handy.

Bulmahn and Young were the most concerned about points (c) and (f) especially with elementary education majors. These two points painted a dismal picture when linked to the notion that a teacher's interest in a subject and his or her mathematics anxiety might be transmitted to generations of our student population.

Joanne Becker (1986) became aware of mathematics anxiety in elementary education majors while she was teaching on the college level. She did a study designed to substantiate or refute the claim of mathematics anxiety in elementary education majors. Becker used Fennema and Sherman's Math Anxiety Scale (1976) to develop her 72 question survey. It was administered to 152 students. Half of these students were elementary education majors.

Becker's research found an "alarming" degree of math anxiety in the elementary education majors. Their attitudes toward mathematics was considered neither positive nor negative. She concurred with Bulmahn and Young on their suggestion of hiring

mathematics specialist in elementary schools. Becker did stress that all blame for college students' mathematics anxiety could not and should not be shouldered by teachers.

Research done by Kelly and Tomhave in 1985 indicated that on the Mathematics Anxiety Rating Scale (MARS) elementary education majors had higher rates of anxiety than the general college population. The male elementary education majors scored significantly lower anxiety ratings than the female students. Their suggestion was that elementary education majors receive immediate help in the form of support groups. Fauth and Jacobs (1980) believed that the members of the support group should be professional mathematics teachers who have an understanding of the anxiety and some of it's causes, also that the affected teachers should investigate the source of their anxiety.

In their survey, Widmer and Chavez (1982) researched the presence of mathematics anxiety in teachers and investigated reasons for this anxiety. During their review of the literature they cited a) math anxiety as primarily but not exclusively a female trait, due to culturally induced expectations and experiences (Ernest, 1976; Fennema, 1974; Fennema and Sherman 1977a, 1977b; Maccoby and Jacklin 1974), b) mathematics anxiety as an inhibitor of career choices (Bulmahn and Young, 1982; Ernest, 1976; & Sells, 1978), and c) math attitudes were linked to the attitudes and behaviors of the teachers' educators. All three of these can be seen as possibly having major impacts on the learned and (theoretically) transmitted mathematics anxiety from <u>these</u> teachers to their students.

Kelly and Tomhave in their 1985 paper state that "there is a strong indication that women at the University of Minnesota in 1980-1981 were avoiding selecting mathematics courses necessary for many professional and technological careers." This supports Sells (1978) who noted that 92% of the first year female students at the University of California were so mathematically unprepared that they limited themselves to just 30% of the career choices available.

These studies impact at the elementary level where the vast majority of the teachers are female. It has been noted that both men and women are affected by mathematics anxiety but women apparently suffer more (Kelly and Tomhave, 1985; Burton, 1979; Osen, 1974; Tobias, 1980). This is reportedly not due to any documented proof that women can not do math (Fennema and Sherman, 1977) nor to a belief that one sex is superior to the other (Fennema, 1974), but in societal expectations where women are not supposed to do well in math, it is a male domain (Kelly & Tomhave, 1985).

The Role of Manipulatives in Understanding Relationships in Elementary School Mathematics

Majorie A. Mathison (1977) presented a paper where she stressed content manipulation for clarification and understanding of skill, creativity and remediation for those with math anxiety. She also stressed the integrated approach to learning in order to help students see relationships between mathematics and everyday situations. Helping students understand these relationships may

foster new positive attitudes. Mathison discussed instruction being significantly more influential in the development of attitudes towards mathematics than curriculum (Aikens, 1976).

Boling, in her 1991 article entitled, "They Don't Like Math! Well, Let's Do Something", makes statements about teaching styles, why kids don't like math and recommendations for what to do. The number of students who identify mathematics as their favorite subject decreases as their grade level increases. This research is supported by a Weekly Readers' poll (Pederson, Bleyer, and Elmore, 1985).

There are alot of reasons given for students slowly but surely beginning to dislike mathematics. Most of the reasons can be correlated with the biological and developmental age of the students. The older students get the more problems they may begin to experience with mathematics. Peer influence, difficult math concepts, concrete learning orientation and rapid physical growth cause some problems between mathematics and the upper elementary student (Boling, 1991).

Boling's research gives these explanations of the causes listed in her study, a) students become aware, through peer pressure, that there are differences between boys and girls as they begin to form more bonding relationships, b) fifth graders are still at the concrete or semi-concrete level of learning while many skill presentations at that level are more abstract and c) students' physically are growing causing them discomfort with long periods of stillness and quietness. Teachers could utilize their students' newly developed socialization skills to their advantage in teaching the

more complex skills with great consideration being made as to this effectively being accomplished. Teachers could use active participation involving the students, along with the use of manipulatives, peer tutoring, flexible grouping and any other appropriate developmental teaching techniques. All of these methods will help students draw the necessary connections and focus on the relationships and understandings needed to be successful with mathematics.

Many studies have shown that a major learning problem results from teachers not using multiple methods, such as concrete manipulation, to develop new and possibly more difficult skills. Scott (1983) stated that few teachers use manipulative materials. Intermediate school teachers use fewer concrete approaches when presenting mathematical concepts to their students than primary teachers (Boling, 1991; Zambo, 1990). There is a rapid decline in the use of manipulatives as students progress through grades 2 and up (Scott, 1983). Studies have shown that our students, especially females, begin to shy away from the subjects of mathematics and science as they move to the upper elementary grades. This theory has been supported by Suydam (1984). If these documented facts are to be considered, then we can recognize the move by the National Council of Teachers of Mathematics (NCTM) in 1989 as being progressive and timely. They called for more manipulative use, less paper and pencil, more active participation by the students and less drill and practice. The NCTM also called for training sessions to show teachers how to make using manipulatives meaningful and effective tools for their students' learning.

The benefits of manipulative usage can be seen by many teachers while others express skepticism (Kennedy, 1986). In 1987, Gretchen Johnson taught her preservice teachers the value of manipulatives by selecting to teach them a difficult concept with concrete objects. She chose to teach the metric system believing that if her students learned through manipulatives they would be convinced of the value of using them with their own students in the future.

The New Mexico Commission on Higher Education supported a program with elementary school teachers in a rural area on making and effectively using manipulatives in the classroom. In their summary they stated that students benefit by having hands on experiences in mathematics. They also stated that teachers benefitted by having a deeper understanding of the manipulatives they produced in the workshop sessions (Hadfield and Lillibridge, 1991).

Kennedy cited many theorist, (Dienes, 1960; Fennema, 1972; Piaget, 1952; and Skemp, 1982) who answered questions about the individual's need to use concrete objects and to actively participate in their own learning. Piaget and Skemp believed that the individual child goes through stages of cognitive development. Piaget's theory is that the student needs manipulative materials as learning tools in all four stages of development. Skemp's theory places manipulative use in the first level of development along with physical activities which he states will help the learner internalize the instruction. Dienes stated that learning tools or manipulatives should used by students to help them get a better understanding of the concept of

numerals. Fennema gave specific thought to the appropriateness of the materials chosen and the individuals developmental stage. All of these theorist gave great praise to the benefits and effectiveness of manipulative use in the classroom.

Tooke, Hyatt, Leigh, Snyder, and Borda (1992) ask the question, "Why then aren't our students being taught using these proven instructional materials?" Their article about the middle school student's learning gives some foresight into the problem. A statement often heard from intermediate or middle grade instructor was a major concern to the researchers. "That's fine for the elementary level but not for the intermediate level students" was the answer given by many upper grade teachers to questions about using manipulatives. More intermediate teachers made like statements than those who did not. Many middle school teachers also stated that manipulatives are a) just toys for primary students, b) can be used only for the remediation of slower students and c) to immature for their street-wise students (Tooke, Hyatt, Leigh, Snyder & Borda, 1992).

The teacher's guide could possibly be a contributor to the concept that manipulatives are not useful on the intermediate level (Gilbert and Stodolsky, 1986). Most spend a very short time on the presentation of new material. These presentations are usually performed with paper and pencil giving limited assistance in helping students draw on their prior knowledge of the relationships to previous developmental skills. When manipulatives are suggested it is with little explanation of the benefits of using them at that time.

Studies show that manipulatives can and do help students, (fourth grade and higher) understand more abstract concepts through their use (Driscoll, 1982). Moser supported this in his 1986 article entitled Curricular Issues, where he states that manipulatives should be used by students of all ages and that they can benefit from the use. Moser states that manipulative use should be an integral part of planning and that manipulatives which can be used repeatedly for a variety of lessons are cost effective.

As children work with manipulatives they begin to see relationships, they begin to learn mathematics (Suydam, 1984). Suydam gives a suggestion for a common problem in using manipulatives, when she states that when it is not possible for all students to have manipulatives, the teacher might model the lesson. The teacher then can focus the students' attention on learning the skill instead of on playing with the manipulatives and at the same time be in control of the manipulatives.

The sense of not being able to control or manage manipulatives in their classroom is a stated reason for limited use given by many teachers. Control and cost factors add to the debate about the usefulness of manipulatives throughout the educational field. Often times the amount of time a guide suggests for using a specific manipulative for a skill does not justify the energy spent nor the financial resources that might be expended to secure these learning tools (Kennedy, 1986).

Tips for Management of Manipulatives by Parish, Kamp, and McGilvroy (1989) gives ten steps to aid principals in finding a solution to this perceived problem. The most effective tip would

seem to be the involvement of teachers at the decision making level where manipulatives are concerned. The inclusion of their suggestions when deciding on textbook and manipulative purchases and management might give teachers a greater degree of ownership and responsibility in using manipulatives. These authors recognize that each school is unique, but state that a workable system for managing a manipulative based mathematics program is worth the extra effort.

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Chapter Three

Design of the Study

Setting

Atlantic City is in the southern part of Atlantic County in Southern New Jersey. It is a coastal city on what is known as Absecon Island. Atlantic City's population of approximately 35,000 is very culturally and economically diverse. It has been said that Atlantic City experiences diversities found in cities ten to twenty times it's size.

The Atlantic City Public School District has ten schools, six elementary schools (K-6 grades), two junior high schools (7-8 grades), one high school (9-12 grades) and one school that houses a single kindergarten class along with a preschool program. There were 6,955 students enrolled in the district as of September 13, 1994. The racial composition of the students was 4,224 Black students, 1,709 Hispanic students, 634 White students, 378 Asian/Pacific students and 10 American Indian students. The teaching staff in the Atlantic City Public School District numbered 454 members as of September 30, 1994.

Description of the Population and Sample

The population of this study was 203 teachers of elementary school mathematics. This included 152 classroom teachers (grades K-6), 33 Basic Skills or Compensatory Education teachers, 1 math lead teacher and 17 special education teachers. The number of classroom teachers by grade level was 25 kindergarten, 22 first grade, 19 second grade, 19 third grade, 19 fourth grade, 17 fifth grade and 18 sixth grade. The other 13 classroom teachers taught a variety of grade combinations. There were 167 female teachers and 36 male teachers in the study. All of the participating teachers hold the appropriate grade level teaching certificates and degrees for the state of New Jersey. Some have furthered their education and obtained post graduate status and many have received advanced degrees in education.

Description of the Instrument

The instrument, J. L. C. Brown's Mathematics Teaching Survey, was designed specifically for this study. It used a Likert rating scale and consisted of 45 positively worded statements and 10 negatively worded statements. The teachers were asked to indicate whether they (5) strongly agreed, (4) agreed, (3) uncertain, (2) disagreed or (1) strongly disagreed with each statement that comprised the survey. The statements questioned the effectiveness

of manipulatives in teaching elementary school mathematics, math anxiety in teachers and teachers' confidence levels in communicating mathematics skills to their students.

Each of the 45 positively worded statements were assigned a value from 5.0 to 1.0, while each negatively worded statement was given a reverse rating. If a teacher answered a positively worded statement with a 5 (strongly agreed), the score was 5.0, whereas if the statement was worded negatively the same answer of 5 (strongly agreed) would receive a score of 1.0.

Validity of the J. L. C. Brown's Mathematics Teaching Survey was established when the survey was reviewed by and discussed with three experts in the field of mathematics education. All suggestions and comments were taken into account and the necessary revisions were made to the instrument. The reliability of the survey was checked by using the survey with three elementary teachers from a district similar to the Atlantic City School District. After two weeks the survey was readministered to establish a reliability coefficient.

Design of the Instrument

The survey organization began with an extensive review of the literature written about teachers' attitudes towards mathematics and manipulatives, as well as mathematics anxiety in teachers. The development of the thesis problem and hypotheses lead to futher

investigation into the types of existing surveys or questionaires currently being used to gather like information. It was found that no one survey or questionaire had been designed to gather the data necessary to answer this particular thesis problem and hypotheses. It was then recommended that a new survey be constructed for the purpose of examining the above mentioned topics. Ten statements were designed to investigate teachers' confidence level in teaching and learning mathematical skills. Fifteen statements where designed to investigate the existence of mathematics anxiety in teachers. Thirty questions were designed to investigate the amount of time teachers spent on using manipulatives, teachers' attitudes towards manipulatives and the teachers' perceived effectiveness of manipulative use at their particular grade levels. A Likert type scale was used to assist teachers in rating each statement effectively and in a timely fashion. Other information, such as current grade level taught, years of teaching experience, gender, race, and last degree earned was added to the survey to help with the accuracy of reporting the data and to establish support or lack of support of the hypotheses stated. The survey was tested using teachers from a like educational community. After a two week waiting period the survey was retested to establish reliability. A copy of the survey and the cover letter distributed throughout the district to each participant is included in the addendum of the thesis. A contact person in each building was consulted with the necessary information such as distribution arrangements (which varied depending on building size and accessibility), the timeline and the method of accountability. The completed surveys were placed in

sealed boxes by the participant. These boxes were strategically placed in each building by the contact person. Each participant was asked to initial the sheet attached to the box in order to verify the return of his survey.

Relationship of the Instrument to the Null Hypothesis

The general hypothesis states that there will be no relationship between math anxiety in teachers and the frequency of use of manipulatives. The J. L. C. Brown's Mathematics Teaching Survey was designed and used to gather the necessary information for a comparison study between teachers of various grade levels, their math anxiety levels and their gender. The same instrument was used to test the remaining three hypothesis.

Procedure and Time Period for Data Collection

A four week time period was established for having the J. L. C. Brown's Mathematics Teaching Survey approved, distributed, completed by the teachers and returned to the author. On February 3, 1995, Dr. R. Mark Harris, Superintendent of Schools in Atlantic City met with the author and subsequently approved the J. L. C. Brown's Mathematics Teaching Survey for distribution throughout the district to the elementary mathematics teachers. On February 14,

1995 introductory letters and surveys were distributed to teachers, in sealed addressed envelopes, by the appointed people in their schools. The teachers were asked to complete their survey and place them in the sealed designated box in their school's office by February 22, 1995. The teachers were also asked to place their initials beside their name on the attached building roster in order to identify anyone who had not returned their survey. The survey boxes were collected from each school's office on February 24, 1995. A second survey and letter was distributed on February 27, 1995 to anyone who had not initialed the check sheet attached to their survey box. These surveys were collected by the author on March 3, 1995.

Summary

In Chapter Three, the population, sample, and instrument of the study were outlined and discussed. A total of 203 elementary mathematics teachers were surveyed for the purpose of establishing connections between grade level taught, math anxiety in teachers and their subsequent use of mathematics manipulatives to communicate math concepts to their students.

Chapter Four

Analysis of the Data

The J. L. C. Brown's Mathematics Teaching Survey was distributed to 201 kindergarten through sixth grade, Special Education and Basic Skills teachers in the Atlantic City Public School system. This study attempts to determine if there is any correlation between the grade level taught and teachers' mathematics anxiety, teaching confidence level and use of mathematics manipulatives. The variables chosen for this study are : 1) current grade level assignments, 2) attitude towards the use of manipulatives and 3) level of confidence felt by teachers as they instruct in the subject of math.

Test of the Hypotheses and Results

Most of the data presented has been statistically analyzed using a statistical Analysis of Variance with the probability level being set at 0.05 chance of accidental occurrence. The hypotheses being tested using the J. L. C. Brown's Mathematics Teaching Survey are: H_1) There will be no significant differences between the level of mathematics anxiety in teachers between kindergarten through

third grades and fourth through sixth grades: H_2) There will be no significant differences between the level of mathematics teaching confidence in Primary and Intermediate teachers:

H_3) There will be no significant difference between kindergarten through third grade teachers (Primary) and fourth through sixth grade teachers (Intermediate) in their attitudes toward using manipulatives to teach mathematics concepts at their present grade level and H_4) There will be no significant differences between the use of manipulatives to teach the Atlantic City districtwide curriculum between kindergarten through third grades and fourth through sixth grades.

Presentation of the Statistical Analysis of the Data Related to Comparisons of Teachers' Mathematics Anxiety, Mathematics Teaching Confidence and Teachers' Attitudes Toward Manipulative Benefits and Use

Table 1 summarizes the actual number of surveys distributed and returned by each elementary school in the Atlantic City Public School District. It can be seen that two hundred and one (201) surveys were distributed throughout the district to those elementary school teachers who instruct students in mathematics. The total number of one hundred twenty five surveys returned represent an overall return rate of sixty-two percent.

The lowest percent of school return rate was 49%, with the highest school return rate for multiple surveys being 83% and a single survey school being 100%, giving an average school return

rate of 67%. This response rate is significantly higher than indicated in most literature on surveys. This may be attributed to the distribution of the survey and subsequent check and balance methods as described in Chapter Three. The response rate allowed for sufficient data by which to fully evaluate all four hypotheses.

TABLE 1

Number of J. L. C. Brown's Mathematics Teaching Surveys Distributed and Returned - Reported By School Name

School	Distributed	Total Returned	Per Cent Returned
Brighton Avenue	29	20	69%
New Jersey Avenue	36	30	83%
Richmond Avenue	11	8	73%
Dr. Martin Luther King	39	19	49%
Indiana Avenue	39	19	49%
Uptown School Complex	37	20	54%
Chelsea Heights	9	5	56%
Venice Park	1	1	100%
Surveys Returned without school clarification	-	3	-
Total	**201**	**125**	**62%**
Average Return	**-**	**-**	**67%**

Table 2 shows the distribution and return of the J. L. C. Brown's Mathematics Teaching Survey (See Appendix C) by grade level. It is deemed important to show through this table, that the rate of distribution and return recorded as percents did not vary greatly among the traditional kindergarten through sixth grades. The highest return rate was 72% at the sixth grade level. There is no distinct pattern or correlation between the grade level and the return rate. The lowest return rate of 53% was at the fifth grade level. The researcher does note that in combination grades the return rate varied greatly from one extreme to another. There were five surveys returned without grade level identification, it is noted that they could be the reason for the widely varying percentages. There were six traditional grade levels and combination levels above the average return rate and five traditional and combination grade levels below it.

TABLE 2

Number of J. L. C. Brown's Mathematics Teaching Surveys Distributed and Returned - Reported By Grade Level or Teaching Assignment

Grade Level or Subject Taught	Distributed	Returned	Per Cent Returned
Kindergarten	25	16	64%
First Grade	22	13	59%
Second Grade	18	11	61%
Third Grade	19	12	63%
Fourth Grade	19	12	63%
Fifth Grade	17	9	53%
Sixth Grade	18	13	72%
Combination Grades	-	-	-
First & Second	3	3	100%
Second & Third	2	1	50%
Third & Fourth	2	0	0%
Fourth, Fifth & Sixth	1	1	100%
Fifth & Sixth	5	2	40%
Basic Skills	32	16	50%
Special Education	17	10	59%
Special Assignment	1	1	100%
No Grade Identification Given	-	5	-
Total	201	125	62%

Table 3 shows the number of J. L. C. Brown's Mathematics Teaching Survey distributed and returned reported by elementary school grouping, kindergarten through third grade (primary), forth through sixth grade, (intermediate), Basic Skills, Special Education and other specialists. This table has been included in this research to emphasize that the percentage rate of return was not significantly different between the primary and intermediate levels.

The primary level kindergarten through third grade has a return rate of 62%. The intermediate level, fourth grade through sixth grade has a return rate of 61%. This shows an insignificant difference in return rates of 1%. This is deemed important to show that the groups return rates are not uncontrolled variables in the outcome of this research.

TABLE 3

Number of Surveys Distributed and Returned - Reported by Elementary School Grouping

Grade or Subject Grouping	Distributed	Returned	Per Cent Returned
Primary (Kindergarten - Third)	90	56	62%
Intermediate (Fourth - Sixth)	61	37	61%
Specialist, Special Ed. & Basic Skills	50	27	54%
Teaching Assignment Not Indicated	-	5	-
Total	201	125	62%

Table 4 represents the mean scores as measured by the J. L. C. Brown's Mathematics Teaching Survey in three areas of elementary mathematics teaching. These areas are 1) teachers' mathematics anxiety, teachers' confidence level of instructing students in mathematics and teachers' attitude towards the benefits and use of manipulatives to teach mathematics. The number (N) of surveys returned is listed by grade level along with the mean scores for each section. A maximum score of sixty (60) could be achieved with a rating of five (5) points for each of the thirteen (13) statements

relating to teachers' mathematics anxiety with the minimum score of twelve (12) being received for one (1) point per statement on this section. A maximum score of sixty (60) could be received based on five (5) points for each of the twelve (12) statements referring to the confidence level of mathematics teaching. A minimum level of I point for each of these twelve (12) statements on confidence could be received. On the section of the survey relating to attitudes toward manipulatives and their usefulness, composed of thirty (30) statements, a maximum score of one hundred fifty (150) could be achieved with thirty (30) being the minimum score.

TABLE 4

An Overall Presentation of the Results of the J. L. C. Brown's Mathematics Teaching Survey - Reported By Grade Level or Teaching Assignment

Grade Level or Specialist	Number of Surveys Returned (N)	Mean Score Teachers' Mathematics Anxiety	Mean Score Confidence in Teaching Mathematics	Mean Score Manipulative Benefits and Use
K	16	40.09	37.13	123.13
1	13	36	37	115.38
2	11	36.64	36.73	116.09
3	12	34.33	41.67	117.75
4	12	38.42	35	112.50
5	9	37.78	36.78	120.63
6	13	35.46	39.23	110.31
1 & 2	3	41	44.67	125.33
2 & 3	1	43	38	101
3 & 4	0	-	-	-
(4) 5 & 6	3	37	35.33	97.67
Special Education	10	41.40	35.80	116.70
Basic Skills	16	37.06	40.50	106.75
Specialist	1	39.22	38.16	111.71

Table 5 shows the results of a statistical Analysis of Variance reported by grade level grouping for statements numbered 3, 4, 5, 6, 7, 8, 11, 13, 14, 20, 22 and 25 on Teachers' Mathematics Anxiety. For the purpose of this analysis kindergarten through sixth grades were placed into their particular grade level grouping, Primary or Intermediate. Mean scores for combination grades and Specialist were not used in the analysis to draw a clearer correlation between grade level grouping and anxiety. It can be seen that at the Primary level the mean score was 37.667 with a standard deviation 2.082. At the Intermediate level the mean score was 37 with the standard deviation being 1.732. At the 0.05 level of significance the F value was 2.333 and no significant differences exist between the two sets of mean scores. Therefore, H_1 which stated that there will be no significant difference in the level of mathematics anxiety in teachers between kindergarten through third grade and fourth through sixth grade teachers is accepted.

These findings seem to be contrary to reported findings on mathematics anxiety and grade level relationships. It has been reported in the literature that there is an inverse relationship between grade level and mathematics anxiety. In other words the lower the grade level the higher the level of mathematics anxiety.

There can be a number of reasons for the reported findings and the statements in the literature. The probable and/or possible causes of this situation are discussed in Chapter Five.

TABLE 5

Analysis of Variance
For Teachers' Mathematics Anxiety By Grade Level Grouping

Grade Level Grouping	Number	Mean Score	Standard Deviation
Primary	3	37.667	2.082
Intermediate	3	37	1.732

F = 2.333

Table 6 shows the mean scores reported by grade level grouping, for statements numbered 1, 2, 9, 10, 15, 16, 17, 18, 19, 21, 23 and 24. These statements were in reference to how confident teachers felt about instructing their students in any and all mathematical concepts. The maximum possible score was sixty (60) with the minimum possible score being twelve (12). For the purpose of this analysis kindergarten through sixth grades were placed into their particular grade level grouping, Primary or Intermediate. Mean scores for combination grades and Specialist were not used in the analysis to draw a clearer correlation between grade level grouping and mathematics teaching confidence level. A statistical Analysis of Variance was computed to determine if there was a significant difference between the confidence level of mathematics instruction at the Primary and Intermediate levels. It can be seen that at the Primary level the mean score was 38.25 with a standard deviation 2.5. At the Intermediate level the mean score was 37 with the standard deviation being 1.633. At the 0.05 level of significance the

F value was 1.081 therefore, no significant differences exist between the two sets of mean scores. Therefore, H_2 which stated that there will be no significant differences between the level of mathematics teaching confidence in Primary and Intermediate teachers is accepted.

Even though there was no significant differences found between these two grade level grouping, it can be seen that the mean scores and standard deviations are indicating that the Primary level teachers are more diverse in their level of confidence than the Intermediate teachers. The mean scores from both of these groups does show that their confidence level is moderate. The highest possible score was sixty (60), with the lowest being twelve (12) making the mean scores from these grouping just over halfway between the two.

The fact that there were no significant differences is contrary to the existing research which says that there is a difference in the confidence level of teachers as the grade level assignment increases. A possible reason for this contradiction may be the number of years that each of the sample teachers has spent at a particular grade level. This means that a Primary teacher who has taught at a certain level for five or more years feels very comfortable with the curriculum at that level. The same could be said for the intermediate level teachers. More discussion on possible causes of this situation are discussed in Chapter Five.

TABLE 6

Analysis of Variance For Teachers' Confidence Level of Teaching Mathematics By Grade Level Grouping

Grade Level Grouping	Number	Mean Score	Standard Deviation
Primary	3	38.25	2.5
Intermediate	3	37	1.633

F = 1.081

Table 7 shows the mean scores for teachers' attitudes toward manipulatives and the proposed benefits of using them. The mean scores are recorded by grade level or teaching assignment. Out of a possible high score of one hundred fifty (150) and a possible low score of thirty (30), it can be seen that the mean score at the Primary level was 118 and the standard deviation was 4.359, while at the Intermediate level the mean was 114.667 with the standard deviation being 5.686. The F value was computed to be .581, showing that there was no significant difference between the two sets of means. Therefore, H_3 which stated that there will be no significant difference between kindergarten through third grade (Primary) and fourth through sixth grade teachers (Intermediate) in their attitude towards using manipulatives to teach mathematics concepts is accepted.

These findings are contrary to those found in the researched literature. The literature stated that Intermediate level teachers seemed to express negative attitudes toward using manipulatives to instruct their particular grade level students in mathematics. Many Intermediate teachers sited various reasons for their attitudes toward the benefits of manipulatives. One particular reason discussed was the fact that many teachers thought manipulatives were too juvenile for their grade level students. They believed that students would develop a lack of interest in the activities and that this would factor into a decrease in the benefits of using manipulatives. Other reasons will be discussed in implications in Chapter Five.

TABLE 7

Teachers' Attitudes Toward Manipulative Use Measured by the J. L. C. Brown's Mathematics Teaching Survey Reported By Grade Level Grouping

Grade Level Grouping	Number	Mean Score	Standard Deviation
Primary	3	118	4.359
Intermediate	3	114.667	5.686

F = .581

Specific statements from the J. L. C. Brown's Mathematics Teaching Survey, were used to assess the amount of manipulative use by grade level and grade level grouping. Some of the statements referred to increasing and decreasing time of manipulative use. Others dealt with particular activities and timing being assessed. Statements numbered 33, 36, 43, 45, 49, 51 and 52, were all positively worded with a possible score of 5 points each. Statements 31, 35 and 37, were negatively worded to assist with internal validity of the study and were scored in reverse as outlined in Chapter Three. The following information was deemed important to assess the significance of grade level as it relates to the use of mathematics manipulatives to teach the Atlantic City districtwide curriculum. The teachers of combination grades first and second rated highest on this section, their mean score was 41.00 out of a possible high score of 60. They were followed by kindergarten teachers with a mean score of 38.20 It is noted the combination grades, fourth, fifth and sixth had the lowest mean score of 28.30. There was no consistent pattern from Kindergarten to sixth grade of the time spent on manipulative use, it did not increase or decrease as the grade level increased. It is noted that the top five mean scores belonged to primary teachers and 4 out of five of the lowest mean scores were for intermediate teachers.

An Analysis of Variance was computed to determine if there were significant differences between the Primary level teachers and the Intermediate level teachers. Table 8 shows the results of this analysis. It can be seen that the mean score for Primary teachers was 36.667 with a standard deviation of 1.155 and the mean score

for Intermediate teachers was 34.333 with a standard deviation of .577. Based on the Analysis of Variance the F value was .143, showing no significant differences between these two groups. Therefore, H_4 which stated that there will be no significant differences between the use of manipulatives to teach the Atlantic City districtwide curriculum between kindergarten through third grades and fourth through sixth grades is accepted. These finding are contradictory to the existing data found in the research literature. The findings in the literature states that there is a negative relationship between grade level grouping and manipulative use. This means that the higher the grade level the lower the evidence of manipulative use to teach mathematics to those upper grade students. Possible causes will be discussed in Chapter Five.

TABLE 8

Analysis of Variance
For Mathematics Manipulative Use
Reported By Grade Level Grouping

Grade Level Grouping	Number	Mean Score	Standard Deviation
Primary	3	36.667	1.155
Intermediate	3	34.333	.577

F = .143

The data from the Analysis of Variance prompted further statistical testing. This was achieved using the Correlation Coefficient Test to determine if relationships existed between 1) mathematics anxiety in teachers, 2) teachers' confidence level in mathematics instruction,
3) attitudes toward manipulatives and 4) amount of manipulative use. Table 9 shows these relationships in table form at the Primary level. The positive or negative degree of correlation can be seen by locating the intersection point of any two variables.

It can be seen that there were significant positive correlations between teachers' mathematics anxiety and attitudes toward manipulatives as well as between mathematics anxiety and the amount of manipulative use. These correlations show a positive relationship between mathematics anxiety and attitudes toward manipulatives and their use.

There was also a significant positive correlation shown between attitudes toward manipulatives to teach mathematics and the amount of use. This correlation of .985 is almost a perfect positive relationship. This implies that the more positive teachers feels about manipulatives and their use to teach mathematics, the greater the use in their classrooms.

There was one significantly negative relationship shown between teachers' mathematics anxiety and their confidence level of mathematics instruction. It is possible that the higher the mathematics anxiety level of Primary teachers the lower their confidence level in regard to teaching the subject of mathematics. This is in accord with the current research on mathematics anxiety

and mathematics instruction. There was absolutely no relationship, at the Primary level, between attitudes toward manipulatives and teachers' confidence level in mathematics instruction according to these findings. Further implications will be discussed in Chapter Five.

TABLE 9

Primary Level Correlation Results
Based on the J. L. C. Brown's Mathematics Teaching Survey

PRIMARY	Anxiety	Confidence	Attitude	Manipulative Use
Anxiety	-	-.7333	.66	.522
Confidence	-.7333	-	0	.174
Attitude	.66	0	-	.985
Time Spent	.522	.174	.985	-

Correlations Coefficient Test were done to determine if relationships existed between 1) mathematics anxiety in teachers, 2) teachers' confidence level in mathematics instruction, 3) attitudes toward manipulatives and 4) amount of manipulative use at the Intermediate level. Table 10 gives an overview of these relationships in table form. The positive or negative degree of correlation can be seen by locating the intersection point of any two variables.

It can be seen that there were significant positive correlations at the Intermediate level between teachers' mathematics anxiety and attitudes toward manipulatives as well as between confidence level of mathematics instructing and the amount of manipulative use. This implies that some Intermediate teachers possess high levels of anxiety but their overall attitudes toward manipulatives may be positive. It can also be seen that teachers' confidence levels are positively related to their amount of mathematics manipulatives use to instruct their students.

There was a perfect negative relationship drawn between teachers' mathematics anxiety in the intermediate grades and the amount of manipulatives use. This implies that the higher the level of mathematics anxiety the lower the level of manipulative use. Other significantly negative relationships that can be seen are between anxiety and confidence levels and attitudes toward manipulatives and the amount of their use to instruct students in mathematics. These scores indicate that just like at the Primary level, teachers on the Intermediate level who have higher mathematics anxiety also tend to have lower levels of confidence in teaching mathematics concepts to their students. Based on this lower confidence level teachers seem to shy away from using manipulatives to assist in their instruction. The table also shows that negative attitudes toward manipulatives tends to cause teachers to spend less time using them to instruct their students in mathematics. It was expected that these negative relationships existed. The research literature on mathematics anxiety, confidence

levels of mathematics instruction and manipulative use at the intermediate level was in agreement with these findings.

TABLE 10

Intermediate Level Correlation Results
Based on the J. L. C. Brown's Mathematics Teaching Survey

Intermediate	Anxiety	Confidence	Attitude	Manipulative Use
Anxiety	-	-.866	.693	-1
Confidence	-.866	-	-.24	.866
Attitude	.693	-.24	-	-.693
Time Spent	-1	.866	-.693	-

Summary

This chapter presented the data collected from the one hundred twenty-five J. L. C. Brown Mathematics Teaching surveys that were received. The surveys had been distributed and completed by kindergarten through sixth grade teachers, Basic Skills teachers and Special Education teachers who instructed elementary school students in mathematics. This population represents the eight elementary schools in the Atlantic City Public School system. The data was summarized in tables to show the mean scores on three topics investigated using this survey. These topics were teachers' mathematics anxiety, teachers' confidence level in mathematics instructing and teachers' attitudes toward manipulatives and the benefits of their use.

An analysis of the tabled data was done in order to accept or reject the four stated hypotheses. Statistical Analysis of Variance were performed to determine if any significant differences existed between two or more sets of mean scores. After analyzing the results of these test and other data, it was found that H_1, H_2, H_3 and H_4 were accepted.

Further analysis was done to determine relationships within each grade level grouping data. The Correlation Coefficient Test produced many positive and negative correlations within each grade level grouping. Significant negative relationships were found between anxiety and confidence levels within both grade level groupings. Another similarity found within both groups was the

significant positive relationships between anxiety and attitudes toward manipulatives. Other relationships can be found by examination of Tables 9 and 10. Those mentioned were just a few of the significant findings. Many of the findings were not in agreement with the research literature and implications and causes will be discussed in Chapter Five.

Chapter Five

Conclusions and Recommendations

Summary of the Problem

This study attempted to determine whether or not elementary mathematics teachers' 1) mathematics anxiety, and 2) confidence level of mathematics instruction correlated with their attitudes toward the benefit of manipulatives and their use in the classroom. The study also attempted to determine if there were statistically significant differences between teachers of the primary level, kindergarten through third grade and the intermediate level fourth through sixth grade. This chapter will summarize the results that were determined through the surveys.

Summary of the Method of Investigation

The elementary mathematics teachers in the Atlantic City Public School District was selected as the sample for this study. A total of 201 surveys were distributed by inter-school mail to every kindergarten through sixth grade teacher as well as all elementary Basic Skills and Special Education teachers and one Science / Mathematics specialist in the district. There were 90 Primary teachers, 61 Intermediate teachers and 50 specialist, Basic Skills

and Special Education teachers in the population. The returned survey sample numbers were 56 Primary teachers, 37 Intermediate teachers and 27 specialist, Basic Skills and Special Education teachers. An overall return rate of 67% was established. The survey distributed and administered to the subjects was the J. L. C. Brown's Mathematics Teaching Survey along with a cover letter explaining the survey's purpose. The participants were asked to rate each of the 55 statements about mathematics anxiety, teaching confidence and manipulative use, using a Likert Five Point Scale. The mean scores by present grade level or teaching assignment and by elementary grade grouping (Primary, Intermediate and Specialist) were computed and placed in various tables. An analysis of each table was completed and in many cases were subject to a significance ANOVA in order to find statistically significant differences in grade level or grade grouping mean scores. Significance was set at the 0.05 level of probability for each analysis.

Summary of the Findings and Conclusions

H_1 which states that there will be no significant differences between the level of mathematics anxiety in teachers between kindergarten through third grades and fourth through sixth grades tested using a significance ANOVA. The mean score for the Primary teachers was 37.667 and the standard deviation was 2.082. The mean score at the intermediate level was 37 and the standard

deviation was 1.732. At the 0.05 probability level the F value was computed at 2.333, showing no significant differences in attitudes toward manipulatives between the two groups. Therefore, H_1 was accepted. An analysis of the data from the section of the survey relating to mathematics anxiety in teachers provided information which indicated that there was no increasing or decreasing pattern established for the level of anxiety in teachers as grade levels increase.

H_2 which stated that there will be no significant differences between the level of mathematics teaching confidence in Primary and Intermediate teachers was tested using a significance ANOVA. The mean score at the Primary level was computed to be 38.25 with a standard deviation of 2.5. At the Intermediate level the mean was 37 with a standard deviation of 1.633. At the 0.05 level of significance the F value was 1.081, this showed that significant differences do not exist between the two groups. Therefore, H_2 was accepted.

H_3 which states that there will be no significant difference between kindergarten through third grade teachers (Primary) and fourth through sixth grade teachers (Intermediate) in their attitudes toward using manipulatives to teach mathematics concepts at their present grade level. The mean established for the level Primary using the ANOVA was computed to be 118 with the standard deviation being 4.359. The same test produced a mean for the Intermediate level of 114.667 with a standard deviation being 5.686. The F value at the 0.05 level of significance was .581, showing that

there was no significant difference between the two sets of means. Therefore, H_3 was accepted.

H_4 which states that there will be no significant differences between the use of manipulatives to teach the Atlantic City districtwide curriculum between kindergarten through third grades and fourth through sixth grades was investigated using a statistical ANOVA. This test was used on the data produced by questions numbered 31, 33, 35, 36, 37, 43, 45, 49, 51 and 52 on use of mathematics manipulatives in the classroom. At the 0.05 level of probability the F value was computed to be .143. The Primary teachers' mean was 36.667 with a standard deviation of 1.155 while the Intermediate level mean was 34.333 with a standard deviation being .577. These findings showed no significant differences between the two groups, therefore Hypothesis four was accepted.

Additional data was investigated using the Correlation Coefficient Test to determine relationships between teachers' mathematics anxiety, confidence level in mathematics instruction and time spent using mathematics manipulatives to teach. Some of the findings were: positive relationships between teachers' mathematics anxiety and time spent using manipulatives and attitudes toward manipulatives and time spent using them to teach. These findings were at the Primary level while at the Intermediate level the same correlations were negative relationships. At the Intermediate level a positive relationship found was between confidence level of teaching mathematics and time spent using them. A positive correlation was found at both levels between attitudes toward manipulatives and teachers' mathematics anxiety.

Implications

The acceptance of H_1 says that there is no significant difference in mathematics anxiety in teachers between the Primary and Intermediate levels. The implication that at least a percentage of teachers from every grade level feels comfortable with mathematics is encouraging. It is noted that the wording of the questions for this section of the survey may not have been representative in terms of mathematics anxiety and grade level preference. According to district policy teachers may not have been given the opportunity to select a preferred grade level thereby being placed where needed. Consequently, grade level and it's effects on mathematics anxiety has not been examined freely. Further study which clarifies grade level preference may produce differing results which would be more in accordance with the research data currently available through the literature. It is noted that mathematics anxiety means using the J. L. C. Brown's Mathematics Teaching Survey were not extremely high at any grade level or grade level grouping. Out of a possible sixty (60), the highest mean score and twelve (12) for the lowest mean, the mean score for multiple returns of 41.40 for Special Education teachers (See Table 4) is considered to be moderate. Another possible reason for the unexpectedly low anxiety means could be that teachers in the sample group did not feel comfortable enough to take a chance and rate the statements more honestly. The fact that the researcher is from the

district and the research was being completed and compiled in the district could have inhibited some teachers.

Based on the findings of this study grade level alone does not dictate level of anxiety. Although this is contradictory to research, for our district this is significant and would be very useful when grade level reassignments need to be made in the district.

As for the presence of mathematics anxiety no matter what the level, inter-grade level meetings might be used to help those teachers who have self-professed mathematics anxiety deal with this issue in a positive manner. According to the literature, showing mathematics as real and necessarily related to their lives helps students develop an appreciation for it's value. The teachers involved in the meetings or workshops could learn to understand the many relationships between mathematics and real life situations. This would be beneficial in helping teachers to eradicate the "cycle of mathematics anxiety transference".

The level of confidence in mathematics instruction at the Primary and the Intermediate levels was not significantly different according to this study. This caused H_2 to be accepted. The expected level of confidence at the Primary level was thought to be significantly higher than it was actually surveyed to be. Out of a possible sixty (60) the mean score for the Primary level was 38.25, this is thought to be moderate. The Intermediate level mean score was 37. The most distinct difference was in the standard deviations for the two groups. The Primary standard deviation was 2.5, while the Intermediate standard deviation was 1.633. This made a significant difference in the computed mean scores. The Primary

level had more diverse scores on an individual bases. The Intermediate scores were more closely aligned.

The statements about confidence may not have been representative in terms of mathematics confidence and it's relationship to grade level preference. Teachers may not have had a choice in their grade level assignments, so how influential their confidence level was to their grade level decision is unknown.

Confidence levels could be related to the number of years teachers have taught at a given grade level. It stands to reason that the greater the amount of practice and use of particular skills to be taught, the greater the level of confidence a teacher would exhibit during instruction. A study could be done which would use years of teaching service at a particular grade level as an additional variable relating to confidence in teaching mathematics.

The fact that H_4, which stated that there will be no significant differences between the use of manipulatives to teach the Atlantic City districtwide curriculum between kindergarten through third grades and fourth through sixth grades was accepted is evidence that many teachers are using them to instruct their students one of the most progressive ways. This implies that manipulatives are being used at both of the elementary levels in the district without significant differences in the teachers' attitudes towards them at these two levels (H_3). This further implies that the call from the National Council of Teachers of Mathematics (NCTM), for more manipulative use in the mathematics classroom is being answered by many educators. It can not be assumed that every teacher, primary, intermediate, or specialist, is convinced of these

proposed benefits of manipulatives. The survey did show that combination grades fourth, fifth and sixth's low mean score of 97.67 implies the need for workshops on the benefits and practical uses of manipulatives, at least for some teachers. The information on teachers' attitudes toward manipulatives could be valuable to supervisors as they plan to further implement the NCTM's Standards for elementary grades. Programs and workshops for all teachers could be helpful if students from every grade level were used to help highlight effective and time considerate ways to use manipulatives. Although there was no particular pattern from kindergarten through grade six on the amount of manipulative use there was a trend for the top five grades showing the greatest amount of use to be at the Primary grouping level.

The findings of this study did not agree with the data presented in the literature. There it was stated that there are significant differences in the amount of manipulative use between Primary and Intermediate grade levels. A possible reason for this discrepancy could be the training that the Atlantic City Public School Teachers have experienced over the past five years. The district has been involved in mathematics teacher training with Project PRISM, Project GAP and many ongoing workshops and training sessions with Rowan College professors and Research for Better Schools. This training emphasized the importance of manipulative use to help students understand relationship in mathematics and it's inter-dependency on other subjects. Teachers were taught how to help students see that mathematics was not an isolated school subject but was relative to real life situations.

Looking at Tables 9 and 10 it can be seen that there is a distinct difference in the relationship between attitudes toward manipulatives and manipulative use in the Primary verses the Intermediate grade level grouping. At the Primary level this relationship is extremely positive, while at the intermediate level it is decidedly negative. A reason for this could be that at the Primary level most textbooks and curriculums are filled with actual manipulatives, lesson plans and activities related to manipulative use. The teachers is simply following what is there. At the Intermediate level the suggestions are there for manipulative use, but the teacher most accumulate the concrete items needed and many times must devise a mean to incorporate teacher made activities into the lessons. This can be very time consuming and difficult without the proper training. The end results would be less manipulative use at the intermediate level along with little understanding of the relationships that would be developed through manipulative use at any grade level.

Recommendations for Further Study

Based on the findings from the analyzed survey data, the following are recommendations for further study:

1. A study could be conducted which would determine the effects of individual schools educational philosophy on the teachers confidence level in mathematics instruction.

2. A study could be conducted which utilizes this survey and adds the effects of gender on mathematics anxiety as a variable.
3. A study could be conducted where years of teaching service is used as a variable to study confidence level of instruction.
4. The J. L. C. Brown's Mathematics Teaching Survey could be distributed and used to collect data from the junior high school and high school teachers in the district. These findings could then be compared with the data from elementary teachers to determine if there are any significant differences between these school levels.

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Appendices

Appendix A

Permission Letter to

Superintendent

509 N. Connecticut Avenue
Atlantic City, N. J. 08401

February 2, 1995

Dr. R. Mark Harris
Superintendent of Schools
Atlantic City School District
Administration Building
1809 Pacific Avenue
Atlantic City, N. J. 08401

Dear Dr. Harris,

My name is Jacqueline L. Brown. I currently teach the second grade at New Jersey Avenue School. I have taught in the Atlantic City School District for twenty-two years. I am enrolled in the Masters of Education program at Rowan College in Glassboro, N. J.

As a requirement for the degree I must complete a research thesis. My topic is "Mathematics Anxiety in Teachers and It's Effect on Their Attitudes Towards Using Manipulatives to Teach Mathematics".

I am requesting your permission to distribute the enclosed survey for the purpose of collecting data, districtwide, from kindergarten through grade six. I will be surveying teachers who teach mathematics to students in the these grade levels. The information gathered will be completely anonymous and will be used strictly for my thesis.

This survey has the approval of my advisor, Dr. Louis Molinari.

Thank you for your consideration of this matter. I anxiously await your decision.

Sincerely,

Jacqueline L. Brown

Appendix B

Cover Letter to Teachers

509 N. Connecticut Avenue
Atlantic City, N. J. 08401

February 14, 1995

Dear Colleagues,

I am an elementary school teacher at New Jersey Avenue School in Atlantic City. I currently teach the second grade. During my twenty-two years in the Atlantic City Public School District I have experienced teaching kindergarten through grade six.

I am asking for your assistance in completing my research requirements for the Masters of Education Program at Rowan College in Glassboro, N. J. I have chosen to gather information for the thesis by using the enclosed survey. The entire survey should take about twenty minutes of your time. It is totally voluntary and anonymity is assured. Your name **nor** any other identifying information is needed.

Your cooperation in completing and returning this survey will help me complete and present a successful study. I have placed a sealed box in your school office for completed surveys. The information will be computed districtwide only.

Enjoy the little treat that is enclosed and thank you in advance for your cooperation and time, smile. If there are any questions please contact me at 344-6465, after 4 P. M.

Sincerely,

Jacqueline L. C. Brown

Appendix C

Survey

J. L. C. BROWN'S MATHEMATICS TEACHING SURVEY

Current Grade Level - Circle One

K 1 2 3 4 5 6 BSIP Special Ed. Biling.

Grades Taught - Circle All Applicable

K 1 2 3 4 5 6 7 8 9 10
11 12 BSIP Special Ed. Biling.

Years of Teaching Experience _____

Gender - Male Female

Race - Caucasian___Non-caucasian_____

Number of Years at Present Grade Level _____

Highest Degree Earned - BA BS MA MS PHD _____

5-strongly agree, 4-agree, 3-uncertain, 2-disagree, 1-strongly disagree

1. I am sure I am prepared to do advanced work in mathematics.	5	4	3	2	1
2. When I was in school my math teachers always encouraged me to take additional math courses.	5	4	3	2	1
3. In my class, the boys are better at math than the girls.	5	4	3	2	1
4. I've always been a little worried about achieving in math.	5	4	3	2	1
5. Math was my favorite subject in school.	5	4	3	2	1
6. Math courses in college were very difficult.	5	4	3	2	1
7. Math courses in college were a waste of time.	5	4	3	2	1
8. I took the least amount of math courses possible.	5	4	3	2	1

9. I've always done well in mathematics.	5	4	3	2	1
10. I chose the most advanced math courses in school.	5	4	3	2	1
11. I worry alot about taking a math test.	5	4	3	2	1
12. I enjoy teaching math concepts to my students.	5	4	3	2	1
13. Math has always been difficult for me.	5	4	3	2	1
14. Taking required math courses make me nervous.	5	4	3	2	1
15. All of my students enjoy math.	5	4	3	2	1
16. I am most comfortable teaching math when utilizing the teacher's guide.	5	4	3	2	1
17. I could use workshops that show how to introduce complex math concepts.	5	4	3	2	1
18. I usually scored above average in mathematics.	5	4	3	2	1
19. I could move two grades higher and still feel comfortable teaching math.	5	4	3	2	1
20. I dread having to take another math course.	5	4	3	2	1
21. I only grade math papers using the teacher's guide.	5	4	3	2	1
22. I would turn down a promotion if it meant using more math skills.	5	4	3	2	1
23. I would rather teach math at a lower grade level.	5	4	3	2	1
24. I always use the guide to plan my math lessons.	5	4	3	2	1
25. Being successful in math means getting the right answer.	5	4	3	2	1
26. Manipulatives are not very useful in teaching math.	5	4	3	2	1

27. Teachers can not show mathematical relationships better by using manipulatives in their lessons.	5	4	3	2	1
28. Students understand math concepts better through the use of concrete materials in their lessons.	5	4	3	2	1
29. Tangrams are not very helpful in teaching problem solving.	5	4	3	2	1
30. Students can not truly reinforce their learning of basic facts using calculators.	5	4	3	2	1
31. Time spent using manipulatives in math classes should not increased.	5	4	3	2	1
32. Pattern blocks can be useful in teaching fractional parts.	5	4	3	2	1
33. If manipulatives were available I'd use them more.	5	4	3	2	1
34. Special monies should be allotted for additional purchases of math manipulatives.	5	4	3	2	1
35. Teachers should decrease the amount of time spent on using math manipulatives.	5	4	3	2	1
36. I spend as much time as possible using math manipulatives during math instruction.	5	4	3	2	1
37. Manipulatives for math instruction are a waste of time.	5	4	3	2	1
38. Textbooks are excellent resource materials.	5	4	3	2	1
39. Textbooks and manipulatives can not be easily intergrated.	5	4	3	2	1
40. I have at least five types of manipulatives available for teaching mathematics.	5	4	3	2	1
41. Upper grade students do not benefit much from the hands on approach to learning.	5	4	3	2	1

42. I find that my students are too advanced for manipulatives.	5	4	3	2	1
43. Each of my students should use their math book daily.	5	4	3	2	1
44. Upper grade teachers should use the appropriate manipulatives to enhance their teaching.	5	4	3	2	1
45. I wish I had used more manipulatives last year.	5	4	3	2	1
46. Almost any concept can be better understood using manipulatives.	5	4	3	2	1
47. Purchasing manipulatives will overtax the budget.	5	4	3	2	1
48. Manipulatives are only useful for the remediation of less advanced students.	5	4	3	2	1
49. I use manipulatives once a week for math instruction.	5	4	3	2	1
50. The hands on approach is too primary for my students.	5	4	3	2	1
51. The district should do more to promote the use of manipulatives for instruction.	5	4	3	2	1
52. Manipulatives can increase time on task for most students.	5	4	3	2	1
53. Children are not encouraged to participate in their own learning by using manipulatives.	5	4	3	2	1
54. Making graphs to collect and interpret data is an important skill.	5	4	3	2	1
55. Calculators are effective tools for teachers to use to help develop math concepts.	5	4	3	2	1

Biographical Data

Name:	Jacqueline L. Brown
Date and Place of Birth:	May 10, 1952 Toledo, Ohio
Elementary School	Landreth Elementary Philadelphia, Pa.
High School:	West Philadelphia Philadelphia, Pa.
Undergraduate School:	Penn State University University Park, Pa.
Graduate School:	Rowan College of New Jersey Glassboro, N.J.
Present Occupation:	Elementary Teacher Atlantic City, N.J.