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An Examination of Georgia Middle School Teachers' and Principals' Beliefs about the NCTM Standards, Factors Influencing the Change Process, and the Role of Identified Principals during the Mathematics Reform Effort in Georgia

Lynn Deal Futch

AN EXAMINATION OF GEORGIA MIDDLE SCHOOL TEACHERS' AND PRINCIPALS' BELIEFS ABOUT THE NCTM STANDARDS, FACTORS INFLUENCING THE CHANGE PROCESS, AND THE ROLE OF IDENTIFIED PRINCIPALS DURING THE MATHEMATICS REFORM EFFORT IN GEORGIA

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ABSTRACT

The National Council of Teachers of Mathematics (NCTM) recommended that schools implement its Standards because they believed that the Standards improved students' mathematical ability. Every mathematics teacher in the state of Georgia had the opportunity to attend or be a part of a workshop, conference, or project involving suggestions for implementing the Standards in the classroom. The problem for Georgia educators was to determine if these Standards were being perceived by principals and teachers, the key change agents, as having merit enough to change their views of how mathematics should be taught. The purpose of this study, therefore, was to examine Georgia middle school principals' and teachers' beliefs about the NCTM Standards and to investigate the process that took place in identified schools making changes in mathematics curriculum and instruction related to the NCTM Standards.

The study involved the use of two survey instruments, the Standards Belief Instrument (SBI) and the Foley Change Questionnaire (FCQ). The SBI was sent to the total population of 275 Georgia middle schools with a 66% return rate. The FCQ was sent to schools identified by experts in the mathematics field. Fifteen schools participated in the questionnaire with a 100% return rate from teachers and an 80% return rate from the administrators.

The results of the study relative to the research questions indicated some noteworthy findings. The principals and teachers overwhelming agreed with each other with regard to the NCTM Standard items on the SBI.

Principals and teachers agreed with each other on 13 of the 16 items. The different grade-level teachers also agreed with each other on the items. The principals and teachers disagreed with the NCTM Standards on 5 of the items. When examining the mathematics reform effort in Georgia, it was found all the initiatives were done at the system level.

VITA

Lynn Deal Futch was born March 2, 1961 in Statesboro, Georgia. After graduating from Statesboro High School, she entered Georgia Southern University where she earned her B.S. degree with an emphasis in Early Childhood and Middle Grades Education. She received an M.Ed. in Early Childhood and Middle Grades Education from Georgia Southern University in 1985. She completed additional course work at Georgia Southern University to acquire an Education Specialist degree in Early Childhood Education, Middle Grades Education, and Leadership. Her work experiences have included teaching first, third, and fifth grades, developing and directing summer camps, serving as education director and coordinator of Project SENSE at the GSU museum, and working as a K-8 educational consultant in science education. She is presently employed by Bulloch County School System as an instructional coordinator at Stilson Elementary School, Stilson, Georgia.

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CHAPTER ONE

INTRODUCTION

General Introduction

Mathematics has always been a fundamental part of the school curriculum (Fennema & Franke, 1992). Because mathematics is a necessary tool for functioning in society, it continues to be an area of scrutiny subject to educational change (NCTM, 1991). Calls for mathematics reform were documented in national reports, A Nation at Risk (NCEE, 1983), Educating Americans for the 21st Century (NSBC, 1983), and The Underachieving Curriculum: Assessing School Mathematics From an International Perspective (McKnight, 1987). The National Council of Teachers of Mathematics (NCTM) responded to these reports by developing three professional documents, Curriculum and Evaluation Standards for School Mathematics (1989), Professional Standards For Teaching Mathematics (1991), and Assessment Standards For School Mathematics (1995), outlining the vision for mathematics education in the United States. These documents were the first of their kind directing curriculum at the national level by a professional educational organization. NCTM utilized many persons and much time in trying to develop and implement the Standards.

It was the intention of this study to assess the beliefs about the NCTM Standards in Georgia Middle Schools. This study was designed to investigate the compatibility between teachers' and principals' beliefs about the NCTM Standards. The beliefs were examined using the Standards Belief Instrument (SBI) designed by Alan Zollman and Emanuel Mason (1992). It was also intended to examine the factors influencing the change process and the role of identified principals who were active in change reforms in

their schools' mathematics instruction. The role of the identified principals and the change factors were researched using the Foley Change Questionnaire (FCQ) developed by Jane Foley.

Historical Perspective

The National Council of Teachers of Mathematics was not the only group to voice concerns about an area of school curriculum. In the late 1980s and early 1990s, new ideas, theories, innovations, and standards were constantly bombarding schools (Murphy, 1990). Initiated by educational researchers and organizations, different educational reform movements introduced to the schools included many national and state programs and changes. With so many educational innovations inundating schools, assessment of changes proved difficult. This study examined two aspects of the educational reform movements being proposed by the NCTM Standards: administrators' and teachers' beliefs about the NCTM Standards and identified principals making changes in their schools' mathematics curriculum in Georgia middle schools.

Research literature of the late 1980s gave schools a toolbox of school improvements and programs, such as quality schools by William Glasser (1990), multiage classrooms by the Society for Developmental Education (1992), Benchmarks for Science Literacy by the National Science Teachers Association (1993) and National Science Education Standards (1995), and whole language approaches by the National Council for Teachers of English (IRA, 1990). Each group expressed concerns about teaching practices and curriculum was taught in its subject area. Because of the many innovations bombarding the schools, teachers and principals had to work together to decide which ones they would choose for local school improvement projects. This author's research examined teachers' and principals' beliefs about one of these innovations, the NCTM

standards and identified principals' roles as a change agent.

NCTM Standards as Innovations

NCTM Standards were a radical departure from the educational practices being emphasized by many educational researchers in the early 1990s (NCTM, 1991). Current educational practices, emphasizing more control by teachers, included Total Quality Management, Quality Schools, and Site-Based Management (Conley, 1993). By 1990, mathematics education was the only school discipline that had written a set of professional standards specifying what students need to know in mathematics and what teachers need to know to empower students mathematically. Also being endorsed by NCTM's Standards document was a change in mathematics curriculum and environment very different from current practice. This study researched the changes that took place in Georgia and the teachers' and administrators' beliefs about the Standards and identified principals who were perceived as making changes in their schools.

National Council of Teachers of Mathematics

The National Council of Teachers of Mathematics examined the International Assessment for Educational Progress (IAEP) study results comparing American students to other nations' students and concurred that changes needed to be made in the way American students were learning mathematics. The National Council of Teachers of Mathematics expressed the need for standards for school mathematics to ensure quality, to indicate goals, and to promote change (NCTM, 1989). One of NCTM's commissions indicated that administrators have a responsibility for the support and development of mathematics teachers and mathematics teaching. Administrators' responsibilities include providing support and developing the use of these standards for making the needed changes so that the NCTM goal of a quality mathematics education for every child could be achieved.

Georgia's Response to the Call for Mathematics Reform

Various organizations that had mathematics education as their primary mission were sparked by the national standards to play a role in the transformation of mathematics education in the state of Georgia. The three major professional organizations were the Georgia Council of Teachers of Mathematics, the Georgia Council of Supervisors of Mathematics, and the Georgia Coalition for Science, Technology, and Mathematics Education. The major state systemic effort was the Georgia Initiative in Mathematics and Science (GIMS).

Georgia Council of Teachers of Mathematics

The Georgia Council of Teachers of Mathematics is a professional organization of mathematics teachers. The objectives of the council are "to encourage an active interest in mathematics and to act as an advocate for the improvement of mathematics education at all levels" (GCTM, 1994, p.1). The organization is affiliated with the National Council of Teachers of Mathematics. GCTM has two NCTM representatives who are in contact with the National Council of Teachers of Mathematics to inform GCTM of goals and objectives of NCTM. GCTM conducts an annual conference for all members. In the past three years, the various workshops have contained strands which presented ways to implement the NCTM Standards.

Georgia Council of Supervisors of Mathematics

The Georgia Council of Supervisors of Mathematics (GCSM) is an organization of all active and retired members of the staffs of Local Educational Agencies (LEAs), Regional Educational Service Agencies (RESAs), institutions of higher education, private education institutions, and the State of Georgia Department of Education whose function is to provide supervisory or consultative services in mathematics education. The organization was formed "to improve mathematics instruction and teacher education

programs, provide an information service regarding mathematics education, and to cooperate with other organizations for the improvement of mathematics education" (GCSM, 1995, p.1). The Georgia Council of Supervisors of Mathematics is affiliated with the Georgia Council of Teachers of Mathematics and the National Council of Teachers of Mathematics.

Georgia Coalition for Science, Technology, and Mathematics Education

The Georgia Coalition for Science, Technology, and Mathematics Education (GCSTME) is an organization of leaders from the corporate, public policy, and education sectors of Georgia. The Coalition intended to be the "champion" for science, technology, and mathematics in the state. This state coalition for mathematics education was developed primarily to change mathematics education in Georgia so that it aligned with the NCTM Standards. The mission of GCSTME is to have "the Standards . . . become the vision and then the reality of how mathematics and science are taught and learned in Georgia's classrooms" (GCSTME, 1995, p.7).

Georgia Initiative in Mathematics and Science

The National Science Foundation provided Georgia with $10 million in funding to implement over a five-year period a statewide systemic program called the Georgia Initiative in Mathematics and Science (GIMS) which targeted middle school (grades 4-8) mathematics and science (GIMS, 1992). GIMS focused on providing an exceptional middle school science and mathematics education for all students in Georgia. GIMS also developed a draft of the Georgia Framework for Learning Mathematics and Science, which translated national standards to Georgia classrooms and defined the content, skills, and habits of mind which should be developed in K-12 classrooms.

Statement of the Problem

A Nation at Risk, published in 1983, provided the impetus for the development of the NCTM's Curriculum and Evaluation Standards for School Mathematics published in 1989. Subsequently the NCTM realized that standards for instruction, and not just for curriculum and evaluation, were necessary. As a result, NCTM's Professional Standards for Teaching Mathematics were published in 1991. NCTM also published in 1995 Assessment Standards for School Mathematics to align assessment with curriculum and instruction outlined in the previous Standards documents.

NCTM recommended that schools align the curriculum with the Standards because NCTM believed that the Standards improved students' mathematical abilities. Several organizations in Georgia began the process of trying to help teachers implement the Standards. Every mathematics teacher in the state of Georgia had the opportunity to be invited to attend or be a part of a workshop, conference, or project involving suggestions for implementing the Standards in the classroom (GIMS, GCTM, GCSTME). The problem for Georgia educators was to determine if these Standards were being perceived by principals and teachers as having merit enough to change their views of how mathematics should be taught. A number of teachers began implementation of the NCTM Standards with support and guidance from their principals in their classrooms as reported by GIMS and the Atlanta Mathematics Project. Teachers, however, found that implementation of the NCTM's Standards required more than a guidebook of lessons. This implementation also required a shift in teachers' beliefs and practices about teaching and learning mathematics and support from their principals.

The purpose of this study, therefore, was to ascertain whether principals and teachers believed in the NCTM Standards. When the implementation process was being examined in Georgia, it was found that the following two conditions existed:

1. There was no valid or comprehensive assessment of the beliefs or implementation of NCTM's Mathematics Standards in Georgia middle schools.

2. This lack of information was problematic for and detrimental to informed decision-making and student mathematics achievement.

Principals' and teachers' beliefs played an important role in determining the implementation of the NCTM Standards in Georgia middle schools. This research data provided factual information for mathematics organizations and schools as they planned the next steps for ensuring the implementation of the Standards.

Purpose

The purpose of this research was to examine teachers' and principals' beliefs about the NCTM Standards in Georgia middle schools. No other research was found that had addressed this aspect of the NCTM Standards. Yet, clearly, teachers' and principals' beliefs played an important role in the implementation of the standards in Georgia middle schools. It was also the intent of this study to examine the role administrators played in helping teachers make a change in mathematics instruction and teaching.

This study examined the beliefs of Georgia middle school administrators and teachers toward mathematics teaching as prescribed by NCTM Standards as measured by the Standards Belief Instrument. It also investigated the compatibility of views between identified principals and teachers in schools making changes. For example, if administrators believed they were providing support and materials, but the teachers did not have the same belief about that support, then the results of this research could help both groups develop a communication channel. The data collected from this research should benefit K-12 teachers, administrators, GIMS, NCTM, other mathematics-related organizations, universities, and colleges of education. The data provided should give them a picture of the perceptions of mathematics teachers and principals in Georgia middle

schools. The populations which would benefit from the data were given a copy of the information to use when planning conferences, workshops, staff development, and professional learning sessions.

Importance of the Study

The American public continues to expect that its students be the best in the world and the media continue to publish comparisons between student performance in the United States and the other industrial nations. In the mid-1990s, many of the educational reforms called for changes in education that would elevate standardized tests scores or at least show an increase from year to year. Achievement in mathematics was a critical part of the student performance profiles available for comparison. Integration of the NCTM Standards into the mathematics curriculum was viewed by many educators as a vital key to overall mathematics improvement. This study was needed because no comprehensive assessment had been done on the beliefs and implementation of NCTM Standards in Georgia middle schools. Many projects had been developed by several Georgia mathematics organizations, but no subsequent research had been done to investigate the progress being made in the state. It was also unique in that mathematics was the first subject area that had fully developed national standards of mathematics instruction and curriculum to be implemented. Many top-down initiatives had failed in the past, so it was interesting to see how well this curriculum from a national organization was being perceived as necessary by principals and teachers.

This study was also designed to help administrators and teachers begin a dialogue about how to improve the mathematics program in Georgia middle schools. It had implications for higher education circles in identifying what was missing for those teachers who were currently teaching and in identifying what future teachers in colleges of education needed to ensure Georgia middle schools' implementation of the NCTM

Standards. This research also had impact in providing GIMS with additional information on middle school mathematics programs in Georgia. It was designed to help GIMS and GCSTME determine how much work was being done in middle schools and how much work still needed to be done in the area of mathematics education. It was also designed to provide information to the Georgia Council of Supervisors of Mathematics (GCSM) to provide its membership with information on how principals can be the change agent in their schools by studying the process used by the identified schools.

The intention of this study was to provide three views of mathematics curriculum reform in Georgia Middle Schools. This first view was to examine the compatibility of principals' and teachers' beliefs about the NCTM Standards in all Georgia middle schools. The second view was to compare beliefs about the NCTM Standards among mathematics teachers of grades 6, 7, 8 and teachers who taught a combination of grades. The third view was intended to examine the change process that took place in schools under identified principals. This view was intended to give other schools whose principals' and teachers' beliefs are compatible several blueprints to discuss and adapt to their situations when attempting to make changes in their mathematics curriculum.

Assumptions

The two instruments used in the study were the Standards Belief Instrument developed and tested by Alan Zollman and Emanuel Mason and the Foley Change Questionnaire developed and tested by Jane Foley. It was assumed that the Standards Belief Instrument (SBI) and the Foley Change Questionnaire (FCQ) were valid and reliable instruments to collect the necessary data. This research also assumed that the administrators and teachers would answer the survey questions with consideration, honesty, and knowledge. The researcher assumed that the principals would give the surveys to the teachers in a timely manner. She also assumed that the identified principals

would distribute the FCQ surveys to all teachers involved in the mathematics curriculum reform.

Objectives of the Study

The questions being addressed by this research are:

1. On which, if any, of the NCTM Standards do teachers agree about their beliefs, as measured by the SBI?
2. On which, if any, of the NCTM Standards do principals agree about their beliefs, as measured by the SBI?
3. To what degree were teachers' and principals' beliefs different on the 16 NCTM Standards statements, as measured by the SBI?
4. To what degree were different grade-level teachers' beliefs different on the 16 NCTM Standards statements, as measured by the SBI?
5. What factors, as perceived by teachers and administrators, influenced the change process during the mathematics reform effort in their schools, according to the Foley Change Questionnaire?
6. Did teachers at identified schools find their principals to have been active change facilitators?
7. What process or plan did principals at identified schools use to make changes?
8. Who did teachers at identified schools think made the greatest contribution to the change process?

Procedures

The data for statistical analysis were obtained from two sources of evaluation, the Standards Belief Instrument (SBI) and the Foley Change Questionnaire (FCQ). There were 275 schools in 120 school systems that had been funded as middle schools for Fiscal Year 1994. The SBI (Zollman & Mason, 1992) was sent to all principals and all regular

mathematics teachers in each of the 275 Georgia middle schools. Data were collected on sex, degree, certification, and other information to provide a demographic profile of the population. The SBI survey was also mailed to identified principals and teachers. Along with the SBI survey, the Foley Change Questionnaire was sent. The FCQ (Foley, 1992) was used to determine the perceptions of teachers about the role of the principal as the change agent and the presence of change factors in their schools. The identified schools were determined by the director of the state systemic initiative agency, GIMS; directors at the GIMS Professional Development Centers; and directors of the various system level initiatives in the Richmond County Schools, the Cobb County Schools, and Marietta City Schools.

Limitations

This study was limited to state-funded middle schools in Georgia and to schools selected by GIMS. This limitation may have affected the teaching methods used by these teachers because each school had to meet specific middle school guidelines and criteria in order to receive middle school incentive grant funding. There may have been schools which did not fit the fiscal year 1994 definition of Georgia middle schools but which were also implementing the Standards. Another possible limitation is that the majority of the identified schools are located in north Georgia.

The section on the identified schools was limited in its generalizability to other school settings. The purpose of the study was to examine and present exemplary middle schools and the process of change that was utilized at those sites. Therefore, generalizability was not a critical consideration. Each school's setting is different and it was the purpose of this study to present only the blueprint each exemplary school used as a guide in other schools formulating their own blueprints for change. The data from the schools were collected ex post facto as school personnel reflected back on the process.

The study documented the involvement of what the present researcher refers to as the second change facilitator. As indicated by research done by Hord and Hall (1987), most schools implementing change had a person who assisted the principal in the change process. In their research, the second change facilitator was an assistant principal, lead teacher, or instructional leader who played a complementary role to that of the principal. This information was obtained from responses to open-ended questions. The resulting data were coded, categorized, and analyzed by the present researcher. It is possible, of course, that another researcher would have made different interpretations.

Definitions of Terms

Belief or Perception: A belief or perception is a "proposition, or statement of relation among things accepted as true; a way to describe a relationship between a task, an action, an event, or another person, and an attitude of a person toward it" (Eisenhart, Shrum, Harding, & Cuthbert, 1988, p.53).

Constructivism: A theory which states that learning is an active, social process. The classroom should be a place where students have authentic opportunities to construct meaning at their own pace. Constructivist theory views the student as the one who acts on the content of knowledge and events within the environment and gains some understanding of the features held by the content and events.

GIMS: Georgia Initiative in Mathematics and Science was the state of Georgia's statewide systemic initiative to improve the teaching and learning of mathematics and science.

Identified schools, identified principals, identified teachers: These schools were identified by the state systemic initiative office, GIMS; directors at the GIMS Professional Development Centers; and directors of the various system level initiatives in the Richmond County Schools, the Cobb County Schools, and Marietta City Schools as being innovative schools in the area of mathematics reform. The principals were perceived as instructional

leaders at their schools. The teachers were selected by the principals as having been involved in the mathematics curriculum reform.

Implementation: Implementation referred to "the actual use of an innovation or what an innovation consists of in practice" (Fullan & Pomfret, 1977, p. 336).

Middle Schools: The Georgia Department of Education defined middle schools as schools which housed a combination of grades five through 8, 6 through 8, or 7 through 8 as long as grade 8 was included as the highest grade. For example, a school housing grades five through 7 would not be eligible for middle school funding because grade 8 is not its highest grade level. There were also some assurances that had to be met by the schools such as team teachers, exploratory classes, and a daily 90-minute planning period for team teachers.

NCTM: The National Council of Teachers of Mathematics is the primary national professional organization of mathematics teachers.

Regular mathematics teachers: Regular mathematics teachers are defined by the researcher as teachers who are part of a middle school team and teach regular classes of mathematics. This definition does not include Chapter I or special education teachers who may teach mathematics to some students.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

This study examined the beliefs of Georgia middle school teachers and principals regarding the National Council of Teachers of Mathematics (NCTM) Standards, the presence of factors influencing change in identified schools, and the role of identified principals in leading the mathematics reform process in their schools. Therefore, it was appropriate to review the research and literature in the domains of educational change and mathematics reform. Three foci were examined within the educational change domain: the process of change, principals' beliefs and roles in change, and the teachers' beliefs and roles in change. Three areas were investigated within the mathematical reform domain: national reports' proposed changes; NCTM's response to these changes; and Georgia's mathematical organizations' responses to these changes. These domains provided a framework for the study of the mathematics reform movement taking place in the 1990s.

Educational Change

Educational change is not new. Change has taken place in education since the conception of schools. Change in education has occurred because of international comparisons, national reports, national commissions, public demands, and other internal and external pressures (Conley, 1993). Researchers have studied the methods educational organizations have used to make changes in curriculum and instruction. These methods have been defined as the change process.

The Change Process

The change process was conceptualized by Leithwood and Montgomery (1982) as "a complex form of individual and organizational learning, resocialization, or growth " (p.310). Educators have found themselves in the change process when dealing with the mathematics curriculum and instruction prescribed by NCTM. Changes take place in two different modes. These two modes are described by Cuban (1988) and Fullan (1991) as first- and second-order changes. First-order changes occur within a stable system that remains unchanged itself. First-order changes are described as being changes that do not disturb the "basic organizational features, without substantially altering the way that children and adults perform their roles" (p.342). Second order changes, however, transform the fundamental structures of the organization. Second order changes "alter the fundamental ways in which organizations are put together, including new goals, structures, and roles" (Fullan, 1991, p.29). Educators seldom have been able to make second order changes successfully in schools (Conley, 1993).

Barker (1992) conceptualized the change process through a paradigm framework. As part of the dynamics of change he discussed the importance of looking toward the future. He defined a paradigm as a set of rules that "establish or define boundaries and tell you how to behave inside the boundaries in order to be successful " (Barker, 1992, p. 32). He discussed the need for paradigm shifts in order for an organization to make changes. A paradigm shift causes a change to a new game and a new set of rules. Within an organization, paradigm shifts come from different sources. Barker (1992) identified four categories of paradigm shifters: young people fresh out of training, older people changing fields, mavericks (people who know the current paradigm, but are not trapped by it), and tinkerers. These shifters are present in any organization; however, it is up to the

leadership to recognize them. NCTM was attempting to affect the mathematics paradigms within the schools by making shifts in the way mathematics was being taught. Sarason (1990), another student of reform, recognized that school reform efforts were taking place. He stated, however, that those efforts will continue to fail as long as reformers fail to confront the social, institutional, and organizational obstacles that have repeatedly kept reform from succeeding. Paradigm shifts will not take place if these obstacles are ignored. He further wrote

> that change will not occur unless there is an alteration of power relationships among those in the system and within the classroom. . . .Teachers cannot create and sustain the conditions for the productive development of children unless the conditions for their growth and development do exist. Public schools need to find a balance between supporting students and supporting teachers--the result may be better schools for all. (p. xiv)

NCTM considered what was known about the change process when striving to implement its mathematics standards in the schools. The organization used this information as it developed the Standards and began sharing a new vision of mathematics curriculum, instruction, and assessment.

Change, as described by Fullan (1991), is a multidimensional process which has three perspectives: the use of new or revised materials, the use of new teaching approaches, and the alteration of underlying beliefs. All three of these aspects were necessary because together they represent the means of achieving educational goals (Fullan, 1991). All three perspectives were a part of the proposed changes advocated by the NCTM Standards. Fullan (1991) went on to describe the factors affecting change in an organization: "existence and quality of the innovation; access to information; advocacy

from central administrators; teacher pressure and support; consultants and change agents; community pressure, support, apathy, and opposition; availability of federal or other funds; new central legislation or policy; problem-solving incentives for adoption; and bureaucratic incentives for adoption" (p. 42).

Fullan's ten factors played an important role in the process of change. Fullan's factors were the basis for items developed in the Foley Change Questionnaire (Foley, 1992). Other factors that pertain to the nature of change itself and that are involved in implementation are "need, clarity, complexity, and quality and practicality of materials" (Fullan, 1991, p. 57). These factors must be present for change to occur (Fullan, 1991). Numerous researchers (Bentzen, 1974; Bok, 1986; Goodlad, 1984) have identified stages in the change process. One of the most useful stage models, developed by Dunn and Griggs (1988), described seven stages: awareness, knowledge, personalization, consequences, collaboration, refocusing, and evaluating. The Foley Change Questionnaire, which relied heavily on Fullan (1991) and Dunn and Griggs (1988), was used to examine schools which were perceived as having undergone major changes in their mathematics curriculum. Fullan's work suggested that changes in actual practices will not take place unless teaching materials, teaching approaches, and teachers' beliefs are considered. He also suggested that the outcome of change initiatives is largely determined by what people think and do. These perspectives lead to this research inquiry of the beliefs of teachers and principals about the NCTM Standards.

The Principal's Role in the Change Process

The Role of Principals' Beliefs in the Change Process

The literature on principals' beliefs about curriculum issues was very limited. Only general studies have been done about principals' beliefs as they related to effective schools

and instructional leadership. There was abundant literature on the importance of the principal in successful program implementation (Fullan, 1991). In their analysis of several schools' reform projects, Emrick and Peterson (1986) identified administrative support as one of most important common factors. They indicated that "utilization rarely occurred when building or district administrative components were indifferent and utilization was virtually impossible in the presence of administrative opposition" (p.71). Therefore, administrators' beliefs about an innovation were important in determining their acceptance of a new innovation for their teachers and students.

Change is more likely to succeed when teachers and administrators have similar perceptions regarding the change (Doan & Doan, 1984; Price, Kelley, & Kelley, 1977; Sadefur & Turner, 1991). There was broad support from effective schools and instructional leadership literature for the notion that principals are influential in the change process (DeBevoise, 1984; Good & Brophy, 1986). The Rand Study of Federal Programs Supporting Educational Change (Berman & McLaughlin, 1977) reported that the projects in which principals were actively involved were more likely to succeed. Principals have the prime responsibility for organizing, supervising, and evaluating teachers. "Since they evaluate teachers, they may have a potentially powerful influence on classroom practices" (Good, Mason, & Grouws, 1988, p.130). School administrators had to accept that "the mathematics called for in these Standards requires time for mathematics; time for teachers to plan, to reflect, to help each other plan instruction; time for professional development; and time to interact" (NCTM, 1989, p.181). Thompson (1984, 1985) argued strongly that beliefs play an important role in the teaching of mathematics. Therefore, it was likely that "administrators' beliefs and preferences also

influenced how classrooms are organized, especially if these preferences are communicated to teachers" (Good, et al., 1988, p.137).

The Principal's Role as a Change Facilitator

This section examined the essential ingredients necessary for change to take place in schools emphasizing the importance of principals as change facilitators. It also discussed research studies which investigated the principals' role in school change.

Educational change and school reform have been major topics in educational literature for many years (Foley, 1993). When educational mandates enforce the typical top-down approach to educational improvement, educators often engage in the ceremony of changing without actually relinquishing anything important. Deal (1984) characterized this approach to reform as "dancing." He suggested that schools have been staging a pretense of reform ("dancing") for the last three decades. Observers enjoyed the dance--much energy was expended, and there was apparent movement,- -but in essence schools and classrooms appeared to remain largely the same (Deal, 1984).

Deal (1984) also warned that top-down approaches to school improvement are doomed to the same type of failure that the educational reforms of the past have experienced. The collaborative planning structures that were reported as successful by elementary schools was a commanding edict for the simultaneous top-down/bottom-up approach that was suggested by Fullan (1991).

Even though the model for successful change provides an outline for considering the phenomenon of the process of change, the parts of the model do not necessarily operate independently of each other. Because change is multidimensional (Fullan, 1991), the dynamic interrelationship among the parts, rather than any one factor, will determine the success of the result. In Foley's study of change in elementary schools, eight

contextual factors exerted a positive influence for change. Foley's eight contextual factors were external support; training; resources; information, research, and new programs; support from parents; building-based autonomy; empowerment; student outcomes; and staff attitude. Educators from the schools in Foley's study (1993) described eight roles and actions of principals as having a positive effect on the process of change: support, planning and participating in the process, providing for training, providing resources, providing information, communicating with parents and constituencies, empowerment of teachers, and leading the change.

In an examination of teachers' perceptions of how administrators helped teachers change their beliefs about teaching mathematics, Foley (1993) identified three major implications:

> First, the role of the principal in the change process was crucial. One teacher in this study said that change occurs at our school because of our principal. Principals can make the difference between success and failure in educational change. Genuine school reform will only take place by starting with the world of teachers in individual classrooms.
>
> Second, even traditional teachers will change their teaching methods and beliefs if they are empowered to make the decisions that will impact their classrooms. Teachers indicated they were more willing to attempt new teaching methods, however, when a risk-free atmosphere was provided by the principal. Teachers responded that they felt they could try new techniques and possibly fail with no fear of reproach from the principal. The teachers felt empowered to change at their own pace and determine when their participation would commence.

> Third, a collaborative planning structure must be implemented. The teachers felt appropriate staff development and on-going training was provided by the principal when it was critical for the process to proceed successfully. (pp. 14-15)

Studies conducted by Hord and Goldstein (1982), Hord and Hall (1987), and Hord and Huling-Austin (1986) examined day-to-day behaviors of principals in an attempt to identify specific concrete behaviors that helped teachers in their improvement efforts. These studies delineated principal interventions in the implementation of new curricula.

Current commentaries consistently emphasized the importance of the principal's role as instructional leader (Conley, 1993). It was clear that principals were expected to exercise this role. A large, in-depth study of principals as change facilitators was initiated by the staff of the Research and Development Center for Teacher Education at the University of Texas (Hord & Hall, 1987). The activity or inactivity on the part of the principal was so powerful that the role of the principal greatly influenced the success of the change initiative.

In the Hord and Hall (1987) study, the researchers used the Principal Teacher Interaction (PTI) Study Instrument to analyze what principals do on a day-to-day basis to induce curriculum implementation and school improvement. For one year, the study documented the interventions of principals and others facilitating implementation of new curriculum programs in nine elementary schools across the United States.

Hord and Hall (1987) generated a list of possible factors in the change process within a school. The influence of the principal was seen as the most powerful factor influencing the success of the change initiatives. As a consequence, the researchers hypothesized that the degree of implementation in school change is related to what the

principal does. Another finding was the discovery of a second change facilitator (CF) who assisted in the change process. The second CF appeared to play a complementary role to that of the principal. The configuration of a change facilitator team was a key to understanding the change process and had direct implications for training and future research on school improvement efforts. The second CF was linked with the role of the principal in influencing change initiatives within the schools.

It was found that principals play an important role in facilitating school improvement. The PTI study showed that in order to provide smoothly organized support, effective principals engaged in many different actions, including continuous planning, formulation of new policies and the adaptation of existing ones, staffing and restructuring of roles, seeking of materials, information, space, and other needed resources. Effective principals also provided staff development and in-service training to support teachers in the implementation process.

Hord and Goldstein (1982) studied behaviors of principals in facilitating change by examining the principals' interventions with the staff involved in the school change. Findings from their research included the following points regarding the principal's role as a change facilitator. The principals in their studies had a managerial role in the change process. The principals' activities included developing supportive structures, providing organizational arrangements, serving as monitors and evaluators. During the debriefings, the principals did not view many of their interventions as being important nor did the teachers recall many of the activities the principals did. Hord and Goldstein concluded that "one year won't do it for implementation, if the innovation is complex or requires much change in teacher practice. Principals must recognize that their role as change facilitator does not come to an end after just one year" (p. 20).

These studies confirmed that principals are a critical factor in facilitating school improvement. Therefore, it is important that principals are involved in the changes being initiated by the NCTM Standards.

Teachers' Role in the Change Process

The Role of Teachers' Beliefs in the Change Process

Teachers of mathematics know from experience that reform documents and agendas for change do not of themselves bring about changes in classroom teaching (NCTM, 1991). The NCTM Standards called for significant change in the teaching of mathematics so that all students are enabled to learn more and different mathematics information and processing. The Standards also required a fundamental change in mathematics curriculum and mathematics instruction (Neiss, 1992). Teachers' instructional practices, in part, created a learning environment or climate for learning. Therefore, it was important to know which factors, reflected in actual classroom practice, were influencing teachers' instructional decisions. Research indicated that teachers' beliefs and teachers' knowledge were related to the instructional decision-making process (Fennema & Franke, 1992; Pajares, 1992; Thompson, 1992). Thus, what a teacher believed about teaching and learning mathematics and what a teacher knew about the content, methods, and materials available to teach mathematics influenced the teacher's instructional decision. All good teaching requires teachers to plan, but the kind of mathematics teaching and curriculum envisioned in the NCTM Standards relied heavily on teachers' judgments, knowledge, and beliefs (Putnam, Heaton, Prawat, & Remillard, 1992). Therefore, it was important to know teachers' knowledge and beliefs prior to their assignment to mathematics classrooms and prior to initiating a change. Teachers' knowledge and beliefs influence their judgment and consequently their teaching.

Teachers' perceptions of mathematics played an important role in teachers' implementation of the NCTM Standards. "One's conceptions of what mathematics is affects one's conception of how it should be presented. One's manner of presenting it is an indication of what one believes to be most essential in it" (Hersh, 1986, p.13). In a study of four fifth-grade teachers, Putnam, Heaton, Prawat, and Remillard (1992) found that the teachers' teaching practices were complex and highly dependent on the teachers' beliefs and knowledge. They also felt that facilitating meaningful change for these four fifth-grade teachers in the mathematics curriculum required these teachers to rethink their present teaching practices and learn new mathematics content. Studies also showed that teachers' beliefs about mathematics and its teaching played a role in shaping the teachers' instructional behavior (Dougherty, 1990; Grant, 1984; Kesler, 1985; Marks, 1987). Therefore, if mathematics curriculum was to resemble the NCTM Standards, then teachers would have to change. Teachers in this case were the objects and the agents of change (Cohen, 1990). Reformers cannot simply tell teachers to teach differently. "And it seems unlikely that this sort of critical change can take place without thoughtful consideration of teachers' knowledge and beliefs and the role they play in shaping instruction" (Putnam, et al., 1992, p. 226).

The authors of the NCTM Standards (1989) stated that they "were confident that many teachers are now ready to teach the kind of mathematics program outlined in the Standards" (p. 253). Research in the area of teacher change indicated that failure to recognize the role that teachers' perceptions played in shaping their behaviors resulted in misguided efforts to improve the quality of mathematics instruction in schools (Thompson, 1984; von Glaserfeld, 1988). A growing number of teachers were implementing the NCTM's Standards. This phenomenon required a significant shift in teachers' beliefs and

practices about mathematics teaching and learning (Wood, Cobb, & Yackel, 1991). The "key to school mathematics reform, however, is teacher empowerment. Teacher empowerment had three aspects: teacher knowledge, teacher beliefs, teacher authority. Teacher knowledge has two sub-components: a mathematical content knowledge and pedagogical content knowledge" (Chambers, 1990, p.551).

> Mathematical content knowledge and pedagogical content knowledge will be of no use to teachers whose beliefs cause them to reject that knowledge. Too many teachers are limited not by their lack of knowledge. . . .Teachers who believe that students cannot solve problems until they have mastered facts and algorithms will not be willing to adjust the priorities in the present program and are likely to reject knowledge that presents an opposing view. Teachers' beliefs, as well as their knowledge, must receive greater attention at both the preservice and the inservice levels. (Chambers, 1990, p.551)

Thus, it was necessary to determine teachers' beliefs about the Standards because beliefs help in understanding why teachers organize and run classrooms as they do. However, when a need is perceived, these beliefs can be changed. Fenstermacher (1979) suggested that "teachers' subjectively reasonable beliefs, once reflexively recognized, could be altered or transformed by being shown to be objectively unreasonable. Teachers would need to be helped in becoming reflexive and self-conscious of their beliefs and presented with objective data on the adequacy or validity of these beliefs and practices only if alternative or new beliefs are available to replace the old" (p.157). Therefore, educational reform programs, like those NCTM endorses, should take teachers' existing beliefs into account (Eisenhart, Shrum, Harding, & Cuthbert, 1988).

Cooney (1990) argued that the success of the current reform movement was contingent upon teachers' abilities to shape the classroom and to create learning environments that were conducive to teaching mathematics according to the NCTM vision. Research on teachers' beliefs about teaching and learning mathematics showed that epistemological shifts must take place (Wood, et al., 1991). Brosnan (1994) further claimed that beliefs about mathematics had a tremendous effect on mathematics performance. Also, subject-matter beliefs of teachers have been shown to have significant impact in the learning of mathematics (Anderson, Anderson, Martin, & Romagnano, 1993). Kapan (1992) added that changes in teacher beliefs were generally not affected by reading and applying the findings of educational research. Instead, teachers make changes through actual practices. They analyze their own teaching practices and use teaching methods shared with them by other teachers. When teachers do use information from outside sources, they filter it through their own belief systems and translate it into one that is workable and compatible with their own unique teaching style. Kapan (1992) further explained:

> the more one reads studies of teacher belief, the more strongly one suspects that this piebald form of personal knowledge lies at the very heart of teaching. Teacher belief appears to arise out of the exigencies inherent in classroom teaching, it may be the clearest measure of a teacher's professional growth, and it appears to be instrumental in determining the quality of interaction one finds among the teachers in a given school. (p. 85)

Researchers found that the instruction the teacher provides to students usually reflected the actual nature of a teacher's beliefs (Kapan, 1992). Bunting (1984) suggested that "assuming a variance between teacher beliefs and teacher behavior, knowledge of the

content of beliefs becomes an important first step in the identification of variables within the educational context which mediate between the thinking and practice of teachers" (p. 198).

This review of research and literature confirmed the need for research in the area of teachers' beliefs about the NCTM Standards before studying the implementation of the Standards. Beliefs must be present before teachers will change their instructional practices. The literature and research review also confirmed the importance of teachers having time to talk and plan together to make changes in the mathematics curriculum. Knowing schools who have gone through the process will be beneficial to those beginning the change process.

Role of the Teacher in the Change Process

At the teacher level in the change process, the degree of change was strongly related to the extent to which teachers interact with each other (Conley, 1993). "Significant educational change consists of changes in beliefs, teaching style, and materials which can only come about through a process of personal development in a context of socialization" (Fullan, 1991, p. 121). Research indicated that teachers must participate in staff development workshops and have conversations about the meaning of the change being proposed in order for change to take place (Werner, 1980). Time for change was a crucial element missing in most teachers' schedules. Teachers must be given the time to plan and discuss ideas with peers in order to incorporate and have time to personalize changes into their own belief systems and teaching styles.

Changes in school mathematics can occur only if it is also recognized that teachers are key figures in the reform process. Low mathematics performance by students, in national and international studies is usually associated with poor teaching (Ball, 1988, dos

Santos, 1993). In particular in the United States and Canada there was a strong call for school mathematics reform and for developing mathematical literacy and mathematical power in all students (NCTM, 1989, 1991, NRC, 1989). As Carlson (1992) wrote,

> Clearly, the success of today's mathematics reforms rests with the teacher. The best assessment or curriculum materials in the world won't do any good unless we do something about teacher education. . . .The success of the Standards depends on two things. How well they will be carried off by the classroom teacher and how well the classroom teacher will be supported to be able to do it. That means formal training and it means monetary support for that training. (p. 21)

If reform in learning mathematics were to be successful, attention had to be given to existing practices of mathematics teachers. As the view of learning mathematics has changed, so must the practices of teaching mathematics change (NCTM, 1989, 1991, NRC, 1989). Several factors played a role in the steps from introduction of a change to full implementation. NCTM identified three principles for successful reform which involve teachers in the process:

> 1. Any program that seeks to enhance the quality of teaching and learning in mathematics must allow teachers to develop, in practical terms, a clear vision of what these changes mean for their own personal professional behavior. It implies that teachers actively reflect on their current practice and make a professional commitment to work toward an improved and expanded repertoire of teaching skills.
>
> 2. Exemplary curriculum materials can help teachers think about their current roles, try out new roles, and modify the way they teach.

> 3. Reshaping the teaching of mathematics requires that teachers have access to a sustaining and well-structured environment for their professional growth. (NCTM, 1990, p. 230)

Chambers (1990) stated that beyond the essential characteristics of the new vision of school mathematics, teachers should be able to discuss the rationale for this particular vision. "Where do teachers get the initial impetus to acquire, study, and discuss the changes being introduced into the schools? In many cases, this impetus will come from a teacher in the district who initiates discussions with colleagues" (Chambers, 1990, p. 551). More frequently, however, the impetus may come from outside the district. This may be through the intervention of an outside consultant, a review by an accreditation team, or an audit by the state education agency or, as in this case, by a national educational organization, NCTM. As Connolly (1988) argued: "studies of school reform and resistance to it, yield a view of teacher agency such that curriculum plans, whether of milieu, subject matter or learner, flounder or prevail on the activities of the teacher" (p. 10).

If educators wanted to improve schools, then it was important that they understand more about teachers and about the role they play. "It is also important to understand how teachers change and grow so that we, as teachers and teacher educators, can make informed decisions about how best to support the change process" (Stephens, Gaffney, Weinzierl, Shelton, & Clark, 1993, p. 2). Shulman (1986) described this challenge, proposing that initiatives for change "must be designed as a shell within which the kernel of professional judgment and decision making can function comfortably" (p. 591). He argued that such initiatives cannot determine directly teachers' actions or decisions, and he concluded that they can at best "profess a prevailing view, orienting individuals and

institutions toward collectively valued goals, without necessarily mandating specific sets of procedures to which teachers must be accountable" (p. 501).

Mathematics Reform

Mathematics reform has been the focus of national reports, professional organizations, and state and local agencies. Mathematics is an important part of the curricula and becomes an area of concern when American students are compared to students in other countries. Mathematics of the 1990s were centered on the NCTM Standards developed by the professional organization, NCTM. It was a time of change involving the curriculum, pedagogy, and assessment of mathematics. The National Council of Research (1990b) reported that according to experts in the field of mathematics, "we are entering a decade in mathematics education of transition from entrenched pre-computer traditions to new structures appropriate to the 21st century" (p.63). The mathematics reform effort was initiated from a substantial amount of research which indicated that students who had hands-on, concrete experiences in mathematics exhibited a higher mathematical achievement (Canny, 1984).

National Reports

The mathematical content of the 1990s school curriculum was about 500 years old (NRC, 1990a). There had been numerous attempts to change the mathematics curriculum in American schools, beginning with the Committee of Ten in the 1890s and including the "new math" of the 1960s and the NCTM's Agenda for Action of 1980 (NRC, 1990a). The 1950s and 1960s witnessed an explosive growth of reform bent on improving the teaching of mathematics in American schools (Grouws, 1992). The 1960s were a time during which a flood of curriculum reform projects in various countries were reported and became collectively known as the new math (Cooper, 1985). Groups in the United States

were also at work discussing the crisis in mathematics. Educators at Ball State Teachers College, University of Maryland, Southern Illinois University, and Boston College started examining high school mathematics for weaknesses and expressed their concerns with the College Entrance Examination Board. From these groups, an abundance of professional publications, filled with articles detailing classroom experiments and debating the psychological and philosophical implications of curriculum revision, brought the mathematics debate to professional attention (Suydam, 1968).

On October 4, 1957, the Soviet Union launched Sputnik I providing additional impetus and injecting the factors of national prestige and national security into the picture of needed mathematics reform (Wooten, 1965). This technological achievement by the Soviet Union raised questions regarding the mathematics curriculum in the United States that carried the controversy out of the world of scholars and into the public domain. "The pressures on school administrators to do something about mathematics noticeably increased. In this climate of turmoil, debate, and public apprehension, the School Mathematics Study Group (SMSG) came into existence" (Wooten, 1965, p. 7). In 1958, SMSG was established and became the largest and best known project on mathematics curriculum. SMSG was given the task of transforming the national goals into operational school programs. Curriculum was written, tested, revised, and published for grades K-12. This curriculum was used in the United States and translated to 15 different languages to be used in other countries. In 1972, SMSG concluded its official work when public funds were no longer available.

With the publication of A Nation At Risk (1983), another major wave of educational reform began. The Mathematical Sciences Education Board (MSEB) group under the direction of Edward Begle was created in 1985 to provide a continuing national

overview and assessment of mathematics education. The MSEB began the search for ways to change school mathematics and provide a national voice for mathematics education in Washington, DC (Grouws, 1992). At this time, the United States Department of Education and the National Science Foundation also invested millions of dollars in research and teacher education. The MSEB led to multiple task forces and various groups becoming involved in the reform of mathematics education. A number of reform reports were generated by these groups. These reports, in turn, prompted a call for changes in mathematics programs in the United States. Edwards (1994) observed that:

> The 1990s reform effort in mathematics education has its roots in the decade of the 1980s and the national reports that focused attention on an impending crisis in education, particularly in mathematics and science (e.g., An Agenda for Action, 1980, A Nation at Risk, 1983, and A Report on the Crisis in Mathematics and Science Education, 1984). It received further impetus with the publication by the NCTM of Curriculum and Evaluation Standards for School Mathematics (1989) and Professional Standards for Teaching Mathematics (1991). The Mathematical Sciences Education Board (MSEB, 1990) urged that school mathematics programs be revised and updated to reflect the NCTM Standards. (p. 2)

The review by Edwards (1994) illustrated the changes adopted but other reports and committees were also involved in the change process. Fitzsimmons and Kerpelman (1994) indicated that over the past decade the public was increasingly concerned about the need for quality in America's schools. The public was particularly concerned about the skill level of students. The press reported on various documents and research done by different commissions which addressed the problem in public education. These reports indicated several factors that have caused these problems. The key factors influencing the

need for school reform were categorized by Fitzsimmons and Kerpelman (1994) and Conley (1993) as problems with student learning, in future economic development, and in technological advances.

Fitzsimmons and Kerpelman (1994) concluded that test results of student performance indicated that United States students performed poorly when compared with other industrialized countries. Schools in the 1990s continued to use outdated textbooks as the central teaching tool which caused students to learn outdated materials (Conley, 1993). Schools continued to cling to the division of academic disciplines rather than providing a problem-solving approach (Conley, 1993).

In the area of economic forces, the United States appeared to be losing some of its competitive edge in the world market (Fitzsimmons & Kerpelman, 1994). The global economy required workers to travel outside the United States; thus United States students should have a competitive edge in mathematics and science (Conley, 1993). Fitzsimmons and Kerpelman (1994) further added:

> The nation's future economic development will be critically dependent upon preparing an adequate work force . . . . Related to these concerns, the average citizen needs to understand science and mathematics better in order to make intelligent decisions about such issues as health care and its costs, the environment and its degradation, and employment and careers. (p. 26)

Key technology forces included the fact that many technologies invented in the United States were being developed and marketed outside the United States (Fitzsimmons & Kerpelman, 1994). Businesses of all types were using computers, and employees were expected to be computer literate. Schools, however, were not funded in a way that they could keep up with the continuous changes in technology (Conley, 1993).

As illustrated by these educational reform reports and other societal forces, educational reform evolved and grew in the United States during the last quarter of the 20th century. Clearly, mathematics education was a concern in each of the reforms.

National Mathematics Reform

The document, Everybody Counts (NRC, 1989), called the nation's attention to curriculum and instruction that were behind the times. The document drew attention to the fact that the present curriculum and instruction reflected neither the increased demands or higher-level thinking skills nor what was known about the best ways for students to learn mathematics. One of the most visible national reforms involving mathematics education was stimulated by the release by President Bush and 50 state governors of the national goals for American education (Deal & Peterson, 1991). By the year 2000, they agreed,

> American children should begin school ready to learn; graduate from school at a rate of 90 percent; demonstrate competence in challenging subject matter and be prepared for citizenship; rise to first in the world in mathematics and science; attend safe, disciplined, and drug-free schools; and join the work force as literate adults and responsible citizens. (Deal & Peterson, 1991, p. 2)

Many mathematical educators and professionals perceived that additional mathematics reform was needed; however, many parents, administrators, and teachers appear satisfied with school mathematics. Apparently, there was a need to expand the awareness of the need to reform school mathematics. Various reports, such as The Underachieving Curriculum: Assessing U.S. School Mathematics From an International Perspective (McKnight, 1987), The Mathematics Report Card: Are We Measuring Up? (Dossey, Mullis, Lindquist, & Chambers, 1988), and Everybody Counts: A Report to the

Nation on the Future of Mathematics Education (NRC, 1989), addressed the need for awareness on the part of educators and all other stakeholders.

The message of these reports indicated "all major components of mathematics education--curricula, teaching, teacher education, testing, textbooks, and software--must change significantly in some reasonably coordinated manner and reach a much broader audience" (NRC, 1989, p.87). Mathematics educators examined the past reforms, such as the new math, to learn from its implementation. In the instances where the new math curriculum was extensively and carefully implemented, it produced significant gains in student performance. However, in most instances, the lack of communication was a major roadblock. Very little was written about new math and few educators understood its rationale. Most educators, therefore, were unable to discuss it with their peers or the public. The fast pace in which students were to learn the new math was not realistic. Change takes time and must be implemented slowly. Despite its drawbacks, the new math taught educators some valuable lessons. Among the most important, as stated by Carlson (1992) "was that any successful effort to improve mathematics curriculum and instruction in the schools will require an extensive public information campaign that reaches all the varied constituencies of mathematics education" (p. 15). This sentiment was echoed by Bush (1993):

> Educational reform is complex. It requires coordinating many components and involving many individuals with varied perspectives, expertise, and influence. No one group can reform education. All parties must take responsibility for the current status of education and act in unison toward reform. (p. 166)

Later results of the International Assessment of Educational Progress (IAEP) in the Mathematics and Science areas showed the United States as last in overall

achievement (Lapointe, Mead, & Askew, 1992). This study, as did three previous studies, heightened the concern of the public, educators, and business leaders for the apparent failure of American education to adequately address mathematics. According to these results, basic skills improved but the study revealed a persistent weakness in higher-order thinking skills among American students.

> The United States has been involved in an educational reform effort for more than a decade. This effort, stimulated by the report of a National Educational Excellence Commission, was being carried out by governors and legislators: mathematics particularly has been a target for improvement. (Lapointe, Mead, & Askew, 1992, p. 117)

The National Assessment of Educational Progress (NAEP) found no sustained improvements in mathematics and science for the period 1990-1992, although there had been a small recovery from the declines during the 1970s (National Council on Education Standards and Testing, 1992). America's schools, as constituted, were the products of an industrial era that ended in the 1940s. However, school mathematics curriculum continued to reflect the industrial needs of the 1920s, not the 2000s. It was argued that to be economically competitive in the 21st century, all students will need to know more mathematics and problem-solving and processing mathematics that is different from the drill-and-practice mathematics currently taught in the programs of most American schools (Romberg, 1990). The real cause, in Romberg's (1990) opinion, underlying the need for change in school mathematics was the shift from an industrial to an informational society. The most compelling evidence for this change came from business and industry.

National Council of Teachers of Mathematics' Reform Effort

The NCTM has taken a leadership role in the mathematics reform effort in the United States. It has written three professional documents outlining a vision for mathematics teaching, learning, and evaluation. The following narrative explored the journey taken by the orgzanization.

Historical Perspective

A Nation at Risk (NCEE, 1983) and other reform reports led the NCTM to the realization that a change was needed in the mathematics curriculum and instruction (Lindquist, 1993). The National Council of Teachers of Mathematics (1989), therefore, also went through a reform as it forged in a new direction to assist in the goal of helping students to become first in mathematics and science. These educational reforms lead to the establishment of standards by NCTM. These Standards were directly formulated from the national and international studies, from business leaders and public concerns, and from educators' concerns over the lack of mathematics achievement of the United States students when compared to students in other parts of the world (NCTM, 1989). This discourse generated the historical perspective to help explain the reasons NCTM perceived a need to develop its standards. According to Mary Lindquist (1993), past president of NCTM,

> Ten years ago, critics of our education system produced A Nation at Risk. Many charged that too little was being done to educate our youth. Standards are too low, and students were not prepared to embrace the challenges and opportunities of the world around us. . . . That monumental report, while startling some, served to strengthen the resolve of mathematics educators. . . .We realized that if we are to enhance our education system, we must raise our standards. If we are to

> prepare our students for the future, we must use the technology of today. If we are charged with laying a foundation for students' success, we must teach mathematics with real-world application, mathematics that makes sense, mathematics that instills in our student the confidence to say "I can."
>
> Out of this situation was born NCTM's Curriculum and Evaluation Standards for School Mathematics published in 1989. The vision of mathematics reform presented in that document transformed mathematics education. . . .We must have standards for instruction, not just for curriculum and evaluation. From this principle was formed NCTM's Professional Standards for Teaching Mathematics, published in 1991. (p. 64)

The NCTM Standards were produced in response to the calls for reform in the teaching and learning of mathematics presented in A Nation at Risk (National Commission on Excellence in Education, 1983) and Educating Americans for the 21st Century (National Science Board Commission on Precollege in Education in Mathematics, Science, and Technology, 1983). The reports argued that schools were failing to educate students to be productive employees in the current workplace (ETS, 1991).

Romberg (1990) indicated that,

> All students should be taught to reason, to design models, to create, and to solve problems. The most important attribute of the information economy is that it represents a switch from physical energy to brain power as the driving force and from concrete products to abstractions as the primary outcomes. The reform for changes in mathematics was brought about through numerous reports. (p. 469)

These problems of mathematics curriculum not matching the necessity of the business, economic, and technological world led many researchers and writers to discuss

the need for systemic reform of the entire school curriculum in mathematics. Systemic reform was defined as reform in which all the key components of the various parts that make up the whole system are involved. Systemic change in the area of mathematics curriculum should begin with clear standards and a consensus on what children should know and be able to do (McKinney, 1993). Standards enable people to work on every part of the system that is affected by the change. With standards, people are able to share a common goal and can work together for better outcomes. The standards allow the students, teachers, administrators, parents, teacher educators, textbook publishers, test publishers, and other stakeholders to work together for educational success. McKinney (1993) saw the need for standards and wrote:

> In the absence of consensus about standards, systemic reform is impossible, because each part of the system will continue doing what it is already doing. The gap between the pieces will be even larger, as different parts of the system continue to push in different directions. Without consensus on standards, systemic reform is jargon without meaning. Systemic reform drives change; when you don't have system reform, change is only temporary. Systemic reform is a new concept for the field of education which is accustomed to doing one thing at a time. (p. iv)

Systemic change of mathematics curriculum cannot be realized without broad support from the educational community. Nor can systematic change of the mathematics curriculum occur without all members of the learning team--students, parents, school administrators, and policymakers--as major participants in the process. All key members are needed to advance the reform effort and transform it to its highest potential (Lacampagne, 1993). Past reform efforts, like the "new math" and back-to-basics movements, died out because all members of the learning team were not involved. It was

evident that teachers cannot accomplish reform alone. "A coordinated school-based reform effort guided by world class standards in mathematics is necessary to transform the mathematics curriculum, teaching methods, and student assessment," asserted Lacampagne (1993, p. 16).

Standards drive all other aspects of systemic reform by giving the group or organization a measure to work toward. Basically, standards provide a foundation on which to build (McKinney, 1993). "In the mid-1990s, American education stood at a turning point, moving for the first time toward a consensus on what children are to learn. The mathematics standards set by NCTM pointed the way toward what needs to be done" (McKinney, 1993, p. iv). They established clear goals and created a consensus about what all children should learn in mathematics.

Major curriculum reform was not new to the school mathematics field, according to Lacampagne (1993). The reform of the new math of the late 1950s and 1960s was a major reform experience for school mathematics. The new math emphasized the unifying mathematical concepts of logic and set theory (Lacampagne, 1993). The new math reform, however, did not receive widespread acceptance. According to Lacampange (1993), the "new math" reform did not receive this acceptance because it did not pay close attention to how students learn and what they are capable of learning at different ages. It also did not address what teachers knew about mathematics and pedagogy or how they could best enhance their own knowledge.

The next reform experience for the field of school mathematics was the back-to-basics movement. The back-to-basics movement emphasized rote memorization. The reform movement of the 1990s grew out of the inability of the back-to-basics movement to address higher-order thinking and problem-solving skills, mathematical skills needed in

the work force, new research findings on mathematical teaching and learning, inexpensive calculators and computers, and the continued lack of achievement in mathematics in international comparison studies for American students (Lacampagne, 1993).

In 1985, NCTM went to the National Academy of Sciences and asked for this association's help in making changes. The Academy developed the Mathematical Sciences Education Board (MSEB) as the coordinating board for all the professional groups involved in making changes. Another important step that the NCTM took in creating the standards was to develop a strong teacher agreement and college-level mathematics educators' leadership. At the same time, the MSEB worked with the groups to have the standards endorsed.

In 1986, the NCTM established the Commission on Standards for School Mathematics to address the issues of the need to make changes in mathematics curriculum. This commission composed a cross section of mathematics educators, including classroom teachers, supervisors, educational researchers, teacher educators, university mathematicians, and parent-teacher association (PTA) representatives. The commission's objectives were to produce a set of standards that would provide a vision of mathematics teaching, an evaluation of mathematics teaching, a professional development scheme for mathematics teachers, and a suggested list of responsibilities for professional development and support (NCTM, 1991).

> Over the next three years, the commission developed a document, Curriculum and Evaluation Standards for School Mathematics, which incorporated the suggestions of the mathematics community and is now accepted as the world class standard for mathematics. By a similar process NCTM also developed the Professional Standards for Teaching Mathematics. Both sets of standards have been endorsed

> by groups representing the mathematics community from kindergarten throughout graduate schools, as well as by many other groups with a stake in mathematics education. (Lacampagne, 1993, p. 1)

The Standards were drafted in 1989 and revised in the summer of 1990. The Standards were "a document designed to establish a broad framework to guide reform in school mathematics in the next decade. In it a vision is given of what the mathematics curriculum should include in terms of content priority and emphasis" (NCTM, 1989, p. v). The Professional Standards for Teaching of Mathematics was designed not only to provide a broad framework but also to "spell out what teachers need to know to teach toward new goals for mathematics education and how teaching should be evaluated for the purpose of improvement" (NCTM 1989, p. vii). These two documents were supported not only by NCTM but also by other professional mathematical and scientific organizations including: American Mathematical Society, Association of State Supervisors of Mathematics, Mathematical Association of America, American Association of School Administrators, and National Science Teachers Association.

The Standards were written to "change the epistemology of mathematics in schools. The notion that mathematics is a set of rules and formalisms invented by experts, which everyone else is to memorize and use to obtain unique, correct answers, must be changed. The documents NCTM produced were prepared on the basis of this belief" (Romberg, 1992). The underlying theory being used to change the epistemology was the constructivist theory. Constructivism is not a new concept to education. During the 1930s and 1940s it was the leading perspective among educators in the United States. Teachers in the constructivist theory are facilitators who assist students in constructing their own conceptualizations and solutions to problems. The major educators involved in

advancing the theory were Lev Vygotsky, Jean Piaget, and John Dewey. Vygotsky was a Russian psychologist and philosopher in the 1930s and is associated with the social constructivist theory. He emphasized the influence of cultural and social contexts in learning and a discovery model of learning (Vygotsky, 1978). Piaget and Dewey were the first to develop a clear idea of constructivism and apply it to the classroom. For Dewey, education depended on active learning (Dewey, 1966). Piaget stressed a holistic approach to learning in which students construct understanding through reading, listening, exploring, and experiencing the environment. Piaget's work included several principles for the classroom. The students should be given the freedom to understand and construct meaning at their own pace through personal experiences. The classroom should be a place where learning is an active process. Learning should also be a social process. Students should work in cooperative groups with peer interaction (Piaget, 1973). Constructivism has emerged as a dominant paradigm in education. It is grounded in the fundamental insight that knowlege cannot be acquired through passive absorption and repeated practice, but is a product of the learner's interaction with the world, and is built from a combination of ingredients, some provided by the environment, and some contributed by the learner (Cobb, 1994). NCTM envisioned mathematics teaching and learning that must look dramatically different from the standard mathematics classroom of modeling a procedure and students practicing it. They envisioned instruction as being developed from problem situations with students actively constructed knowledge (NCTM, 1989).

Apple (1992), however, wondered if the Standards went far enough to evoke this change. He stated that the Standards appeared to be a "slogan system" (Kosimar & McClellan, 1961). Apple (1992) stated that he did not mean it to diminish the

powerfulness of the Standards, but to call attention to the areas of weaknesses in the Standards that must be addressed for the change to take place. He stated that

> Slogan systems need to have three attributes if they are to be effective. First, they must have a penumbra of vagueness so that powerful groups or individuals who would otherwise disagree with them can fit under the umbrella. . . . Yet successful slogan systems cannot be too vague. . . . They need to be specific enough to offer something to the practitioners here and now. . . . Finally, and this is most difficult to specify, a slogan system seems to need to have the ability to charm. Put simply, its style must be such that it grabs us. It offers us a sense of imaginative possibilities and in doing so generates a call to, and a claim for, action. (p. 414)

In 1992, NCTM commissioned a group to write another companion document to the two previous standards documents. This document, Assessment Standards for School Mathematics (NCTM, 1995), was to be written to address the need for changes in assessment. The group members prepared the document and received over 2000 critiques and comments from reviewers. In the summer, fall, and winter of 1994-1995, the document was revised, edited, and finally published in May of 1995. The Assessment Standards were designed to expand on and complement, not replace, the Evaluation Standards. NCTM established a clear mission for the assessment standards. The Assessment Standards for School Mathematics have been produced by the NCTM because it believed new assessment strategies and practices needed to be developed to enable teachers and others to assess students' performance in a manner that reflected the NCTM's reform for school mathematics. "For school assessment practices to inform educators as they progressed toward this vision, it was essential to move away from the 'rank order' of achievement approach in assessment toward an approach that was

philosophically consistent with NCTM's vision of school mathematics and classroom instruction" (NCTM, 1995, p. 1).

Rationale for Development of the Standards

NCTM was the leader in mathematics curriculum, instruction, and teacher education even before the Standards project. Leadership in the area of mathematics had been its primary mission. The Standards project was an extension of the leadership NCTM had long provided. The Standards project, however, was very different from any other reforms or curriculum guidelines that NCTM had done in the past. Even standing alone, the new Curriculum and Evaluation Standards for School Mathematics were more comprehensive than earlier NCTM curriculum guidelines. The formulation of the NCTM Standards required a tremendous amount of effort and time to develop, disseminate, and implement this comprehensive set of national standards for school mathematics in the United States (Crosswhite, 1990). "To understand the Council's motivation for developing national standards or to judge their appropriateness, the context within which this project evolved needed to be examined" (Crosswhite, 1990, p. 454).

"In the mid-1970s, there was a growing concern among professionals in mathematics education that the school curriculum was being narrowed by what has been called the back-to-basics movement. That movement seemed to continue a cyclic pattern of overreaction that has characterized the history of school mathematics in this country" (Crosswhite, 1990, p. 454). Reacting to the narrowing effect on mathematics curriculum of the back-to-basics movement, An Agenda for Action (NCTM, 1980) was written from NCTM's commitment to develop a set of recommendations for school mathematics. An Agenda for Action and the National Council of Supervisors of Mathematics' Position Paper on Basic Mathematics Skills (NCSM, 1978) which focused on the

underachievement of American students in international comparison in mathematics could be viewed as progenitors of the Standards Project (Crosswhite, 1990).

Subsequent to the release of the NCTM's An Agenda for Action (1980), there was an explosion of concern for science and mathematics education in America's schools (Lacampagne, 1993). After the release of A Nation at Risk: The Imperative for Educational Reform (NCEE, 1983), a spate of national commentaries were written indicating the critical conditions of our schools and critical problems with our science and mathematics education in particular. International comparative studies of student achievement added increased national concern over the state of American schools.

> Curriculum was specifically identified as a contributor to an unacceptable achievement pattern for U.S. students in The Underachieving Curriculum: Assessing U.S. School Mathematics from International Perspective (McKnight, 1987). Based on this and other studies, a symposium on international comparative studies sponsored by the Mathematical Sciences Education Board crystallized the national concern even as early drafts for the Curriculum and Evaluation Standards for School Mathematics were being written. All of this activity created an atmosphere that was much more receptive to the notion of national standards for school curricula than had historically been true in the United States.
>
> Less well-known, but concurrent with A Nation at Risk, was the report of the National Science Board Commission on Precollege Education in Mathematics, Science, and Technology (NSB, 1983). This report, titled Educating Americans for the 21st Century, identified many of the curricular issues addressed in the NCTM Standards. The Mathematics Sciences Curriculum K-12: What Is Still Fundamental and What Is Not (CBMS, 1982) was prepared as source material for

the commission to use in developing the Standards. The reports of two national conferences, School Mathematics: Options for the 1990s (Romberg, 1984) and New Goals for School Mathematics (CBMS, 1984) should also be acknowledged as immediate precursors of the NCTM Standards. The Standards and their motivation are also clarified by contemporaneous documents, such as Everybody Counts (NRC, 1989) and Reshaping School Mathematics (MSEB, 1990).

> Never before had a professional organization of teachers undertaken the task of specifying national standards for school curricula in its discipline. In fact, in the formative stages of this project, NCTM was widely advised not to use the word "standards" or in any other way suggest that they might be advocating a national curriculum. The U.S. tradition of local control of schools caused many persons involved with educational agencies to have difficulty separating the notion of national leadership from the specter of federal control. It was not easy for some, even among the NCTM membership, to see that national professional standards need not, and in fact they did not, pose a threat to local autonomy. The NCTM Standards describe a vision for school mathematics; they did not prescribe a curriculum. Local options and local initiatives determine how well and to what extent that vision would be realized. There could be wide variation in specific approaches to curriculum consistent with the NCTM Standards. (Crosswhite, 1990, pp. 455-456)

The process by which these new standards were developed also represented a new dimension in NCTM's professional leadership. In the past relatively small committees had written and developed curriculum guidelines. These NCTM guidelines were then approved by the Board of Directors. "Although it was widely disseminated, like most

documents of its ilk, An Agenda for Action ultimately came to rest on many educators' shelves" (Ball, 1991, p. 1). A more ambitious move seemed necessary. Because the Standards had to be communicated to all the stakeholders through a formally written document, it was necessary to create a sharply defined set of positive statements which clearly indicated a change in the professional philosophy of mathematics educators.

By custom, NCTM task forces were selected carefully, with an eye to representing the professional, geographic, gender, and racial diversity of its membership. The writing groups included experienced teachers, researchers, and teacher educators, from a variety of settings, and with diverse kinds of professional experience. The working groups brought together to develop the Standards had among their members' resources "to interweave the tried-and-true with the novel and idealism with realism" (Ball, p. 1). The group members brought different ideas, ways of talking and thinking and their different representations and commitment. There were countless arguments about words, the prominence of different ideas, and the style of the presentation (Ball, 1991). A first draft was hammered out of the different points of view represented in the group.

The first draft of the Standards was sent to every NCTM member, all school systems, and school principals in the United States. It was also subjected to discussion at many NCTM meetings and at meetings of affiliated groups. It was also reviewed independently by both professionals and nonprofessionals in regional forums conducted by the Mathematical Sciences Education Board (MSEB, 1990). This time the NCTM Council expended extra effort to produce a grass-roots movement to disseminate the NCTM Standards. They worked with various groups including textbook publishers and testing companies to ensure support of the standards.

Ball (1991) emphasized the radically different development and process when she wrote,

> The two standards documents produced by NCTM over the past four years represent an unusual step to inflect the character and quality of mathematics education. . . . Motivated by a desire to change the way mathematics is taught and learned in school, these documents move the discourse boldly behind the proverbial classroom door and provide new directions in both content and approach. (p. 1)
>
> Because standardization implied sameness, standards were frequently seen as calls for quality via uniformity. However, this was only one, narrow view of a standard. A standard can also be a rallying place, a stand taken, or a set of principles about what is valued. In this case, the NCTM standards are all of these ideas. As a vision, informed by multiple perspectives--including research knowledge, moral commitments, political motives, and philosophical orientations--the standards are intended to direct, but not determine practice, to guide, but not prescribe teaching. (Ball, 1991, p. 6)

This was not an easy task. Mathematics educators disagreed about everything from curriculum, pedagogy, skills, and even what mathematics is, including what it means to know, do, or use mathematics. NCTM's challenge was to create something around which mathematics educators could rally as a community. And they would need to be able to persuade a wider public of their stand, a public whose views of mathematics were likely to be more procedure and skill-oriented (Ball, 1991).

Georgia's Reform Effort

The state board of education of Georgia recognized the need for state planning to improve mathematics education for Georgia students. In 1988, the state board of education budgeted $60,000 to be spent on a manipulative-based mathematics program to spread hands-on mathematics to schools throughout the state. A state training center was established in Marietta with a full-time educator in charge of helping develop a program which could be used by other state officials to start their own program (White, 1988).

The state board set up a program in which it examined an experimental group's and a control group's scores on the Iowa Test of Basic Skills (ITBS) in the Marietta City Schools. In the mathematics concepts area on the ITBS, the experimental group scored in the 70th percentile compared with a score at the 63rd percentile for the control group. In the problem-solving area, the experimental group scored in the 72nd percentile compared with a 62nd percentile score for the control group. The greatest gain appeared in the math computation area where the experimental group scored at the 72nd percentile as compared with the control group which scored at the 58th percentile. This experiment in the minds of the state board of education validated the need for hands-on mathematics in Georgia schools (White, 1988).

In 1991, at the Georgia 2000 Conference, Governor Miller stated that he wanted schools in Georgia to become New American Schools as designated by the America 2000 goals established by President Bush and the nation's governors. This task would be difficult for all Georgia schools to accomplish. One of the goals was to lower the drop-out rate to 10%. Georgia's dropout rate at the time was 40%. Another goal was for all students to be competent in five core subjects. However, by 1995, only one national

competency level could be measured and that was in mathematics. Presently, only 15% of Georgia's 8th graders measured up to the national standards (White, 1991).

These statistics, however, did not deter Georgia educators and Governor Miller. In 1992, the state board of education applied for and received two federal grants: one from the National Science Foundation and the other from the United States Department of Education. The purpose of the grants was to teach mathematics to 6th- through 8th-grade students in a new and more appealing way (White, 1992). The project was called the Georgia Initiative in Mathematics and Science (GIMS).

On March 31, 1994, President Clinton added more significance to the curriculum reforms when he signed into law a group of measures to help students meet challenging new academic standards. The act established eight goals to be met by the year 2000. To achieve these goals, eight boards were established to develop course content standards that could revolutionize teaching methods, textbooks, and testing. States would not be required to adopt the standards, but the act offered an incentive: nearly $5 billion in grants during the first five years (White, 1991). A national board was appointed to oversee the grants and to measure progress toward the goals. The only content standards that had been developed and approved at the time were the NCTM Standards.

Georgia's response to this act was explained by former Georgia School Superintendent Werner Rogers who stated that it was a great day for the education of Georgia children. He further iterated that the act signed by President Clinton was being offered as voluntary and the state of Georgia would volunteer (White, 1991). Rogers stated that more than 100 communities across Georgia already embraced Goals 2000 (called America 2000 in its earlier six-goal version by the Bush administration).

From these different events, various organizations that had mathematics education as their primary mission were sparked to play a role in the transformation of mathematics education in the state of Georgia. The three major professional organizations were the Georgia Council of Teachers of Mathematics, the Georgia Council of Supervisors of Mathematics, and the Georgia Coalition for Science, Technology, and Mathematics Education. The major state systemic effort was the Georgia Initiative in Mathematics and Science (GIMS).

Georgia Council of Teachers of Mathematics

The Georgia Council of Teachers of Mathematics, a professional organization of mathematics teachers, proposed "to encourage an active interest in mathematics and to act as an advocate for the improvement of mathematics education at all levels" (GCTM, 1994, p.1). The organization, affiliated with the National Council of Teachers of Mathematics, had an NCTM representative who was in contact with the National Council of Teachers of Mathematics to inform GCTM of goals and objectives of NCTM. GCTM conducted an annual conference for all members. In the past three years, the various workshops had strands concerning implementation of the NCTM standards. All educators who attended workshops and conferences were exposed to the NCTM Standards as the way to teach mathematics.

Georgia Council of Supervisors of Mathematics

The Georgia Council of Supervisors of Mathematics (GCSM), an organization of all active and retired members of the staffs of Local Educational Agencies (LEAs), Regional Educational Service Agencies (RESAs), institutions of higher education, private education institutions, and the State of Georgia Department of Education, provided supervisory or consultative services in mathematics education. The organization was

formed "to improve mathematics instruction and teacher education programs, to provide an information service regarding mathematics education, and to cooperate with other organizations for the improvement of mathematics education" (GCSM, 1995, p. 1). This organization had supported the efforts taken by the Georgia Council of Teachers of Mathematics. During its annual meetings, held during GCTM's annual conference, the organization held various workshops for supervisors of mathematics on the content and implementation of the NCTM Standards.

Georgia Coalition for Science, Technology, and Mathematics Education

The Georgia Coalition for Science, Technology, and Mathematics Education (GCSTME) was an organization of leaders from the corporate, public policy, and education sectors of Georgia. The Coalition intended to be the "champion" for science, technology, and mathematics in the state. Before the development of GCSTME, a state mathematics coalition (GCEME) was formed in 1989 and 1990 with involvement from teachers, educators, mathematics professionals, business leaders, and public policy sectors. This state coalition for mathematics education was developed primarily to change mathematics education in Georgia so that it aligned with the NCTM Standards. As part of the state systemic initiative (SSI), GCEME was charged with the development of adding a state science coalition. The two groups have merged into the Georgia Coalition for Science, Technology, and Mathematics Education (GCSTME). The mission of GCSTME was "the natural extension of the GCEME's: the Standards must become the vision and then the reality of how mathematics and science are taught and learned in Georgia's classrooms" (GCSTME, 1995, p. 7).

GCSTME was involved in several major projects. Two of these projects, the Ideal Mathematics Learning Environment and Project '92, dealt directly with implementing the

NCTM Standards in Georgia schools. The Ideal Mathematics Learning Environment was a joint model project among GCEME, the Coweta County Schools, the Georgia Power Company, and Southern Mills. The project was developed to implement the Standards and to create an improved learning environment, including teacher excitement, student interest, parental involvement, and administrative and community support (GCSTME, 1995). The goal of Project '92 was to implement the NCTM Standards more fully in Georgia schools. This project was designed to support the Columbus Regional Mathematics Collaborative in developing a group of teachers who would be prepared to make Standards awareness presentations to groups across the state. The project was eventually expanded to other areas of the state (Augusta, Atlanta, and Valdosta) (GCSTME, 1995).

Georgia Initiative in Mathematics and Science

The National Science Foundation provided Georgia with $10 million in funding to implement, over a five-year period, a statewide systemic initiative program called the Georgia Initiative in Mathematics and Science (GIMS, 1992). GIMS targeted middle school (grades 4-8) mathematics and science. It focused on providing an exceptional middle school science and mathematics education for all students in Georgia. All the GIMS goals stemmed from Georgia's systemic initiative program vision:

> To create a stimulating climate in which all students will "use their minds well," take responsibility for their lives, and contribute positively to the global community--their families, schools, society, and the environment. To achieve these ends, students must become scientifically and mathematically literate. They must construct meaningful and useful understandings of mathematics and science and thereby become: creative problem solvers, critical thinkers, questioners,

experimenters, innovators, effective communicators, and reflective learners.

(GIMS, 1992, p. 1)

GIMS developed a draft of the Georgia Framework for Learning Mathematics and Science which translated national standards for Georgia teachers and defined the content, skills, and habits of mind which should be developed in K-12 classrooms. GIMS also built in the development of the Program for Administrative Support of Science and Mathematics (PASSM). PASSM was created to define and align the support necessary to create a school and school system environment which promoted exceptional mathematics and science learning experiences for all Georgia students (GIMS, 1994).

Other Projects In Georgia

As stated by Chambers (1990), the impetus for change in classrooms most frequently comes from an outside consultant, a review by an accreditation team, an audit by the state education agency, or the district office. Before the implementation of the state systemic initiative, GIMS, various districts had decided to provide teachers with training in hands-on mathematics as suggested by the NCTM Standards. The various initiatives at the system level included the Atlanta Math Project, Muscogee County Schools, Richmond County Schools, Cobb County Schools, and Clinch County Schools.

The Atlanta Math Project, developed at Georgia State University, was an NSF-supported project designed to serve 13 school systems in the metropolitan Atlanta region. The project provided teachers with experiences to expand their knowledge about teaching mathematics consistent with the NCTM Standards. The project offered summer professional development, peer mentoring, on-site school-year support, and teaching and debriefing sessions (Edwards, 1994).

In 1989, the Muscogee County school system developed the Columbus Collaborative, a regional mathematics coalition which proposed to train all teachers in hands-on mathematics. The Collaborative used the Mathematics Solutions program by the Marilyn Burns Company. As a consequent of participation, each teacher had to talk to two groups about the implementation of the NCTM Standards and had to demonstrate various lessons. The coalition also conducted workshops for administrators to familiarize them with the NCTM Standards. By 1994, the Columbus Collaborative had trained 85% of Muscogee County teachers in the utilization of the NCTM Standards (H. Purks, personal communication, October 1994).

Beginning in 1990, Richmond County school system organized a long-range plan for in-service training for their teachers. The system began with 10 kindergarten teachers and used the Mathematics Their Way materials to introduce the teachers to the use of hands-on mathematics. A teacher from Rockdale County Schools taught the workshop and the 10 kindergarten teachers became mentors for the remainder of the system's teachers. In 1991 the district introduced its first-grade teachers to Box-It, Bag-It mathematics and by 1995 third- and fourth-grade teachers were completing their initial training. The district also organized a Middle Grades Mathematics Committee which used the Transitions Mathematics Program (which is based on the University of Chicago School Mathematics Project). Each of the workshops was built around the NCTM Standards and all the schools received a copy of the NCTM Standards and Addendums (S. Craig, personal communication, May 1995).

Clinch County Schools had every kindergarten through fifth-grade teacher trained in the Marietta Hands-on Mathematics Project. These teachers, along with grade-6 through grade-12 teachers completed training on the NCTM Standards (GACIS, 1995).

Cobb County School teachers were also involved in a Mathematics Project Initiative in a similar way. The teachers received in-service training in the NCTM Standards and Addendums and were taught how to use hands-on mathematics in their classrooms.

Most of the school systems in Georgia who have made changes in their mathematics program had initiatives from the district level. A few individual schools made changes in their programs through their own initiatives; however, no studies or other information were found regarding these efforts.

Summary

Schools are dynamic organizations that try to respond to society's expectations about the education of children, particularly the preparation of students for the future. Changes in schooling practices are accomplished as society perceives the need for change in students' preparation. According to the literature reviewed regarding the NCTM Standards, change in mathematics education was needed in order to educate students for the future. The educational change literature suggested that this change could only take place if principals and teachers were part of the change initiatives. The literature also clearly demonstrated that beliefs play a large role in the way teachers believe and in the way principals think classrooms should function. Therefore, it was valuable to examine teachers' and principals' beliefs when implementing change. Equally important was the belief that both principals and teachers should be actively engaged in the change process. For this change to take place, it was imperative that time be set aside for reflection, discussion, and debate.

This literature and research review formed the conceptual framework for the investigation of middle school teachers' and principals' attitudes toward change, in particular, toward the NCTM Standards. The domains were the principals' beliefs in the

NCTM Standards, the teachers' beliefs in the NCTM Standards, the importance of identified principals' roles in the change process, and the factors which influenced the change process. These domains structured the data collection and analysis.

By studying teachers' and principals' beliefs about NCTM Standards in Georgia middle schools, this study proposed to examine schools to discover if professionals' beliefs were compatible with the NCTM Standards. The intent was to gather information from identified schools to determine to what degree change factors were present in identified schools. The principal's role in implementation (or lack thereof) was also investigated.

CHAPTER THREE
METHODOLOGY

Introduction

The purpose of this study was to provide three views of mathematics curriculum reform in Georgia middle schools. The first view was to examine the compatibility between principals' and teachers' beliefs concerning the NCTM Standards in all Georgia middle schools. The second view sought to compare the beliefs about the NCTM Standards from mathematics teachers at grades 6, 7, and 8. The third view was intended to examine the process of change that occurred in identified schools. These schools were selected according to these criteria: schools which were involved in extensive examination of their mathematics program, schools in which the change process had occurred at the building level, schools in which there had been an organized plan for change, and schools in which the principals was perceived as instructional leaders.

The study was divided into two separate parts. One part of the study employed a survey instrument, the Standards Belief Instrument (Zollman & Mason, 1992), and used the entire population of funded Georgia middle schools in order to examine the congruency of beliefs of middle school principals and mathematics teachers about the NCTM Standards. The second part of the study used 15 identified principals as classified by the Georgia Initiative in Mathematics and Science (GIMS) and the Atlanta Mathematics Project and other experts. The second part also used teachers within those identified schools who had been involved with, or were very knowledgeable about, the change process that took place in their mathematics curriculum. Principals were asked to distribute the surveys to all teachers who were knowledgeable and involved in the change

process. This part of the study used an instrument, the Foley Change Questionnaire (Foley, 1992), to examine the role of the principals as change facilitators in their schools, as perceived by the teachers in the schools included in the study, and to examine the presence and degree of four factors which influence the change process.

Research Questions

The questions addressed by this research were:

1. On which, if any, NCTM Standards do teachers agree about their beliefs, as measured by the SBI?
2. On which, if any, NCTM Standards do principals agree about their beliefs, as measured by the SBI?
3. To what degree were teachers' and principals' beliefs different on the 16 NCTM Standards statements, as measured by the SBI?
4. To what degree were different grade-level teachers' beliefs different on the 16 NCTM Standards statements, as measured by the SBI?
5. What factors, as perceived by teachers and administrators, influenced the change process during the mathematics reform effort in their schools, according to the Foley Change Questionnaire?
6. Did teachers at identified schools find their principals to have been active change facilitators?
7. What process or plan did principals at identified schools use to make changes?
8. Who did teachers at identified schools think made the greatest contribution to the change process?

Methodology

The methodology selected for use in this study was chosen because of the nature of the research questions of this inquiry. The survey method was chosen for this study due to the large number of funded middle schools, the wide range of geographic distances, and the ability of the instrumentation to answer the proposed research questions legitimately.

The Likert scale was used with both of the surveys because of its ease of use and its familiarity among the general population. A six-point Likert scale was chosen because this type of measurement yields greater precision. A Likert scale (Murphy & Likert, 1966) has been shown to be superior to other types of attitudinal rating scales (Borg & Gall, 1989).

The instruments used were the Standards Belief Instrument (SBI), developed by Alan Zollman and Emanuel Mason, and the Foley Change Questionnaire (FCQ) developed by Jane Foley. Both instruments were tested for reliability and validity (Foley, 1992; Zollman & Mason, 1992).

Standards Belief Instrument

The Standards Belief Instrument (SBI) contained 16 Likert-scale items. The SBI (Appendix A) proposed to determine a person's beliefs about the NCTM Standards and not his or her knowledge of the Standards. The items were representative of the Standards and did not include every item in the Standards (Zollman & Mason, 1992). The instrument was developed and pilot tested with a group of educators who were familiar with the Standards. After the pilot testing, several words in each statement were capitalized so that respondents would focus on the intent of each item. The instrument was then tested for construct and content validity. A panel of experts was used by the authors to obtain construct and content validity. The panel of mathematics experts were

individuals who either "helped edit, develop, and/or write parts of the NCTM Standards" (Zollman & Mason, p. 360). The authors further tested for construct validity by using correlations between the instrument items or other information, such as text anxiety. The authors used the Spearman-Brown and the coefficient of alpha to determine reliability. The coefficient of alpha (.803) was higher for a group of teachers who had been trained on the Standards than for an untrained group (.493).

A change in the Likert scale was made so that a finer distinction could be made between teachers who "strongly agreed" with the Standards and those who "strongly disagreed" with the Standards. A Likert scale of six points was used instead of the Likert scale of four points used by the authors. This change in the scale did not affect the validity or reliability of the instrument. This change was suggested by one of the authors of the instrument as a means for generating a more precise assessment of respondent beliefs (A. Zollman, personal conversation, April 1995). Questions 8, 9, 10 on the instrument (Appendix A), initially written about the kindergarten through grade-4 mathematics curriculum as developed by the NCTM Standards, were retained in this instrument because the responses from middle school teachers were important factors in their beliefs about mathematics and how it should be taught. The NCTM mathematics curriculum for kindergarten through fourth grade was the foundation for middle grades mathematics and beliefs about those items should be a consistent factor in beliefs about the Standards.

Foley Change Questionnaire

The purpose of the Foley Change Questionnaire (Appendix B) was to provide information regarding the change process in a school following the identification of school sites that had utilized an effective change process (Foley, 1992). The instrument was developed to be used by elementary schools; however, it was an instrument designed to

measure change and did not contain any items that would restrict its use to only elementary schools. The Likert-scale items were developed from the review of research on educational change and the variables that had been known to be present in an effective change process. The four open-ended items related directly to the author's research questions.

The questionnaire was reviewed by five educators for suggestions. A pilot study was then done with 10 elementary principals and 10 elementary teachers. The return rate for the pilot study was 80%. The questionnaire was once again revised. Next, 10 professionals in the field of educational change reviewed the questionnaire and made suggestions about the significance and relevance of each of the items and domains. The questionnaire was once again modified. The final validation of the questionnaire was accomplished with a group of graduate students.

The Foley Change Questionnaire (FCQ) contains 17 Likert-scale items and three open-ended questions. This instrument was constructed to measure four factors that have been known to effect change in an organization. The four factors measured were the principal's role in the change process, the process of change, teachers' roles in the change process, and contextual factors that could influence any change. Principal behaviors that were included in the questionnaire (Questions 1, 2, 5, 6, 11, 12, and 13) were: developing supportive or organizational arrangements and resources, training, consulting and reinforcing, monitoring and evaluating, communicating externally and internally, and responding to concerns (Foley, 1992). The process of change on the questionnaire (Questions 7, 8, 10, 14, 15, 16, and 17) contained elements of these factors: school improvement should take place at the local level; any changes must include all those affected by the decisions; school improvement should follow a systematic plan with a

clearly defined purpose; and research should be used to support and to make decisions about changes (Foley, 1992). The questionnaire items (Questions 4 and 9 and the open-ended questions) measuring teachers' roles in the change process included collegiality, positivism, goal clarity, and continuity (Foley, 1992). The contextual factors (Question 3 and the open-ended questions) encompassed support, involvement, and attitude of the principal; behaviors and leadership skills of the principal; flow of communication; scale of funding; teacher/administrator harmony; and design of the process (Foley, 1992). When analyzing the open-ended questions, the various elements of principals' behavior, teachers' role, change process, and contextual factors were used to code the responses.

The open-ended questions were changed in order to fit this study's research questions better. These questions were examined by Georgia Southern University Educational Leadership professors and doctoral students. The groups made recommendations on wording. The revisions were made to the questions. Miles and Huberman (1984) suggested the use of independent reviews to reduce the possibility of researcher bias that were "serious enough to need correction" (p. 51). Certain adjustments were made to the questions to make them clearer to the assessment of the change process and to make them more relevant to the researcher's study. The Likert scale was also expanded to a six-point scale to allow for finer distinctions among the respondents' scores.

Subjects

Two instruments, the SBI and the FCQ, were used in this study. The SBI instrument used in the first part of this study was sent to the entire population of funded Georgia middle schools. The entire population was selected in an effort to obtain the most valid and reliable assessment possible. Middle schools were chosen because the state

initiative targeted them as the first group of schools to initiate changes through the Georgia Initiative in Mathematics and Science (GIMS). The list of funded middle schools was provided by Alice Smith, Coordinator of Middle Grades Education at the Georgia State Department of Education. The list contained the 275 schools that were funded as middle schools for the 1994-1995 school year. Each principal in the 275 schools received an SBI survey. The principal was asked to give all regular mathematics teachers in grades 6,7, and 8 a copy of the survey to complete. A regular mathematics teacher was defined as one who served on a team of teachers and was not a Chapter I or a special education teacher. Georgia defined a middle school as one which contained grade 8 and any other grades within the school. Most of the Georgia funded middle schools had the 6th-through-8th configuration. However, a few of the funded middle schools also had grade 5. These schools were few in number and the researcher decided not to use grade 5 because it would have had a much smaller representation than the other grades. Therefore, only teachers who taught mathematics at grades 6, 7, or 8 were part of the study.

The Foley Change Questionnaire, the second part of the study, used identified principals and teachers in schools where changes in mathematics had taken place. These schools were identified by Georgia's systemic initiative, Georgia Initiative in Mathematics and Science (GIMS) and the Atlanta Mathematics Project and other agencies. Initially the state department was contacted to provide names of persons who were knowledgeable about schools making changes in their mathematics curriculum and who could recommend schools that met the necessary requirements to be included in the second part of this study. The people who were considered experts in this field by the state department were Wanda White, project director at the GIMS office in Athens, and Karen Schultz, director of the

Atlanta Mathematics Project. White and Schultz were asked to give the names of schools which met the following criteria: schools which were involved in extensive examination of their mathematics programs, schools in which the process had occurred at the building level, schools in which there had been an organized plan for change, and schools in which the principals were perceived as instructional leaders.

Wanda White was contacted and provided the researcher with a list of 11 schools which met the requirements of this study. Karen Schultz supplied the researcher with a list which included the names of the same schools given by White and of four additional schools. Only one of these additional schools was used, however, because it was the only middle school.

Follow-up by the researcher led to contacts with Bill Roughhead, head of mathematics at the State Department of Education; the directors of the GIMS Professional Development Centers; Jane Barnard, president of GCTM; Maxine Lee, secretary of GCSM; and various persons who directed the different system level mathematics initiatives in Clinch County Schools, Richmond County Schools, Cobb County Schools, Marietta City Schools, Muscogee County Schools, and Valdosta State University for names of schools which met the research criteria. These individuals gave the names of some of the same schools which were on White's and Schultz's lists. These contacts, however, contributed three more schools to the list of selected schools.

Consequently, a list of 15 schools was obtained by a synthesis of responses by experts. These 15 schools received the SBI survey along with the Foley Change Questionnaire (FCQ). Each principal was asked to fill out both surveys. The principal was asked to give the SBI survey to all mathematics teachers at grades 6, 7, and 8. The principals were asked to give the FCQ to all the teachers who had been actively involved

with, and who were knowledgeable about, the change process that had taken place in their mathematics curriculum. The principals' selection of teachers could have biased the sample; however, the researcher assumed that the principals would include all the teachers who were involved in the change and not isolated individuals.

Design

This study was designed to be a descriptive study of the beliefs of Georgia middle school principals and teachers about the NCTM Standards. It was also designed to determine the role of identified principals as change facilitators in their mathematics program, as perceived by teachers, and to examine the presence of factors related to the change process. Two survey instruments were used to gather these data, the SBI (Zollman & Mason, 1992) and the FCQ (Foley, 1992). Questions were also included to provide some demographic and background information on the subjects (see Appendix A & B). These questions were examined by educational administration professors and doctoral students in the educational administration department. The questions were then modified to provide a more accurate description by the respondents.

The Likert scale on both instruments was changed to a six-point scale. This change was made to force the respondents to make a choice and provide additional levels of discrimination for the data analysis.

Data Collection

The SBI instrument was sent to all 275 funded middle schools as listed in the 1995 Georgia Public Education Directory (Public Information and Publications, 1994). The FCQ instrument was sent to all 15 identified schools. The surveys were mailed to the respondents in the fall of 1995. Each principal was mailed a packet of surveys and a 10 X 13" self-addressed, stamped envelope for returning the surveys. To return the FCQ, a

single, self-addressed, stamped envelope was attached to the individual questionnaire for teachers and administrators to mail back their surveys separately. This procedure was done to protect the teachers' confidentiality more fully concerning their responses about their administrators.

Each packet contained a cover letter to the principals and teachers. There were four different cover letters. One cover letter was sent to principals not identified by GIMS or the Atlanta Math Project and other experts (Appendix C). A second cover letter was attached to each teacher's survey in this same group (Appendix D). The third cover letter was sent the principals in the group selected by the GIMS project or the Atlanta Mathematics Project (Appendix E). The fourth cover letter was attached to the teachers' surveys in this same group (Appendix F). The cover letters explained the rationale, importance of the study, and the participants' responsibilities. It instructed principals to forward the teachers' letters and surveys to all of the regular mathematics teachers at grades 6, 7, and 8 in their schools.

If a completed survey was not returned by the due date, a follow-up letter was mailed to the principal with a duplicate questionnaire (Appendix G & H). Telephone calls were made to schools which failed to return surveys after the duplicate questionnaires were sent.

Treatment of the Data

Survey items were matched to the research questions and results were presented for each research question. The data collected from each group of respondents were tabulated. Data were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were used to describe the results of the study. Inferential

statistics were used to determine significant differences between responses to the survey items in the study.

Descriptive statistics were used to analyze the demographic information for each group. Frequency of responses, measures of central tendency, variance, and standard deviation were determined for each item in both survey instruments. Descriptive statistics were also used to analyze the NCTM standards which teachers and principals believed to be accurate representations. They were also used to determine teachers' and administrators' responses to the role the principals played in the change process as measured by the Foley Change Questionnaire.

Inferential statistics were used to determine significant differences between teachers and principals on the SBI and FCQ. The groups of tests used for studying differences between the means, on some particular variable, of distinct groups of items are the family of analysis of variance. The multivariate analysis of variance (MANOVA), one of the types of ANOVA, was used to compare the means and standard deviations between teachers and principals. The MANOVA is "anova in which the single response variable is replaced by several variables" (Hand & Taylor, 1987, p. 3). In this study, the MANOVA was used because of the interest in the "combination of the raw variables being measured and exploration of the between-group patterns of differences on a set of variables" (Hand & Taylor, 1987, p.4). The MANOVA was used because of the various dependent variables present in the study and caused less of a Type I error than using multiple t-tests. Significant difference was determined at $p < .05$ level. The MANOVA was used to analyze differences between principals' and teachers' beliefs and among teachers at different grade levels beliefs on the SBI. It was also used on the FCQ data to analyze teachers' and

administrators' perceptions of the role of identified principals and the perceptions about the change variables present in the school.

Data from the open-ended questions on the Foley Change Questionnaire were analyzed through a review of responses. Comments from principals and teachers were recorded for each item and identical responses were totaled on an ongoing basis. The elements identified in the principals' role, the teachers' role, change process, and contextual factors were used to help code the responses. After reviewing the literature relevant to the domains presented in Chapter II, these comments were examined and similar responses were grouped into broad strategies (Miles & Huberman, 1984) that were emphasized in the change literature. Even though the data for the open-ended survey items were gathered through qualitative procedures, the recurring presence of certain factors in these schools that affected successful change efforts were deemed as meaningful for administrators interested in the process of change.

CHAPTER FOUR

RESULTS

Introduction

The purpose of this study was to examine the compatibility of principals' and teachers' beliefs about the NCTM Standards in all Georgia middle schools. The Standards Belief Instrument (SBI) was emplyed toward this end. In addition, the Foley Change Questionnaire was used to report the teachers' and principals' perceptions about the factors which influenced the change process and the teachers' perceptions about the identified principals' role in schools. The research questions were examined by utilizing descriptive statistics, MANOVA, and qualitative methods. The chapter was divided into two parts: one reporting on the SBI and the other on the FCQ. The questions addressed by this research were:

1. On which, if any, of the NCTM Standards do teachers agree about their beliefs, as measured by SBI?
2. On which, if any, of the NCTM Standards do principals agree about their beliefs, as measured by SBI?
3. To what degree were teachers' and principals' beliefs different on the 16 NCTM Standards statements, as measured by the SBI?
4. To what degree were different grade-level teachers' beliefs different on the 16 NCTM Standards statements, as measured by the SBI?
5. What factors, as perceived by identified teachers and principals, influenced the change process, as measured by the Foley Change Questionnaire?

6. Did teachers at identified schools find their principals to have been active change facilitators?
7. What process or plan did principals at identified schools use to make changes?
8. Who did teachers at identified schools think made the greatest contribution to the change process?

Procedures

The SBI data were requested from 275 Georgia middle schools. The surveys were sent to administrators of the middle schools and regular mathematics teachers in grades 6, 7, and 8. Of the 275 schools, 184 schools returned the surveys for a 66% return rate. The return rate resulted in responses from 172 administrators and 1264 teachers. For the final analyses, 1436 of the 1586 returned surveys were used. One hundred fifty of the surveys were incomplete or not filled out by a middle school mathematics teacher. Statistical treatment for data analysis included descriptive statistics and MANOVA.

The FCQ data were gathered from 15 schools identified by the Georgia Initiative in Mathematics and Science (GIMS), the Atlanta Mathematics Project, and mathematics supervisors at the state and local level. These schools were identified as involved in extensive reform of their mathematics program and as schools in which the principal was perceived as an instructional leader. Of the 15 schools surveyed, teacher surveys were returned from all 15 schools. Eighty percent of the administrators returned data. Usable returns were received from 12 administrators and 75 teachers. Statistical analysis of the data included descriptive and inferential statistics and qualitative methods.

Findings

Standard Beliefs Instrument

One part of this study examined research questions about the NCTM Standards. The SBI instrument was used to report the compatibility of teachers', principals', and different grade-level teachers' beliefs about the NCTM Standards. This survey was sent to the total population of Georgia middle schools (N = 275) which qualified for middle school incentive grants. For the purposes of this study regular mathematics teachers were described as those teachers who were part of a middle school team and who taught regular classes of mathematics. This definition did not include Chapter I or special education teachers who taught mathematics to some students. Some teachers (n = 69) indicated that they taught multiple grade levels due to the size of the school or a different teaming model. Some teachers, for example, wrote on the survey that they taught all the upper-level mathematics classes (Pre-Algebra, Algebra, and Trigonometry) for grades 6, 7, and 8.

Demographic Profile

Administrators

The administrators (n = 172) in this study were identified from the Georgia middle schools list that was published by the Georgia Department of Education for the 1994-1995 academic year. The demographic information reported in this section is depicted in Table 1. The administrators who returned the surveys consisted of 97 (56.4%) males and 75 (43.6%) females. The findings indicated a highly educated work force (87.2%) with six or more years of college education. Most of the administrators (87.8%) had a Leadership-6 or Leadership-7 certification. The subject area certification obtained prior to leadership

certification was varied. The areas of 7-12 history (23.8%), middle grades 4-8 certification (17.5%), and physical education (11.6%) were the majority of the administrators' first area of expertise. Two experience factors, the number of years in the present school and the number of total years of experience, were examined for principals. Regarding the number of years in their present school, the principals had from 1 to 29 years of experience (M = 7.23, mode = 2.00, Mdn = 10.50, SD = 6.474) with 63.8% of the principals at their present school for 0-6 years; 32.6% for 7-15 years; and 3.6% for 16 or more years. Information was also gathered about the total years as a principal. These principals had 1to 33 years of experience (M = 8.99, mode = 1.00, Mdn = 13.50, SD = 6.999). For total number of years of experience, 42.4% of the principals had been in the principal position for six or less years, 40.6% for 7-15 years, and 17% for 16 or more years of total experience as an principal.

Teachers

The teachers in the study were regular mathematics teachers who taught mathematics to sixth-, seventh-, or eighth-grade students. From the 275 schools which received the survey, 1264 teachers responded. The demographic information reported in this section is contained in Table 1. The majority of the teachers were female (83.6%). The teachers were evenly divided between 6th, 7th, or 8th grade (30.7%, 32.1%, and 29.2% respectively). The other teachers (8%) taught a combination of grades. These combinations were the result of school size and different teaming models.

The larger percent of middle grade teachers had a Bachelor of Science in Education (46.4%) or a Master of Education degree (38.4%). Sixty-one percent of the teachers had a middle grades certification. Fewer than one in six teachers (15.9%) had a 7-12 mathematics concentration as their subject area of concentration. When reporting

Table 1.
Demographic Profile of Georgia Middle School Principals and Teachers Responding to the Standards Belief Instrument About the NCTM Standards

	ADMINISTRATORS		TEACHERS	
	Frequency (n = 172)	Percentage	Frequency (n = 1264)	Percentage
Gender				
Male	97	56.4	207	16.4
Female	75	43.6	1057	83.6
Degree Level				
B.S.	2	1.2	586	46.4
M.ED.	20	11.6	486	38.4
Ed.Sp.	118	68.6	180	14.2
Ed.D. or Ph.D.	32	18.6	2	.2
Other			10	.8
Certification				
L-5	20	11.6	26	2.1
L-6	119	69.2		
L-7	32	18.6		
P-5			45	3.6
4-8			781	61.8
7-12			126	9.5
Two Certifications				
P-5 & 4-8	1	.6	101	7.9
4-8 & 7-12			88	6.9
Three Certifications				
P-5, 4-8, & 7-12			30	2.4
K-8, 1-8, or P-12*			65	5.1
Other			8	.6
Subject Area				
Secondary Science	12	7.0	29	2.3
Secondary Math	7	4.1	201	15.9
Secondary History	41	23.8	28	2.2
Secondary Reading	13	7.6	21	1.6
Secondary Education	15	8.6	14	1.1
P.E.	20	11.6		
Other	14	9.1	41	3.3
Quarter Hours of College Math				
0-15			270	21.4
16-25			353	27.9
26-45			318	25.2
46-60			165	13.1
61-75			82	6.5
76-100			49	3.8
101-120			27	2.1

*Older certifications, when renewed will be P-5, 4-8, 7-12 or is a life certificate.

the number of years at their present position, a large difference was discovered between the mean and median (M = 7.40, mode = 1.00, Mdn = 17, SD = 4.61). The large difference between the mean and median resulted from 68% of the teachers teaching 8 or less years, 20% of the teachers for 9-15 years, and 12% of the teachers for 16 to 33 years at their present position. More than half of the teachers (65.5%) in this study took 45 hours or less of college mathematics.

Research Questions

The first four research questions involved reporting teachers' and principals' beliefs about the NCTM Standards. In order to analyze the research questions, a review of the SBI instrument was necessary. The SBI instrument contained 16 6-point Likert scale items. With a 6-point Likert scale, responses connoted that 1 = strongly disagreed, 2 = disagreed, 3 = somewhat disagreed, 4 = somewhat agreed, 5 = agreed, and 6 = strongly agreed with the Standard statement.

The items on the SBI instrument were representative of the NCTM Standards. The items were either direct quotes or inverse of direct quotes of the Standards resulting in means that were not comparable. In order to avoid confusion during the presentation and later discussion of the results, the negative statements were worded to reflect a statement which supported the NCTM Standards. The reworded statements were used in Tables 2 and 3 and in the discussion of each research question. The scale values of the negative items also were reversed to permit comparability. The comparable means were determined by subtracting the negative means from seven and the resulting reverse-scale means were used in Tables 2 and 3 and in the discussion. This procedure was possible due to the fact that if a respondent strongly disagreed with a negatively-worded item, they would also strongly agree with its positive equivalent. The negative items were reworded

according to the NCTM statements and are used as descriptors in Tables 2 and 3 (Appendix I).

Research Question Number One: Teachers' Agreement With the Standards

The first research question assessed teachers' agreement with the NCTM Standards as measured by SBI. Teachers' responses were categorized according to the means and percentages at each scale level. Table 2 contains all of the resulting means and standard deviations used in this discussion of teachers' agreement. A mean of 6.00 would have indicated complete strong agreement with the item. A mean of 1.00 would have indicated complete strong disagreement with the item. Means ranging from 6.00 to 3.51 indicated increasing agreement while means from 3.50 to 1.00 indicated increasing disagreement. The range was divided by the number of scale values to obtain a ratio of .833. Then .833 was subtracted from each possible response (6.00-.83 = 5.17) to obtain a degree scale of the following:

6.00-5.17 (Strongly Agree--SA)
5.16-4.34 (Agree--A)
4.43-3.51 (Somewhat Agree--SWA)
3.50-2.68 (Somewhat Disagree--SWD)
2.67-1.85 (Disagree--D)
1.84-1.02 (Strongly Disagree--SD)

The mean responses for items 2, 3, 6, and 15 showed strong agreement with the Standards (M = 5.30, 5.40, 5.40, 5.44, respectively). Teachers believed that students should share their problem-solving thinking and approaches with other students (item 2); that mathematics can be thought of as a language that must be meaningful if students are to communicate and apply mathematics productively (item 3); that the study of mathematics should include opportunities to use mathematics in other curriculum areas (item 6); and that learning mathematics must be an active process (item 15).

The mean responses for items 1, 4, 5, 7, and 13 indicated agreement (M = 4.34, 5.10, 4.72, 4.63, 4.43, respectively). These items stated that problem solving is a process that should permeate the entire program (item 1); a major goal of mathematics instruction is to help children develop the belief that they have the power to control their own success in mathematics (item 4); children should be encouraged to justify solutions, thinking, and conjectures in various ways (item 5); children should connect ideas both among and within areas of mathematics (item 7); and a demonstration of good reasoning should be regarded even more than a student's ability to find correct answers (item 13).

The teachers' mean responses indicated that they somewhat disagreed with items 14 and 16 (M = 3.50 and 3.50). These items stated that calculators should be available to students at all times (item 14) and that children enter kindergarten with considerable mathematical experiences and some understanding of mathematics concepts (item 16).

The mean response for item 8, 10, and 11 (M = 3.22, 2.78, and 2.89) reflected somewhat disagreement with the NCTM Standards. These items stated that decreased attention should be given to reading and writing numbers symbolically (item 8); skill in computation should not precede word problems (item 10); that the learning of mathematics is not a process in which students absorb information, storing it in easily retrievable fragments as a result of repeated practice and reinforcement (item 11).
The mean responses for items 9 and 12 (M = 2.19 and 2.47) indicated the teachers disagreed with those statements about the Standards. They disagreed with the items which included concepts such as: decreased emphasis on the use of clue words (items 9); and mathematics being taught as more than as a collection of concepts, skills, and algorithms (items 12).

Table 2.
Georgia Middle School Principals' and Teachers' Agreement with the NCTM Standards As Measured by the SBI

	Principals		Teachers	
Items	M	SD	M	SD
1. Problem solving is a process that should permeate the entire program.	4.33	1.598	4.34	1.617
2. Students should share problem-solving approaches with other students.	5.28	.812	5.30	.967
3. Math can be thought of as a language that must be meaningful if students are to communicate and apply math productively.	5.28	.794	5.40	1.690
4. Major goal is to help children develop belief they have the power to control math success	4.99	1.032	5.10	1.062
5. Children encouraged to justify solutions, thinking, and conjectures in various ways	4.51	1.528	4.72	1.443
6. The study of math should include opportunities to use math in other curriculum areas.	5.50	.907	5.40	.919
7. It is important that children connect ideas both among and within areas of mathematics.	4.74	1.274	4.63	1.388
8. Decreased emphasis should be given to reading and writing numbers symbolically	3.25	1.169	3.22	1.235
9. Decreased emphasis should be given to use of clue words to solve problems	2.32	1.104	2.19	1.228
10. Skill in computation and word problems should be taught and used together.	2.99	1.474	2.78	1.511
11. Learning math is not a process in which students absorb information through repeated practice.	3.01	1.394	2.89	1.402
12. Mathematics is more than a collection of concepts, skills, and algorithms.	2.42	1.126	2.47	1.706
13. A demonstration of good reasoning should be regarded even more than students' ability to find correct answers.	4.42	1.158	4.43	1.198
14. Appropriate calculators should be available to all students at all times.	3.72	1.578	3.50	1.674
15. Learning math must be an active process.	5.37	.850	5.44	.841
16. Children enter Kindergarten with considerable math experience and some understanding of math concepts and skills.	3.66	1.570	3.50	1.521

In conclusion, this study was important because it gave a picture of Georgia middle schools teachers' beliefs about the NCTM Standards. The data indicated that teachers agreed with items 1, 2, 3, 4, 5, 6, 7, 13, 14, 15, and 16 and disagreed with items 8, 9, 10, 11, and 12 (Appendix J). None of the teachers' mean responses indicated strong disagreement.

It should also be noted that this conclusion was based on the group's means. When using the mean for Likert-scale items, useful information about the individual responses are not revealed by the mean. When the standard deviation ranges from moderate to quite large as some of these items did, then the means may not be an accurate picture of the individual responses. Differences among the standard deviations are noteworthy, but are not a part of the interactions being examined by this research. A more complete picture of the frequencies and percentages are provided for the reader in Appendix K.

Research Question Number Two: Principals' Agreement with the Standards

The second research question reported principals' agreement with the NCTM Standards. Principals' responses were categorized according to the means and percentages at each scale level. Table 2 contains all the resulting means and standard deviations used in this discussion of principals' agreement with the Standards. The means were analyzed according to increasing agreement or increasing disagreement on the following scale:

6.00-5.17 (Strongly Agree--SA)
5.16-4.34 (Agree--A)
4.43-3.51 (Somewhat Agree--SWA)
3.50-2.68 (Somewhat Disagree--SWD)
2.67-1.85 (Disagree--D)
1.84-1.02 (Strongly Disagree--SD)

The mean responses for items 2, 3, 6, and 15 showed agreement with the Standards (M = 5.28, 5.28, 5.50, 5.37, respectively). The principals agreed that students should share their problem-solving thinking and approaches with other students (item 2); that mathematics can be thought of as a language that must be meaningful if students are to communicate and apply mathematics productively (item 3); that the study of mathematics should include opportunities of using mathematics in other curriculum areas (item 6); and that learning mathematics must be an active process (item 15).

The principals' mean responses to items 4, 5, 7, and 13 (M = 4.99, 4.51, 4.74, and 4.42) indicated agreement. The principals agreed that a major goal of mathematics instruction is to help children develop the belief that they have the power to control their own success in mathematics (item 4); children should be encouraged to justify their solutions, thinking processes, and conjectures in a variety of ways (item 5); it is important that children connect ideas both among and within areas of mathematics and not be taught in isolation (item 7); a demonstration of good reasoning should be regarded even more than a student's ability to find correct answers (item 13).

The principals somewhat agreed with items 1, 14, and 16 (M = 4.33, 3.72, and 3.66, respectively) These items stated that problem solving is a process that should permeate the entire program; calculators should be available to all students at all times (item 14); and children enter kindergarten with considerable mathematical experiences (item 16).

The mean responses for items 8, 10, and 11 (M = 3.25, 2.99, and 3.01) indicated somewhat disagreement with the Standard statements. These items stated that decreased attention should be given to reading and writing numbers symbolically (item 8); skill in computation should not precede word problems (item 10); and the learning of

mathematics is not a process in which students absorb information, storing it in easily retrievable fragments as a result of repeated practice and reinforcement (item 11).

The mean responses for items 9 and 12 (M = 2.32 and 2.42) indicated they disagreed with those statements about the Standards. These items concerned mathematics instruction. They disagreed with the items which stated decreased emphasis should be given to the use of clue words (items 9); and mathematics is more than a collection of concepts, skills, and algorithms (items 12).

In conclusion, this study was important because it gave a view of Georgia middle schools principals' beliefs about the NCTM Standards. The data indicated that principals agreed with items 1, 2, 3, 4, 5, 6, 7, 13, 14, 15, and 16 and disagreed with items 8, 9, 10, 11, and 12 (Appendix J). None of the principals' mean responses indicated strong disagreement.

It should also be noted that this conclusion was based on the group's means. As indicated by the reasons on page 85, the individual responses were not used. A more complete picture of the frequencies and percentages are provided for the reader in Appendix K.

Research Question Number Three: Difference Between Teachers and Principals

The third research question examined the congruency between teachers' and administrators' beliefs about the NCTM Standards. From the MANOVA analysis, there was no statistically significant difference between principals' and teachers' beliefs on the collection of items ($F_{(16,1381)} = 1.53$, $p = .080$). The η^2 indicated that approximately 2.7% of the variance was explained by the group membership.

In examining the means in Table 2, the following results were found. Teachers and principals strongly agreed with items 2, 3, 6, and 15. They agreed with items 4, 5, 7, and

13. The principals somewhat agreed with item 1 whereas the teachers agreed with it. On items 14 and 16, the principals agreed with the item but the teachers somewhat agreed. The principals and teachers somewhat disagreed with items 8, 10, and 11. Both groups disagreed with items 9 and 12.

The importance of these results indicated that principals and teachers agreed at the same level on 13 of the 16 items about the NCTM Standards. They did not, however, agree with NCTM on every concept. It was very remarkable that teachers and principals so strongly agreed with each other on the content of the Standards statements (Appendix J).

Research Question Number Four: Difference Between Teachers at Different Grade Levels

The fourth research question reported different grade-level teachers' beliefs about the NCTM Standards. When examining the results for difference among the groups for each item, no statistically significant difference was found among 6th, 7th, 8th grade, and multi-grade teachers on the collection of items ($F_{(32, 2224)} = .97$, $p = .487$). In most cases, the means were close to identical. The η^2 indicated that approximately 3.88% of the variance was explained by the group membership. The results are in Table 3.

The 6th, 7th, 8th, and multigrade teachers strongly agreed with items 2, 3, 6, and 15 and agreed with items 4, 5, 7, and 13. They somewhat disagreed with items 8 and 11 and disagreed with items 9 and 12. 6th and 7th grade teachers agreed with item 1 while 8 and multigrade level teachers somewhat agreed. Seventh, eighth,and multi-grade level teachers somewhat disagreed with item 10 and sixth grade teachers disagreed. On item 16, 6th and 7th grade teachers somewhat disagreed while 8th and multigrade level teachers somewhat agreed (Appendix L).

Other Information About the NCTM Standards

A section of the survey was used to obtain further information from the teachers and administrators about the NCTM Standards. The three questions were included on the SBI survey to gather general information about the NCTM Standards. The three questions were: (1) Have you heard of the NCTM Standards?; (2) Have you attended a workshop on the NCTM Standards?; and (3) Is your school currently using the NCTM Standards as part of your mathematics curriculum? The data received from the Georgia middle school teachers and principals indicated that fewer teachers (88.4%) than administrators (95.4%) had heard of the NCTM Standards. Sixty-one percent of the teachers and 75% percent of the administrators had not attended any workshop about the NCTM Standards. Most of the teachers (71.5%) agreed with the administrators (68.6%) that the school was using the NCTM Standards.

Foley Change Questionnaire

The second part of this study examined schools selected by mathematics supervisors at the state and local levels. Fifteen middle schools were selected on the criteria that changes appeared to have been made in their mathematics programs relative to the NCTM Standards. The purpose of this part of the study was to report the factors influencing the change process and to determine how these identified middle school principals helped teachers change their beliefs about teaching mathematics and guided the process of mathematics reform at their school sites. The Foley Change Questionnaire was used to gather data about the specific behaviors of middle school principals that positively Affected the process of change. The questionnaire was analyzed using descriptive and inferential statistics and qualitative research to answer the research questions and provide

Table 3.
Teachers at Different Grade Levels' Beliefs About the NCTM Standards as Measured by the Standards Belief Instrument

	6th Grade		7th Grade		8th Grade		Combination	
Items	M	SD	M	SD	M	SD	M	SD
1. Problem solving is a process that should permeated the entire program.	4.41	1.589	4.40	1.610	4.32	1.657	3.92	1.576
2. Students should share problem-solving approaches with other students.	5.29	1.041	5.32	.910	5.31	.930	5.24	1.041
3. Math can be thought of as a language that must be meaningful if students are to communicate and apply productively.	5.34	.963	5.42	.874	5.30	.941	5.45	.895
4. Major goal is to help children develop belief they have the power to control math success	5.11	1.116	5.10	1.022	5.09	1.039	5.08	1.104
5. Children encourage to justify solutions, thinking, and conjectures in various ways	4.75	1.426	4.70	1.465	4.70	1.455	4.74	1.404
6. The study of math should include opportunities to use math in other curriculum areas.	5.42	.928	5.40	.925	5.40	.877	5.38	1.017
7. It is important that children connect ideas both among and within areas of math.	4.55	1.441	4.67	1.392	4.67	1.340	4.67	1.348
8. Decreased emphasis should be given to reading and writing numbers symbolically	3.24	1.247	3.20	1.170	3.22	1.281	3.23	1.284
9. Decreased emphasis should be given to use clue words to solve problems	2.28	1.320	2.12	1.118	2.20	1.206	2.13	1.353
10. Skill in computation and word problems should be taught and used together.	2.22	1.576	2.73	1.563	2.80	1.412	2.73	1.563
11. Learning math is not a process in which students absorb information through repeated practice.	2.77	1.374	2.88	1.427	3.01	1.386	2.94	1.442
12. Mathematics is a more than a collection of concepts, skills, and algorithms it includes investigating and reasoning and a means of communication.	2.47	1.229	2.51	1.272	2.52	1.255	2.60	1.293
13. A demonstration of good reasoning should be regarded even more than students' ability to find correct answers.	4.37	1.227	4.48	1.419	4.43	1.196	4.44	1.319
14. Appropriate calculators should be available to all students at all times.	3.37	1.650	3.54	1.687	3.57	1.650	3.65	1.780
15. Leaning math must be an active process.	5.41	.859	5.45	.790	5.45	.860	5.47	.907
16. Children enter kindergarten with considerable math experience and some understanding of math concepts and skills	3.41	1.544	3.43	1.517	3.66	1.458	3.51	1.541

supplementary information on the process of change in these 15 identified middle schools. Some demographic information was also gathered to provide a profile of these identified schools.

Demographic Profile

Administrators

The demographic information reported in this section is located in Table 4. The administrators in this study were evenly distributed between males (n = 6) and females (n = 6). The majority of the administrators (75%) had an education specialist or doctorate degree with most of them (83.3%) having Leadership-6 or Leadership-7 certification. Before their leadership certification, most of these administrators (91.7%) had either middle grades, secondary education in history or secondary education in English as their first certification. Most of the administrators (58.2%) have been principals for 8 or fewer years (M = 8.33, Mdn = 8.50, Mode = 8.00, SD = 4.5193).

Teachers

The demographic information reported in this section is located in Table 4. The teachers in the identified schools which responded to the survey were mostly females (92%) with only a few males (8%). The responses received from the different grade levels was distributed among 32 6th-grade teachers, 24 7th-grade teachers, and 18 8th-grade teachers. One teacher who responded taught 6th, 7th, and 8th grade. Most of the teachers had a Bachelor of Science (48.0%) or Master of Science (42.7%) in Education. More than half were certified in the middle grades (64%). Of the teachers certified in secondary education, only 8 of them had secondary mathematics as their subject area. These teachers were evenly divided among the number of hours of college mathematics. One-fourth of the teachers had three or fewer college mathematics courses. The largest

Table 4

Demographic Profile of Identified Georgia Middle School Principals and Teachers Who Responded to the Foley Change Questionnaire

	ADMINISTRATORS		TEACHERS	
	Frequency	Percentage	Frequency	Percentage
Gender				
Male	6	50.0	6	8.0
Female	6	50.0	69	92.0
Degree Level				
B.S.	2	16.7	36	48.0
M.ED.	1	8.3	32	42.7
Ed.Sp.	5	41.7	6	8.0
Ed.D. or Ph.D.	4	33.3	1	1.3
Certification				
L-5	2	16.7		
L-6	6	50.0	2	3.7
L-7	4	33.3	1	1.3
4-8			48	64.0
7-12			5	6.7
Two Certifications				
P-5 & 4-8			6	8.0
4-8 & 7-12			3	4.0
Three Certifications				
P-5, 4-8, & 7-12			1	1.3
K-8, 1-8, or P-12*			9	12.0
Area of Degree				
Secondary History	2	16.7		
Secondary English	2	16.7	2	2.7
Secondary Science			1	1.3
Secondary Math			6	8.0
Home Economics	1	8.3		
Other			1	5.3
Grade Level				
6th			32	42.7
7th			23	30.7
8th			18	24.0
6th, 7th, 8th			1	1.3
Quarter Hours of College Math				
0-15			17	22.7
16-25			17	22.7
26-45			21	28.0
46-60			16	21.3
61-75			2	2.7
76-100			1	1.3
101-120			1	1.3

* Older certifications, when renewed, will be P-5, 4-8, or 7-12 or is a life certificate

percentage (28%) had taken 26-45 hours of college mathematics followed by 0-15 hours (22.7%), 16-25 hours (22.7%), and 46-60 hours (21.3%).

Research Questions

The Foley Change Questionnaire was used to gather information about 15 identified schools which made changes in their mathematics programs relative to the NCTM Standards. The FCQ instrument contained 17 6-point Likert scale items along with three open-ended items. The Likert scale used on the FCQ survey ranged from 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = somewhat agree, 5 = agree, to 6 = strongly agree. All of these items, unlike those items on the SBI, were worded in a positive direction. These items were used to answer the last four research questions:

5. What factors, as perceived by teachers and administrators, influenced the change process during the mathematics reform effort in the identified schools according to the Foley Change Questionnaire?
6. Did teachers at identified schools find their principals to have been active change facilitators?
7. What process or plan did principals at identified schools use to make changes?
8. Who did teachers at identified schools think made the greatest contribution to the change process?

Research Question Number Five: Teachers' and Principals' Perceptions About Factors Influencing the Change Process

The fifth research question reported the congruency between teachers' and administrators' beliefs about the factors influencing the change process during the mathematics reform effort at their schools. From the MANOVA analysis, there was no

statistically significant difference between principals' and teachers' beliefs on the collection of items ($F_{(17, 69)} = 1.03$, $p = .440$). This research question analyzed data from all of the 17 Likert scale items. The responses from all the items were examined for the factors influencing the change process. These factors were present in different items represented by four conceptual areas: principal behaviors (items 1, 2, 5, 6, 11, 12, and 13), change process (items 7, 8, 10, 14, 15, 16, and 17), teachers' role (items 4 and 9), and contextual factors (items 3). The results were presented in Table 5.

Commonalties and differences were examined between teachers' and principals' responses to the items through the analyses of the means. The means were analyzed according to increasing agreement or increasing disagreement with the items on the FCQ. A mean of 6.00 would have indicated complete strong agreement with the item. A mean of 1.00 would have indicated complete strong disagreement with the item. Means ranging from 6.00 to 3.51 indicated increasing agreement while means from 3.50 to 1.00 indicated increasing disagreement. The range was divided by the number of items to obtain a ratio of .833. Then .833 was subtracted from each possible response (6.00-.83 = 5.17) to obtain a degree scale of the following:

6.00-5.17 (Strongly Agree--SA)
5.16-4.34 (Agree--A)
4.43-3.51 (Somewhat Agree--SWA)
3.50-2.68 (Somewhat Disagree--SWD)
2.67-1.85 (Disagree--D)
1.84-1.02 (Strongly Disagree--SD)

When examining the mean responses for principals behaviors, items 1, 2, 5, 6, 11,12, and 13 were evaluated. The principals and teachers agreed the principals were a positive influence (item 1), demonstrated a high degree of support (item 2), provided resources (item 11), and provided teachers with time to plan (item 13).

Table 5.
Georgia Middle School Teachers' and Principals' Perceptions about the Role of Identified Principals as Measured by the Foley Change Questionnaire

	Administrators		Teachers	
	M	SD	M	SD
Items				
1. Principals effective a positive influence	4.50	.905	4.37	1.295
2. Principal demonstrated a high degree of support	5.00	.853	4.72	1.203
3. School fosters atmosphere of change	5.25	.622	4.61	.889
4. Teachers had positive attitude about change	4.83	1.115	4.61	1.161
5. Principal provided leadership	4.58	.900	4.01	1.191
6. Principal was driving force	3.67	1.155	3.13	1.222
7. Teachers not involved were kept informed	5.00	1.091	4.41	1.867
8. High degree of collaboration	4.33	.888	4.01	1.635
9. Teachers believed in the worth of their efforts	5.08	1.084	4.72	1.214
10. Everyone affected was involved in making decisions	4.67	1.302	4.28	1.476
11. Principal provided resources	4.83	.718	4.39	1.497
12. Principal provided information	4.25	.866	3.68	1.490
13. Principal provided teachers with time to plan	4.50	1.000	4.35	1.502
14. Efforts focused on clearly defined purpose	4.67	1.073	4.71	1.206
15. Systematic plan followed	4.50	1.087	4.63	1.148
16. Research utilized	3.92	1.621	4.43	1.816
17. NCTM Standards utilized	4.83	1.115	4.79	1.044

Principals agreed that they had provided leadership (item 5) while teachers somewhat agreed. Principals and teachers somewhat agreed that the principal had provided information (item 12). On item 6, principals somewhat agreed but teachers somewhat disagreed that the principal was the driving force.

The next set of items examined concerned the change process. The set included items 7, 8, 10, 14, 15, 16, and 17. Principals and teachers agreed on items 7, 14, 15, and 17. These items stated that teachers not involved were kept informed (item 7), efforts focused on a clearly defined purpose (item 14), a systematic plan was followed (item 15), and the NCTM Standards were utilized (item 17). Both groups somewhat agreed that a high degree of collaboration was present (item 8). On item 10, the principals agreed that everyone affected was involved in making decisions but the teachers only somewhat agreed. The teachers agreed that research was utilized (item 16) but the principals only somewhat agreed.

In the area of teachers' roles, both groups agreed that teachers had a positive attitude about change (item 4). They also agreed that teachers believed in the worth of their efforts (item 9).

The last area examined a contextual factor related to the change process. The principals strongly agreed that the school fostered an atmosphere of change while the teachers agreed.

In conclusion, an examination of the factors influencing the change process in Georgia middle schools indicated various outcomes. The principals and teachers agreed about most of the factors contributing to the positive influence of the principals' behaviors. They were not in complete agreement about the principal's role as a driving force and the principal's provision of leadership. Teachers and principals in regard to the

change process factors agreed that most of those factors were present. They did not, however, have the same views about the utilization of research (which teachers felt was used more) and about informing teachers not involved (which principals agreed more strongly).

The mean responses to the teachers' roles and contextual factors indicated agreement. Principals more strongly agreed that the school fostered an atmosphere of change.

Overall, teachers and principals somewhat agreed to agreed (Appendix M) that all of the factors necessary to change were present in varying degrees during their mathematics reform effort. The principals and teachers had consistent ideas about the factors influencing the change process in their buildings. They were in agreement about the important items needed to achieve mathematics reform and understood and indicated they somewhat disagreed that the ones not under the principal's control were not present at a high level. The principals and teachers agreed that the actions over which the principal had control were being done by the principal. The actions that could not be controlled by the principal because it was a system-driven initiative were not ignored, but seemed understood by the group as not being part of the principal's role.

Research Question Number Six: Teachers' Perceptions of Principals' Role

This research question was analyzed by using the items regarding principal behaviors that influence the change process. This question was analyzed by using the means of the teachers' responses on the FCQ (Items 1, 2, 5, 6, 11, 12, and 13) which were identified as principal variables. These variables were identified separately to report the teachers' perceptions of exemplary principals' role as change agents within their schools. These results are reported in Table 5.

When each of the items regarding the principal's role were examined, the teachers' means indicated they agreed with items 1, 2, 11, and 13 (M = 4.37, 4.72, 4.39, 4.35, respectively). They agreed that the principals had a positive influence on the change process (item 1), exhibited a high degree of support (item 2), provided resources (item 11), and provided planning time (item 13). They somewhat agreed (M = 4.01, 3.68) that the principal provided leadership (item 5) and that the principals provided teachers with the necessary information (item 12).

They responded differently about the principal's role on item 6 (M = 3.13). The teachers somewhat disagreed that the principal was the driving force.

The mean responses of the teachers related to the principal behavior variables were reported to provide an analysis of teachers' perceptions about the actual activities demonstrated by the principals (Appendix M). The teachers' perceptions of the principals' role indicated that teachers felt the principals provided leadership, participation, and support in the areas they were able to control. The two areas that they may not have had control over were due to the system-level initiatives. Their responses indicated they understood the role the principals were able to perform in their schools.

Qualitative Findings from the FCQ

The last three questions on the Foley Change Questionnaire were qualitative in nature because teachers and principals were asked to write in their responses. The questions were used to gather further information about the procedures used to make a change in the mathematics curriculum, the role of teachers, and the role of the principals or other persons who played an important part in the process of mathematics reform. The teachers' and principals' answers were coded and grouped according to the responses.

Research Question Number Seven: Process or Plan For Change

The FCQ survey contained an open-ended question which asked teachers and principals to describe the sequence of events that occurred in order to make changes in their mathematics programs. In the cases of all of the schools, the initial effort was made at the system level. None of the schools had personnel who made the initial effort. All the schools indicated that their plans were very similar to the usual textbook adoption plan. In those plans, the sequence of similar events were: the mathematics curriculum director for the school system asked for teacher volunteers to serve on the committee; the committee had a workshop to learn how to choose a book; the committee met with the publishers and distributors; the books were previewed and each member ranked the books and had the teachers at the school rank the books; the committee met back with their rank-order lists; a textbook was chosen from the highest ranking one; staff development was planned for the teachers to attend; the curriculum was implemented and reviewed at the end of the year.

There were teachers and administrators from two schools, however, that described a more extensive, system-level plan that their schools had embraced and implemented. School A respondants indicated that the changes in their mathematics program had been the result of a system-wide movement. Two years before the mathematics textbook adoption was to take place, the county invited teachers from the various schools to serve on a curriculum revision committee. The committee met as a K-12 body and also met in grade-level divisions (K-2, 3-5, 6-8, and 9-12) to set goals for the mathematics curriculum to meet the NCTM Standards. During the second year, the teachers were asked to use the new curriculum and make suggestions for the final draft of the document. When the adoption year came, the committee used a copy of the draft

curriculum to narrow the number of books on the state textbook adoption list. Each mathematics teacher had a part in the final textbook selection from the committee's recommended list of books that most closely fit the NCTM Standards. The textbooks were not the only resource, however, that the school made available to the teachers. The teachers also had the addendum books by NCTM and various manipulatives. The teachers indicated that the faculty had embraced the vision of how mathematics should be taught and learned according to the NCTM Standards.

A systemwide initiative was also the first movement for the change in the mathematics curriculum for School B. The teachers at this school began with dissemination of articles and information from the NCTM publications by the mathematics consultants for the system. The teachers 5 years previously were involved with the Atlanta Mathematics Project, with the goal of achieving change in mathematics education. As an administrator wrote, the plan included "teachers' planning, teaching the curriculum, debriefing (reflective teaching model), mentoring each other, meeting, and doing mathematics together." The teachers had staff development classes which taught the application of the NCTM Standards to classroom procedures and methods, and using the constructivist approach to teaching and student learning. The group then spent two years writing curriculum to fit the NCTM Standards in preparation for textbook adoption year. This school was also involved with Project GIMS which provided further in-service and support of the NCTM Standards for all mathematics and science teachers in the middle schools. As one teacher wrote, '[This system has] made great strides in developing a community of mathematics teachers who plan, teach, reflect, and do mathematics together." The school was involved in various other system-level middle school programs implemented to improve mathematics competence, instruction, and collegiality.

Research Question Number Eight: Teachers' Perceptions of Change Agents

The teachers' perceptions of the role of their principals and any secondary change agent were gathered through an open-ended question on the FCQ survey. The last question on the questionnaire asked teachers to write in what role the principal played in helping teachers change their beliefs about teaching mathematics and in guiding the process of mathematics reform in the school or in demonstrating a positive influence on the change effort. More than 80% of the teachers wrote in responses to the open-ended questions. The process of change discussed by most teachers was the adoption of new textbooks. The role of the principals, as acknowledged by the teachers, included: informing teachers of classes (32%), being supportive (77%), providing professional leave (59%), allowing for space and materials (68%), delegating authority necessary to the mathematics chairperson (30%), standing behind the school's decision when it was different from the county's decision (25%), providing money to completely fund materials for every teacher (20%), and providing time for planning and meetings (67%). One teacher stated, "Our principal played an important role in this change by giving the reins to the teachers, who ultimately use the program. He supported our decisions and gave us the time needed to make those decisions." Another teacher wrote, " Our principal was a positive influence by becoming knowledgeable about the changes by attending teleconferences, reading the standards, and helping get parents involved by personally inviting them to the school and to the meetings. She also encouraged communication throughout the faculty by designating meeting times for the sole purpose of discussing mathematics reform in our school." At a third school, a teacher wrote, "The principal encouraged in-service and allowed time for teachers to participate in guiding mathematics reform. The principal meets weekly with teachers at grade levels to inform them of the

changes and to encourage improvement and make motions for necessary changes. The principal is well-informed and demonstrates a positive influence in curriculum matters."

Two schools indicated that their principals had played no role in the mathematics reform because all meetings were done at the system level and handled at the school level through a mathematics department chair and an assistant principal. The principals and the teachers from those two schools wrote that this was not the principal's job.

The teachers were also asked to name any other person who helped the school change its mathematics instruction and to indicated the role that person played in the change process. The four most frequent responses from the teachers were system-level curriculum directors (65%), mathematics chairpersons (30%), assistant principals (20%), and university professors (5%).

All the teachers and principals acknowledged a system-level curriculum director as one of the key persons in helping change to take place in their schools. One teacher wrote, "The curriculum director was the most helpful and knowledgeable about the changes. She met with teachers and had a series of meeting to share ideas, methods, and troubles in the change process." Another teacher penned, "The mathematics curriculum director led us step-by-step through the adoption process and allowed us to discuss our concerns and opinions while focusing on the students."

The next person most commonly mentioned as a secondary or primary change agent was the mathematics department chairperson. One teacher stated, "The chairperson organized the entire process and was always available for discussions and clarifications. She was the most informed and experienced and had stayed up-to-date on the current trends and communicated them to the others." Another wrote, "the mathematics

chairperson led the reform by sharing information about the NCTM Standards and encouraged teachers to attend workshops and to try the new methods."

Assistant principals were also mentioned as playing a major role in the change process at the school level. "The assistant principal provided much of the leadership in this effort to support teachers," wrote one teacher. The principal of one of the schools indicated, "the assistant principal is our curriculum specialist. Therefore, she guided the process and kept me informed of the needs of the teachers."

Two schools indicated that university professors served as secondary change facilitators. The professors were actively involved in the change process. The professors wrote grants to help support the ongoing effort to train the teachers in the new methods of teaching mathematics. They also provided computers, technology support, preservice and graduate students to help in the classrooms, and personal assistance.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Summary

This study was designed to examine principals' and teachers' beliefs about the NCTM Standards, factors influencing the change process, and the role of identified principals in the mathematics reform effort in Georgia Middle Schools. Two survey instruments, the Standards Belief Instrument (SBI) and the Foley Change Questionnaire (FCQ), were used to gather data.

There were 172 administrators and 1264 teachers who responded to the SBI survey. Most of the administrators had specialist degrees with a Leadership-6 certification while most of the teachers had bachelor or master of science degrees with middle school certification. Most of the teachers had 45 or fewer hours of college mathematics. A large majority of the teachers and principals had heard of the Standards, but relatively few of them had attended any workshops. Most of them indicated that they were using the Standards in their schools.

The results of the study relative to the research questions indicated some noteworthy findings. The principals and teachers overwhelmingly agreed with each other with regards to the NCTM Standard items on the SBI. Principals and teachers agreed with each other on 13 of the 16 items. The different grade-level teachers also agreed with each other on the items. Many of their means were identical. The principals and teachers also disagreed with the NCTM Standards on five of the items.

These items appear to be related to the more specific recommendations about mathematics by NCTM than to the items which appear more global. The literature review by this researcher indicated that in most studies, the principals and teachers did not agree on various matters. Therefore, the results from this study are significant because these two groups overwhelming agreed with each other in regards to the Standards items.

The FCQ included 12 administrators and 75 teachers who responded to the questionnaire. When examining the mathematics reform effort in Georgia, it was found that the principal was not the change facilitator and that all the initiatives were undertaken at the system level. It appeared from the narratives that most of the work done on the Standards involved the underlying principles in Standard 2 (teacher's role in discourse) and in Standard 4 (tools for enhancing discourse) because 75% of the teachers wrote that money was given for manipulatives and time was given for teachers to talk and plan and share. Only five teachers indicated that they had been involved in the study of the constructivist theory of learning which underpins the Standards documents and which provides support for the application of the theory to practice in the classroom.

Conclusions

The conclusions were drawn from the analysis of the data in answer to the eight research questions which formed the basis of this study. The principals had higher degree levels and different certifications which indicated they had different educational backgrounds from the teachers. However, they remarkably agreed with the teachers on the Standard items. It is surprising to the researcher that these two groups who in related but different roles in the school so closely agreed with each other on a curriculum matter. It was also interesting that although most of the principals and teachers had not attended

workshops about the Standards, they agreed with most of items regarding the Standards on the SBI. When the results were analyzed, it revealed that again most of the educators had not attended a workshop but had heard of the Standards and yet most of the principals and teachers agreed the Standards were being used in their schools. It was also noteworthy that teachers and principals agreed with most of the Standards but did not agree with some of the Standards that related to specific concepts.

The second survey was used to examine the mathematics reform effort in identified schools. From the data, it was concluded that only first-order changes took place in the identified schools. The initiatives were driven at the system level and were based on textbook adoption procedures. Teachers indicated little had changed in their schools except the adoption of textbooks. Only five teachers noted that they had gone through an extensive change in the way mathematics was being taught.

Discussion of Research Findings

Examining the results of the study revealed that many global topics were involved. The study examined beliefs, the change process, and leadership concepts. The vehicle for studying all these areas was the NCTM Standards which have been widely disseminated since 1989. This study attempted to look at teachers' and principals' perceptions in regards to Standards and to the overall vision of mathematics reform in Georgia. In order to do this, the history of the Standards and the theories espoused by change and leadership literature were examined in relation to the research findings.

When reviewing the results from this study, a picture of mathematics reform in Georgia was presented. The principals and teachers agreed with most of the Standards, though change seemed not to have been made when viewing exemplary schools. There

appears to have been the "dancing" pretense described by Deal (1984) in which much energy was expended and apparent movement was made but little has changed. The NCTM expended much energy in the formulation of the Standards. There is apparent movement, as demonstrated by the results of this research indicating that teachers and principals agreed with most of the Standards. However, there was little evidence that changes have been made in the classrooms. There has been a massive 4- to 5-year old mathematics Standards campaign. However, this research showed that although there is agreement among people responsible for mathematics education on the front line, this belief in the Standards has failed to change what teachers do in the classroom. A review of the leadership and change theory was necessary to discover the reasons for the lack of second-order changes in the classrooms.

First, an examination of the content of the Standards was reviewed. The NCTM authors published the NCTM Standards which described their vision of what a mathematics curriculum should include, along with descriptions of student activities that should take place in the classroom. In order to examine the Standards, a view of their content is necessary. The Standards appear to be a slogan system (Komisar & McClellan, 1961). They have enough of a generic nature to appeal to powerful groups or individuals who would otherwise disagree. In the case of this study, most of the Standards items were agreed upon by the principals and teachers indicating they may have been generic enough that almost everyone would agree with them. The second characteristic of a slogan system is that it should have "the ability to charm" (Apple, p. 414). The ability to charm means the slogan makes the reader want to take action or it may play on fears as to what may happen if action is not taken. In the case of this study, the NCTM took a

positive approach and called for educators to make changes in mathematics teaching and learning in order to prepare students for the future and to meet the national goals. Its vision called for the Standards to be the rallying place for teachers who wanted to be advocates for children and to teach children in the way that was best for them to learn. The third characteristic is that they need to be "specific enough to offer something to practitioners here and now" (Apple, p. 414). The Standards do offer specific activities and suggestions for the classroom teacher. However, the principals and teachers did not agree with the standards which prescribed specifics about certain concepts.

According to the leadership and change theories, principals and teachers should engage in shared decision making for real changes to occur in the classrooms. Sarason (1990) stated that change will not take place for teachers unless power relationships are changed. Fullan (1991) related similarly that teachers must have a definite purpose to change and all stakeholders must be involved. Sarason (1990) and Fullan (1991) both asserted that teachers must be given the opportunity to grow in the professional areas. In this study, the majority of the teachers have not been exposed to the constructivist theories prescribed by the Standards. In order to implement the Standards fully, the constructivist theory must be understood and embraced by the teachers. As reported by Chambers (1990),

> mathematical content knowledge and pedagogical content knowledge will be of no use to teachers whose beliefs cause them to reject knowledge. Too many teachers are limited not by their lack of knowledge. Teachers who believe that students cannot solve problems until they have mastered facts and algorithms will not be willing to adjust the priorities in the present program and are likely to reject

> knowledge that presents an opposing view. Teachers' beliefs, as well as their knowledge, must receive greater attention at both the pre-service and the in-service levels. (p. 551)

The teachers indicated that system-level curriculum directors played the major role in the mathematics reform effort. Cuban (1988) and Fullan (1991) recognized two types of changes which take place in educational settings. The first type, first-order changes, are changes which occur "without disturbing the basic organizational features, without substantially altering the way that children and adults perform their roles" (Cuban, 1988, p. 342). The other type, second-order changes, are changes that "alter the fundamental ways in which organizations are put together, including new goals, structures, and roles" (Fullan,1991, p. 21). No site-based management was present in the identified schools which indicated that the change was a first-order change and not a second-order change. For the most part, mathematics textbooks do have a strand of the Standards within them. However, they are not able to change the way teachers teach the Standards in the classrooms. These findings revalidated research investigated by Werner (1980) which indicated that teachers must participate in staff development workshops and have conversations about the meaning of the change being proposed in order for the change to take place. In the case of the NCTM Standards, however, 61% of the teachers indicated they had not attended a workshop about the Standards.

Leadership and change theory agree that change must come from within an organization. Paradigm shifts must take place. The principals and teachers in this study appear to be in the second stage, knowledge, of the Dunn and Griggs (1988) model. They appear to have gone through the first stage of awareness and now need the second stage

of knowledge to move into the third stage of personalization. For the initiative to become personalized, it needs to take place at the school level within the classrooms and be supported by administrative and system level. Teachers make changes through actual practice. "Genuine school reform will only take place by starting with the world of teachers in the individual classrooms" (Foley, 1993, p. 14). It would be interesting to know what would have happened if the changes had been a school-based plan initiated by the teachers.

Implications

Although the principals and teachers agreed with 11 of the standards, changes are not being made at the school level. Mathematics classrooms are different from the way they were several years ago in that cooperative learning and more manipulatives are being used. However, as indicated by the teachers' and principals' beliefs, many of the traditional concepts, such as clue words to solve word problems, skill in computation preceding problem-solving, and use of teacher-directed modeling and repeated student practice are still being used. In order for real changes envisioned in the NCTM Standards to occur, paradigm shifts must take place within the schools. The items the principals and teachers disagreed with concerned specific concepts embraced by the constructivist theory. Teachers and principals need staff development on the constructivist theory of teaching and learning mathematics.

NCTM and other mathematical organizations also need to begin work in this area. They need to quit worrying about whether or not teachers and principals believe in the Standards, because as this study shows, for the most part they do, and begin concentrating on actual practice and support for changed practice. Teachers need a toolbox of teaching

techniques that give them support after they have tried some of the new ideas. If they do not have this variety of options then they will return to the tried-and-true methods because they are perceived by teachers as being successful for most students, and they are familiar and easy. The organizations need to continue to listen to teachers and use an integrated approach so they do not end up in battles similar to whole language versus basal readers or back-to-basics versus new mathematics. Teachers and principals must be nurtured in this new process.

Dissemination

The use of the result of this research study could be of importance to various groups. The data collected from this research could benefit teachers, administrators, GIMS, other mathematics-related organizations, universities, and colleges of education. This information could be used by these groups to plan conferences, workshops, staff development and professional learning sessions. The present researcher provided information to these groups in numerous ways. She presented the findings at a joint-conference held by the Research Council for Diagnostic and Prescriptive Mathematics (RCDPM) and The American Institute for the Improvement of Mathematics Learning and Instruction (The Malei Institute) in February of 1996. She submitted proposals to the Georgia Council of Teachers of Mathematics and GIMS to present at their conferences. The researcher disseminated a summary of the material to other mathematical organizations--NCTM, GCSM, and GCSTME--and to the mathematics education departments at Georgia Southern University, Armstrong State College, and Savannah State College. The researcher sent a manucript for approval to School Science and Mathematics and The Mathematics Teacher. She also sent a copy of the results to

teachers and principals who participated in the study, and requesting feedback, and to regional systems' curriculum directors.

Recommendations

The research findings offer recommendations for implementing the Standards and for further research:

1. Workshops and in-service programs for teachers and principals on the constructivist theory underpinning the Standards vision. Although principals and teachers agreed with most of the Standards items on the SBI, they did not agree on some of the concepts that dealt with the constructivist theory on how students learn mathematics.

2. Development by NCTM or other organizations of more practices and models for teachers to use to teach the Standards. Most states have a local or district-level mathematics organization. These organizations need to develop model classrooms with a fully qualified teacher in charge so that all teachers within the state have access to such training and support. Each model classroom can also provide needed problem-solving experiences that would be relevant to its area's population.

The researcher makes the following recommendations for further research:

1. Use multiple regression to explore relationships between teachers' years of experience, degree level, certification, and number of mathematics courses and their responses on the SBI.

2. Add an open-ended question to the SBI which asks the respondents to look back over their structured responses. Respondents answering 3 or 4 for a question would be instructed to provide the reasons behind their responses.

3. Administer the SBI to elementary, middle, and high school teachers and draw comparisons among the three different groups.

4. Follow up on changes made in the classrooms with a qualitative study. The research would examine mathematics classrooms in different geographic locations and gather data to describe the mathematics classroom and compare it to past research.

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APPENDIX A

STANDARDS BELIEF INSTRUMENT
[Used with permission of author, Alan Zollman]

PLEASE COMPLETE AND RETURN BY _____, 1995.

Please read each question carefully and select the answer that is most accurate or best reflects your beliefs. No person will be identified when the results are compiled. A statement rated as a 6 would indicate that you strongly agree with the statement. A rating of 1 indicates that you strongly disagree with the statement.

	Strongly Disagree					Strongly Agree
1. Problem solving should be a SEPARATE, DISTINCT part of the mathematics curriculum.	**1**	**2**	**3**	**4**	**5**	**6**
2. Students should share their problem-solving thinking and approaches WITH OTHER STUDENTS.	**1**	**2**	**3**	**4**	**5**	**6**
3. Mathematics can be thought of as a language that must be MEANINGFUL if students are to communicate and apply mathematics productively.	**1**	**2**	**3**	**4**	**5**	**6**
4. A major goal of mathematics instruction is to help children develop the belief that THEY HAVE THE POWER to control their own success in mathematics.	**1**	**2**	**3**	**4**	**5**	**6**
5. Children should be encouraged to justify their solutions, thinking, and conjectures in a SINGLE way.	**1**	**2**	**3**	**4**	**5**	**6**
6. The study of mathematics should include opportunities for using mathematics in OTHER CURRICULUM AREAS.	**1**	**2**	**3**	**4**	**5**	**6**
7. The mathematics curriculum consists of several discrete strains such as computation, geometry, and measurement which can best be taught in ISOLATION.	**1**	**2**	**3**	**4**	**5**	**6**

	Strongly Disagree					Strongly Agree
8. In K-4 mathematics, INCREASED emphasis should be given to reading and writing numbers SYMBOLICALLY.	**1**	**2**	**3**	**4**	**5**	**6**
9. In K-4 mathematics, INCREASED emphasis should be given to the use of CLUE WORDS (key words) to determine which operation to use in problem solving.	**1**	**2**	**3**	**4**	**5**	**6**
10. In K-4 mathematics, skill in computation should PRECEDE word problems.	**1**	**2**	**3**	**4**	**5**	**6**
11. Learning mathematics is a process in which students ABSORB INFORMATION, storing it in easily retrievable fragments as a result of repeated practice and reinforcement.	**1**	**2**	**3**	**4**	**5**	**6**
12. Mathematics SHOULD be thought of as a COLLECTION of concepts, skills, and algorithms.	**1**	**2**	**3**	**4**	**5**	**6**
13. A demonstration of good reasoning should be regarded EVEN MORE THAN students' ability to find correct answers.	**1**	**2**	**3**	**4**	**5**	**6**
14. Appropriate calculators should be available to ALL STUDENTS at ALL TIMES.	**1**	**2**	**3**	**4**	**5**	**6**
15. Learning mathematics must be an ACTIVE PROCESS.	**1**	**2**	**3**	**4**	**5**	**6**
16. Children ENTER KINDERGARTEN with considerable mathematics experience, a partial understanding of many mathematics concepts, and some important mathematical skills.	**1**	**2**	**3**	**4**	**5**	**6**

DEMOGRAPHIC INFORMATION
(for teachers)

Please respond to the following items by circling the appropriate response(s) or filling in the blank:

1. Which grade level(s) do you currently teach? 6 7 8

2. How many years at that grade level? _____

3. What is your degree level? B.S. M.Ed. Ed.S. Ed.D/Ph.D.

4. What is your certification? P-5 4-8 7-12 Other _____

5. Gender Male Female

6. Have you heard of the National Council of Teachers of Mathematics (NCTM) Standards? Yes No

7. Have you attended a workshop on the NCTM Standards? Yes No

8. Is your school currently using the NCTM Standards as part of your mathematics curriculum? Yes No

9. Approximately how many hours of college mathematics have you had? Circle one.

0-15 16-25 26-45 46-60 61-75 76-100 101-120

DEMOGRAPHIC INFORMATION
(for principals)

Please respond to the following items by circling the appropriate response or filling in the blank:

1. How many years have you been a principal? _____

2. How many years have you been principal at this present school? _____

3. What is your degree level? B.S. M.Ed. Ed.S. Ed.D/Ph.D.

4. What is your administrative certification? L-5 L-6 Other _____

5. What teaching certification did you have before administration? P-5 4-8 7-12 Other _____

6. Gender Male Female

7. Have you heard of the National Council of Teachers of Mathematics (NCTM) Standards? Yes No

8. Have you attended a workshop on the NCTM Standards? Yes No

9. Is your school currently using the NCTM Standards as part of your mathematics curriculum? Yes No

10. How many regular mathematics teachers do you have this year? _____

APPENDIX B

FOLEY CHANGE QUESTIONNAIRE
[Used with permission by author, Jane Foley]

Please read the following statements and circle the number on the scale which best describes the process your school utilized when making decisions to **change your mathematics program**. A statement rated as a 6 would indicate that the statement describes your school very accurately. A rating of 1 indicates that the statement is not accurate at all for your school.

	Strongly Disagree					Strongly Agree
1. The principal effected a positive influence on the change efforts.	**1**	**2**	**3**	**4**	**5**	**6**
2. The principal demonstrated a high degree of support.	**1**	**2**	**3**	**4**	**5**	**6**
3. The school fosters an atmosphere of change.	**1**	**2**	**3**	**4**	**5**	**6**
4. The teachers who were involved in the changes approached the prospect of change with a positive attitude.	**1**	**2**	**3**	**4**	**5**	**6**
5. The principal provided leadership.	**1**	**2**	**3**	**4**	**5**	**6**
6. The principal was the driving force behind the change process.	**1**	**2**	**3**	**4**	**5**	**6**
7. Teachers who were not involved in the changes were kept informed about the progress of the changes.	**1**	**2**	**3**	**4**	**5**	**6**
8. There was a high degree of collaboration between the principal and the teachers who were involved in the changes.	**1**	**2**	**3**	**4**	**5**	**6**
9. The teachers who were involved believed in the worth of their efforts.	**1**	**2**	**3**	**4**	**5**	**6**
10. Everyone who was affected by the changes was involved in making the decisions.	**1**	**2**	**3**	**4**	**5**	**6**

	Strongly Disagree					Strongly Agree
11. The principal provided the resources that were needed.	**1**	**2**	**3**	**4**	**5**	**6**
12. The principal provided the information that was needed.	**1**	**2**	**3**	**4**	**5**	**6**
13. The principal made arrangements to provide teachers with the time they needed to plan for the changes.	**1**	**2**	**3**	**4**	**5**	**6**
14. The change efforts were focused on a clearly defined purpose.	**1**	**2**	**3**	**4**	**5**	**6**
15. The change efforts followed a systematic procedure.	**1**	**2**	**3**	**4**	**5**	**6**
16. Research was utilized to make decisions about changes in the instructional program.	**1**	**2**	**3**	**4**	**5**	**6**
17. The NCTM Standards were utilized to make decisions about changes in the instructional programs.	**1**	**2**	**3**	**4**	**5**	**6**

18. Describe the sequence of events that occurred in order to make changes in your mathematics program or attach a copy of agendas, minutes, or notes from meetings. Think of it in terms of a plan to share with other schools which would like to make changes in their mathematics instruction.

19. Describe the role teachers played in the change efforts.

20. What role did the principal play in helping teachers change their beliefs about teaching mathematics and in guiding the process of mathematics reform in your school, or in demonstrating a positive influence on the change effort? Did other persons help your school change its mathematics instruction? If yes, what role did the persons play?

APPENDIX C
First Cover Letter to Principals

October 21, 1995

Dear Principal:

This letter is to request your participation in a research study I am conducting as part of my Ed.D. program in Educational Administration at Georgia Southern University. This study examines principals' and teachers' perceptions of the NCTM Standards. I need your help gathering the data necessary for the research. There is, of course, no penalty should you decide not to participate.

I have enclosed a survey for you and multiple copies for teachers. Completion and return of the survey will be considered permission to use your results in the study. The survey will take only 5-7 minutes to complete. I have enclosed a self-addressed, stamped envelope to expedite return mail.

Your questionnaire is coded. This is only being done so that I will know which questionnaires were returned and thus which need to be followed up. Please be assured that your answers will remain confidential and the code will be destroyed when all the data are collected. Individual respondents will not be identified in the study.

Thank you for your timely and thoughtful participation. Please feel free to contact me if you have any questions (home, 912/587-5181; school, 912/823-3160). If you have any questions or concerns about your rights as a research participant in this study, you may contact Tom Case, Ph.D., Chair of the Institutional Review Board, 912/681-5205. A copy of the study's results will be sent to the participants on request.

PLEASE RETURN SURVEYS BY _____.

Respectfully,

Lynn Futch

APPENDIX D
First Cover Letter to Teachers

October 21,1995

Dear Teacher:

I am writing to request your participation in a research study I am conducting as part of my Ed.D. program in Educational Administration at Georgia Southern University. This study is examining teachers' and principals' perceptions of the NCTM Standards. I need your help gathering the data necessary for the research. Completion and return of the survey will be considered permission to use your results in the study. There is, of course, no penalty should you decide not to participate.

The survey will only take 5-7 minutes to complete. Your survey is coded. This is only being done so that I will know which questionnaires were returned and thus which need to be followed up. Please be assured that your answers will remain confidential and all codes will be destroyed when all the data are collected. Individual respondents will not be identified in the study.

I can't thank you enough for your assistance. Please feel free to contact me if you have any questions (home, 912/587-5181; school, 912/823-3160). If you have questions about your rights as a research participant in this study, you may contact Tom Case, Ph.D., Chair of the Institutional Review Board, 912/681-5205. A copy of the results will be sent to participants upon request.

PLEASE RETURN SURVEYS TO PRINCIPAL BY _____.

Sincerely,

Lynn Futch

APPENDIX E
First Cover Letter to Identified Principals

October 21, 1995

Dear Principal:

I am writing to request your participation in a research study I am conducting as part of my E.D. program in Educational Administration at Georgia Southern University. The study examines teachers' and principals' perceptions of the NCTM Standards and the change process in mathematics reform. I spoke with Wanda White and your school was recommended for inclusion in my research. I am specifically interested in your school's process of planning for change and the role you played in these changes. Completion and return of the survey will be considered permission to use your results in the study. There is, of course, no penalty should you decide not to participate.

Your school has been identified by the Georgia Initiative in Mathematics and Science (GIMS) as a school that is an example of a mathematics reform site. I am asking you and your teachers to respond to the **two** enclosed questionnaires. Please take the Standards Beliefs Instrument Survey (coded #1) and the Foley Change Questionnaire (coded #2) yourself. Please give the Standards Beliefs Instrument Survey to all regular mathematics teachers in grades 6, 7, and 8. Then also give the Foley Change Questionnaire surveys to the regular mathematics teachers in grades 6, 7, and 8 who were involved in and have the most knowledge about the change process in your school's mathematics curriculum.

Your questionnaire is coded. This is only being done so that I will know which questionnaires were returned and thus which needs to be followed up. Please be assured

that your answers will remain confidential and the code will be destroyed when all the data are collected. Individual respondents will not be identified in the study. I have enclosed a self-addressed, stamped envelope to expedite return mail.

Thank you for your timely and thoughtful participation. Please feel free to contact me if you have any questions (home, 912/587-5181; school, 912/823-3160). If you have questions about your rights as a research participant in this study, you may contact Tom Case, Ph.D., Chair of the Institutional Review Board, 912/681-5205. A copy of the survey will be sent to participants upon request.

PLEASE RETURN SURVEYS BY _____.

Sincerely,

Lynn Futch

APPENDIX F
First Cover Letter to Identified Teachers

October 21, 1995

Dear Teacher:

I am writing to request your participation in a research study I am conducting as part of my Ed.D. program in Educational Administration at Georgia Southern University. The study examines teachers' and principals' perceptions of the NCTM Standards and the change process in mathematics reform. I am specifically interested in your school's process of planning for change and the role your principal played in these changes. Completion and return of the surveys will be considered permission to use your results in the study. There is, of course, no penalty should you decide not to participate.

I am asking you to respond to the Standards Belief Instrument (coded #1) if you teach a regular mathematics class in grades 6, 7, or 8. I am also asking for those of you who were involved in and have the most knowledge about the change process in your mathematics curriculum to respond to the Foley Change Questionnaire (coded #2).

Your questionnaire is coded. This is only being done so that I will know which questionnaires were returned. Please be assured that your answers will remain confidential and the codes will be destroyed after all the data are collected. Individual respondents will not be identified in the study.

Thank you for your timely and thoughtful participation. If you have any questions or concerns about your rights as a research participant in this study, you may contact Tom Case, Ph.D., Chair of the Institutional Review Board, 912/681-5205. Please feel free to contact me if you have any questions (home, 912/587-5181; school, 912/823-3160).

PLEASE RETURN SURVEYS BY _____.

APPENDIX G
Follow-Up Letter to Principals

November 29, 1995

Dear Principal:

On October 21, I sent you a letter requesting you to respond to a brief survey regarding beliefs about the NCTM Standards. I am very interested in all the responses and they are very important to this research effort. As a fellow administrator, I realize that it is very difficult to find time in your busy schedule to respond. As of today, I have not received a response from you or your teachers.

I have enclosed another copy of the survey. It is designed to take only a few minutes of your time to complete. I would appreciate it if you would give it your timely attention. If our letters crossed in the mail, please excuse this inconvenience. Thanks again for your help.

Sincerely,

Lynn Futch

APPENDIX H
Follow-Up Letter to Identified Principals

November 29, 1995

Dear Principal:

On October 21, I sent you a letter requesting you to respond to two brief surveys regarding beliefs about the NCTM Standards and the change process at your school. I am very interested in all the responses and they are very important to this research effort. As a fellow administrator, I realize that it is very difficult to find time in your busy schedule to respond. As of today, I have not received a response from you or your teachers.

I have enclosed another copy of the surveys. Please distribute the Standards Beliefs Instrument Survey (coded #1) to yourself and all teachers who teach a regular mathematics class in grades 6, 7, & 8. Please distribute the Foley Change Questionnaire (coded #2) to yourself and teachers in grades 6, 7, & 8 who were involved in and have the most knowledge about the change process in your mathematics curriculum.
It is designed to only take a few minutes of your time to complete. I would appreciate it if you would give it your timely attention. If our letters crossed in the mail, please excuse this inconvenience. Thanks again for your help in this research endeavor.

Sincerely,

Lynn Futch

APPENDIX I

The Standards Beliefs Instrument, Valence, and Item Basis

Item	Valence	Item Basis in Standards
1. Problem solving should be a SEPARATE, DISTINCT part part of the mathematics curriculum.	-	Problem solving is not a distinct topic but a process that should permeate the entire program and provide the context in which concepts and skills can be learned (NCTM, 1990, p.23).
2. Students should share their problem solving thinking and approaches WITH OTHER STUDENTS.	+	Ideally, students should share their thinking and approaches with other students and with teachers (p.23).
3. Mathematics can be thought of as a language that must be MEANINGFUL if students are to communicate and apply mathematics productively.	+	Mathematics can be thought of as a language that must be meaningful if students are to communicate mathematically and apply math productively (p.26).
4. A major goal of mathematics instruction is to help children develop the belief that THEY HAVE THE POWER to control their own success in mathematics.	+	A major goal of mathematics instruction is to help children develop the belief that they have the power to control their own success and failure (p. 29).
5. Children should be encouraged to justify their solutions, thinking, and conjectures in a SINGLE WAY.	-	Children should be encouraged to justify their solutions, thinking process, and conjectures in a variety of ways (p.29).
6. The study of mathematics should include opportunities of using math in OTHER CURRICULUM AREAS.	+	In grades K-4, the study of math should include opportunities to make connections so that students can use mathematics in other curriculum areas (p. 29).

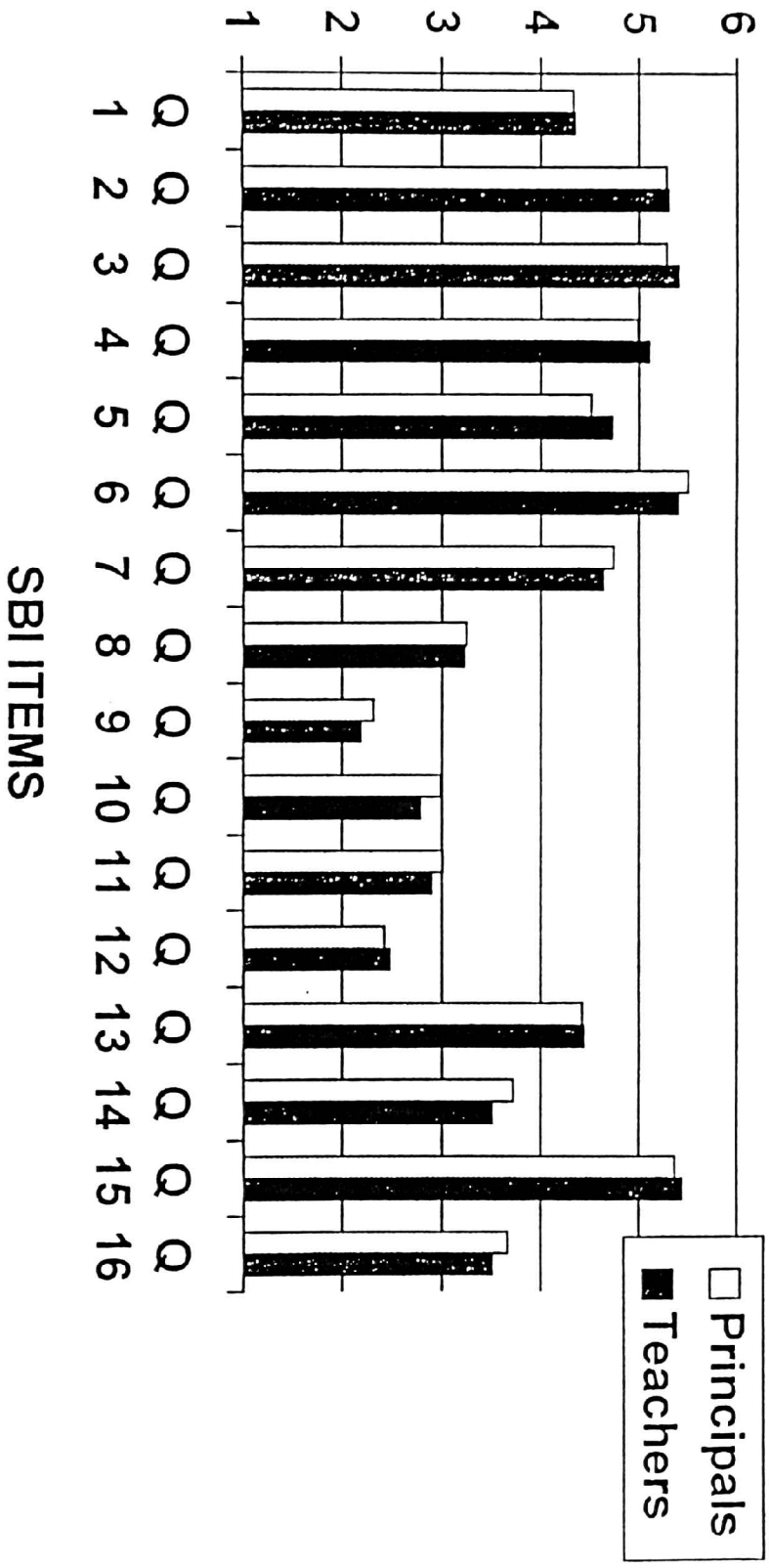
Item	Valence	Item Basis in Standards
7. Mathematics curriculum consist of discrete strains such as computation, geometry, and measurement which can best be taught in ISOLATION.	-	The math curriculum is generally viewed as consisting of several discrete strands. As a result, computation, geometry, and measurement tend to be taught in isolation. It is important that children connect ideas both within and among areas of math (p. 32).
8. In K-4 mathematics, INCREASED emphasis should be given to reading, writing, and ordering numbers symbolically.	-	Summary of changes in content and emphasis in K-4 math-- decreased attention- number: early attention to reading, writing, and ordering numbers symbolically (p.21).
9. In K-4 mathematics, INCREASED emphasis should be given to the use of CLUE WORDS to determine which operation to use in problem-solving.	-	Summary of changes in content and emphasis in K-4 math-- decreased attention - problem-solving: use of clue words to determine which operation to use (p.21).
10. In K-4 math, skill in computation should PRECEDE word problems.	-	Traditional teaching emphasis on practice in manipulating expressions and algorithms as a precursor to solving problems ignore the fact that knowledge often emerges from the problems. This suggests that instead of the expectations that skill in computation should precede word problems, experience with problems helps develop the ability to compute (p. 9).
11. Learning mathematics is a process in which students ABSORB INFORMATION, storing it in easily retrievable fragments as a result of repeated practice and reinforcement.	-	In many classrooms, learning is conceived of as a process in which students passively absorb information storing it in easily retrievable fragments as a result of repeated practice and reinforcement. Research findings from psychology indicate that learning does not occur by passive absorption alone (p.10).

Item	Valence	Item Basis in Standards
12. Mathematics SHOULD be thought of as a COLLECTION of concepts, skills, and algorithms.	-	This notion is based on the recognition of mathematics as more than a collection of concepts and skills to be mastered; it includes methods of investigating and reasoning, means of communications, and notions of context (p.5).
13. A demonstration of good reasoning should be regarded EVEN MORE THAN students' ability to find correct answers.	+	In fact, a demonstration of good reasoning should be rewarded even even more than students' ability to find correct answers (p.6).
14. Appropriate calculators should be available to ALL STUDENTS at ALL TIMES.	+	Because technology is changing mathematics and its uses, we believe that appropriate calculators should be available to all students at all times (p.8).
15. Learning mathematics must be an ACTIVE PROCESS.	+	Young children are active individuals who construct, modify, and integrate ideas by interacting with the physical world, materials, and other children. Given these facts, it is clear that the learning of mathematics must be an active process (p.17).
16. Children ENTER KINDERGARTEN with considerable mathematical experience, a partial understanding of many mathematical concepts, and some important mathematical skills.	+	Children enter kindergarten with considerable mathematical experience, a partial understanding of many concepts, and some important mathematics skills (p.16).

Zollman & Mason (1992), p. 363-364.

APPENDIX J

Mean Responses of Teachers' and Principals' Beliefs on SBI



APPENDIX K

Frequency Distribution of Teachers' and Principals' Responses on the SBI

Principals

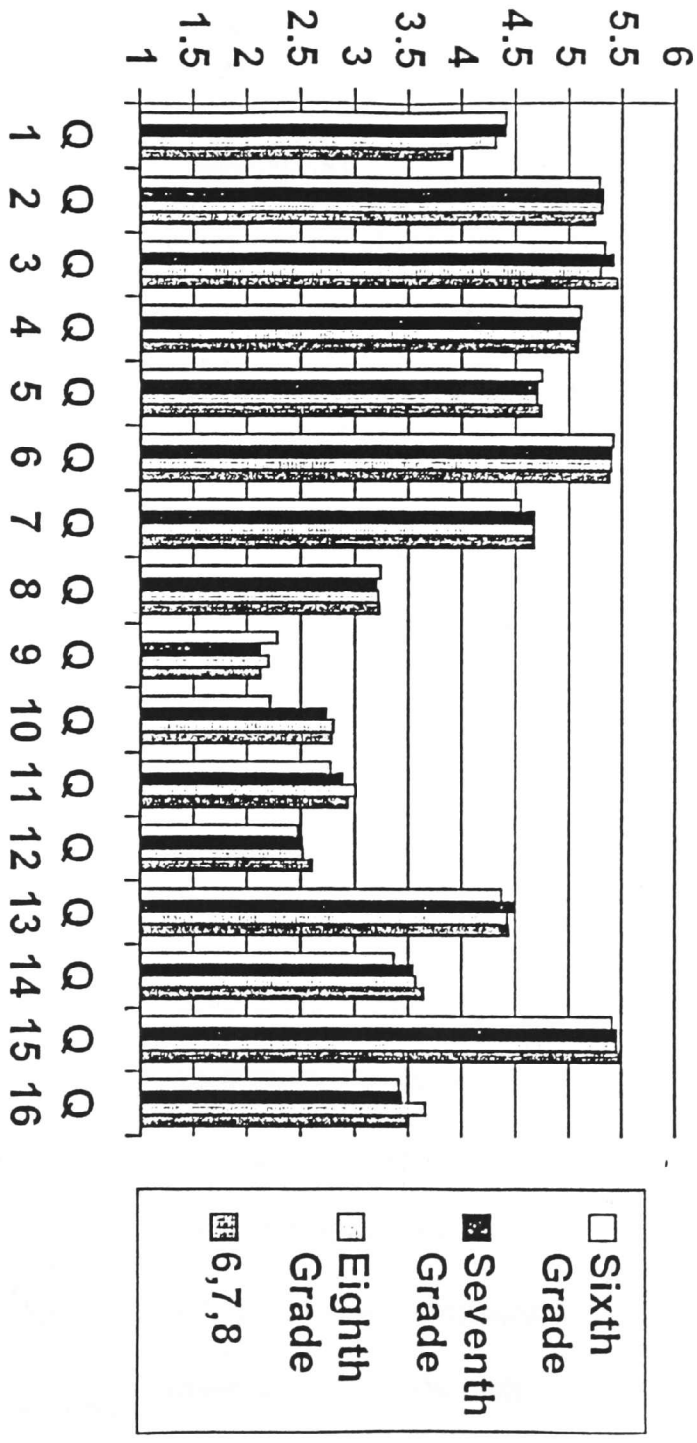
	6.00	5.00	4.00	3.00	2.00	1.00
1.	24.5% (42)	33.1%(57)	13.4%(23)	11.6%(20)	8.1%(14)	9.3%(16)
2.	44.8% (77)	43.6% (75)	7.6% (13)	3.5% (6)	0%(0)	.6% (1)
3.	44.2%(76)	43.0%(74)	10.5%(18)	1.7%(3)	0% (0)	.6% (1)
4.	36.6% (63)	36.6%(63)	19.2% (33)	5.2%(9)	1.2%(2)	1.2%(2)
5.	34.9%(60)	26.2%(45)	15.7%(27)	11.6%(15)	16.7%(16)	14.1%(9)
6.	65.7%(113)	26.2(45)	4.1%(7)	1.7%(3)	4.1%(7)	1.2%(2)
7.	32%(55)	36.6%(63)	15.7%(27)	7.6%(13)	5.8%(10)	2.3%(4)
8.	4.1%(7)	9.3%(16)	25.6%(58)	33.7% (58)	22.1% (38)	5.2% (9)
9.	.6%(1)	2.9%(5)	12.8%(22)	18.6%(32)	40.1%(69)	25.0%(43)
10.	6.4%(11)	14.0%(24)	14.5%(25)	21.5%(37)	27.3%(47)	16.3%(28)
11.	5.2%(9)	11.1%(19)	20.3%(35)	29.1%(50)	19.2%(33)	15.1%(26)
12.	.6%(1)	5.2%(9)	9.9%(17)	25.6%(44)	37.2%(64)	21.5%(37)
13.	19.2%(33)	30.8%(53)	27.9%(48)	17.4%(30)	3.5%(6)	1.2%(2)
14.	16.9%(29)	16.9%(29)	23.3%(40)	19.2%(33)	12.8%(22)	11.0%(19)
15.	53.5%(92)	36.0%(62)	6.4%(11)	2.3%(4)	1.7%(3)	0%(0)
16.	15.1%(26)	16.3%(28)	25.6%(44)	14.5%(25)	19.2%(33)	9.3%(16)

Teachers

	6.00	5.00	4.00	3.00	2.00	1.00
1.	33.3%(421)	22.6%(286)	13.7%(173)	12.5%(158)	8.1%(14)	9.3%(16)
2.	53.6%(678)	30.9%(390)	10.9%(129)	2.9%(37)	1.6%(20)	.8%(10)
3.	56.6%(715)	29.5%(373)	9.7%(122)	2.5%(31)	1.0%(13)	.8%(10)
4.	45.1%(570)	30.7%(388)	15.9%(201)	5.8%(73)	1.4%(18)	1.1%(14)
5.	39.7%(502)	26.9%(340)	13.7%(173)	11.6%(15)	6.3%(80)	4.4%(55)
6.	59.3%(750)	27.9%(353)	8.4%(106)	2.4%(30)	1.1%(14)	.9%(11)
7.	34.7%(439)	27.1%(343)	15.7%(199)	13.1%(166)	6.2%(78)	3.1%(39)
8.	4.4% (56)	9.6%(121)	25.6% (323)	33.3%(421)	18.2% (230)	8.9%(113)
9.	2.8%(35)	3.3%(42)	6.5%(82)	19.1%(241)	34.6%(437)	33.8%(427)
10.	5.4%(68)	10.8%(136)	13.4%(170)	21.0%(265)	23.7%(300)	25.7%(325)
11.	5.0%(63)	10.7%(135)	14.2%(179)	25.3%(320)	28.3%(358)	16.5%(209)
12.	2.8%(36)	5.6%(71)	10.2%(129)	23.8%(301)	35.9%(454)	21.6%(273)
13.	2.2%(28)	5.1%(65)	12.1%(153)	30.5%(385)	29.9%(378)	20.2%(255)
14.	16.1%(204)	15.0%(189)	19.5%(247)	16.2%(247)	17.3%(219)	15.8%(200)
15.	59.3%(749)	30.1%(380)	7.4%(94)	6.4%(11)	2.3%(4)	0%(0)
16.	11.7%(148)	15.3%(193)	23.3%(295)	21.3%(269)	17.9%(226)	10.5%(133)

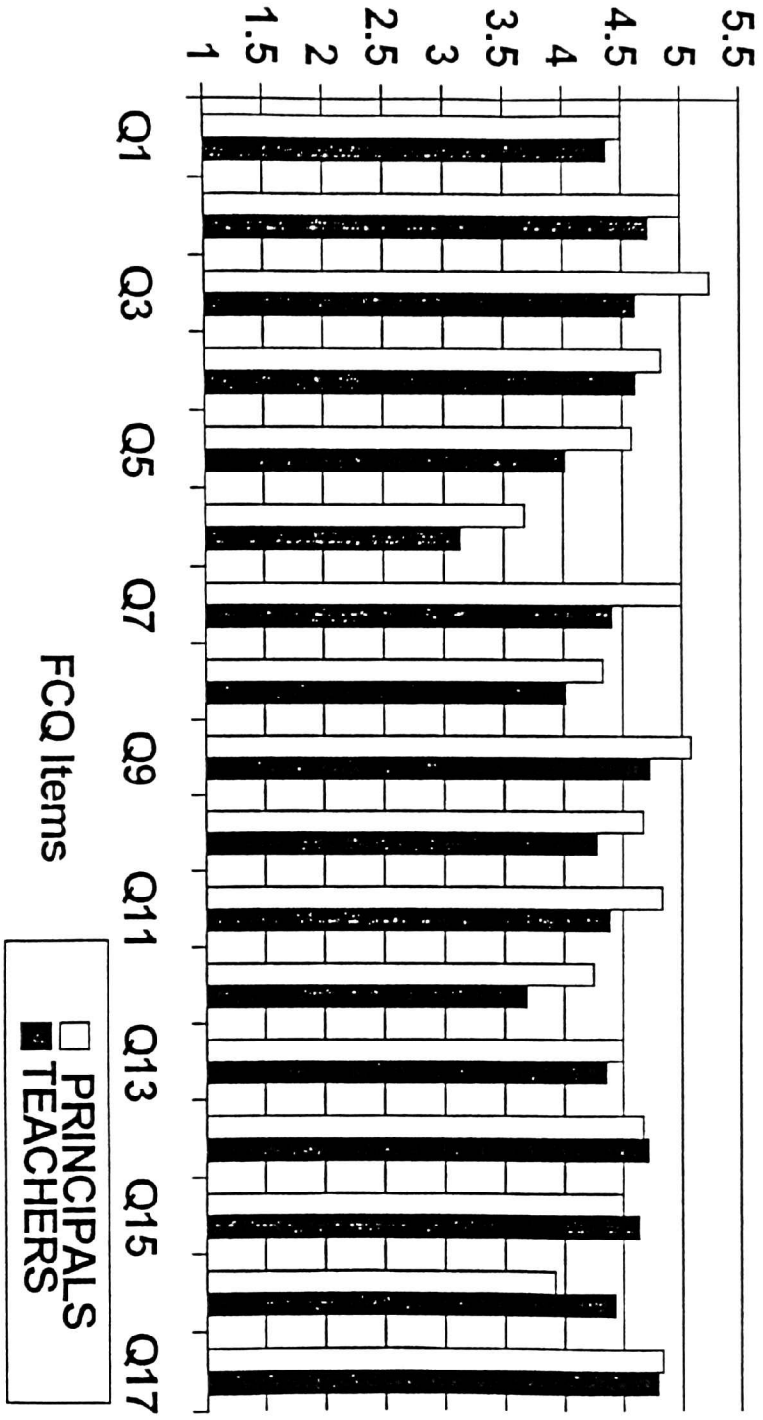
APPENDIX L

Mean Responses of Different Grade Level Teachers' Agreement on the SBI



APPENDIX M

Mean Responses of Principals' and Teachers' Perceptions of Change Factors



APPENDIX N

Institutional Board Review

INSTITUTIONAL REVIEW BOARD

GEORGIA SOUTHERN UNIVERSITY

To be submitted to the Institutional Review Board (IRB) for the protection of Human Subjects in Research prior to the initiation of any investigation involving human subjects. A copy of the research proposal and approval form must be attached.

APPROVAL FORM

Date: July 24, 1995

Research Title: Perceptions of Georgia teachers' and principals' about the NCTM standards in Georgia middle schools.

Principal Investigator: Lynn Futch Title: Doctoral Student

Department: EDLTR

Campus Address: LB 8143 Phone: 5079

Signature: Lynn D. Futch 4/11/95
Principal Investigator (If student researcher, major professor)

Department Head

Determination of Institutional Review Board:

Human Subjects: _____ At Risk ___✓___ Not At Risk

Action: ___✓___ Approved _____ Not Approved

_____ Reapproved _____ Returned for Revisions

Signed: Thomas L Cox Date: 8/10/95
Chair, Institutional Review Board

APPENDIX O

Permission to Use the Standards Beliefs Instruments (SBI)

Northern Illinois University
DeKalb, Illinois 60115-2888

Department of Mathematical Sciences
(815) 753-0567

FAX (815) 753-1824

(815) 753-6750
FAX 815/753-1112
e-mail: zollman@math.niu.edu

May 15, 1995

Ms. Lynn Futch
316 Sassy's Lane
Statesboro, GA 30458

Dear Lynn:

Thank you for requesting consent to use my Standard's Belief Instrument. You have my permission to use this instrument in your research as long as you cite the source.

I like the direction you are going with your research. I have enclosed a soon to be published article I did with Paul de Mesquita on teachers' preferences that also might be connected to your research survey of principals. This article discusses the most often mentioned reasons for not changing instruction, namely, beliefs that the new instruction strategy is either unacceptable, ineffective, impractical time-wise, requires too much technical skill, or too difficulty to implement.

I also have enclosed a "Call for Paper" for the 23rd annual meeting of the Research Council for Diagnostic and Prescriptive Mathematics Conference to be held in Melbourne, Florida, on February 29 - March 2, 1996. I think a preliminary report on your dissertation would be favorably received.

This might feel too soon to be reporting on your research, but I strongly urge you to submit a proposal by June 1st. By next February you will have some data, if only preliminary, to share. I think this is a very good, nurturing conference to begin discussing your research. It is not the size and aloofness of NCTM or AERA, and the faculty who attend are very bright, supportive, and caring professional researchers. They would be interested in your research. RCDPM publishes the journal, *FOCUS on Learning Problems in Mathematics.*

Since you in the first group of PhD candidates at Georgia Southern, I also advise you to request funding from the Graduate School to attend and present at RCDPM. I would be willing to send a letter of support to your institution on your behalf.

My final piece of advice is for you to get a copy of *How to Complete and Survive a Doctoral Dissertation* by David Sternberg, 1981, St. Martin's Press, New York (ISBN 0-312-39606-6). It has lots of down-to-earth hints on picking committee members, disseration anxieties, etc.

Sincerely,

Alan Zollman, Ph.D.
Mathematics Education

APPENDIX P

Permission to Use the Foley Change Questionnaire (FCQ)

Flint Lake Elementary School
4106 North Calumet Avenue
Valparaiso, Indiana 46383

Dr. Jane Foley, Principal
(219) 531-3160
(219) 531-3164 FAX

Lynn Futch
316 Sassy's Lane
Statesboro, GA 30458
June 29, 1995

To Lynn Futch:

You have my permission to use the questionnaire from my dissertation. The only thing that I request is that you reference it as being developed by me. Good luck with your study; let me know if I can help in any other way.

Sincerely,

Jane Foley

Jane Foley, Ph.D.
Flint Lake Principal

APPENDIX Q

Permission to Use Crosswhite's Work

Don Pratt
School Science and Mathematics
Executive Secretary

Mr. Pratt:

I am working on my doctoral dissertation at Georgia Southern University in Statesboro, GA. The title of my dissertation is "An Examination of Georgia Middle School Teachers' and Principals' Beliefs About the NCTM Standards, Factors Influencing the Change Process, and the Role of Identified Principals During the Mathematics Reform Effort in Georgia."

In my review of the literature chapter, I have used extensively long quotes from an article in the School Science and Mathematics Journal. I would like permission to use these quotes. I need a letter of approval to include in the appendices. The article title and author are: "National Standards: A New Dimension in Professional Leadership" by F.J. Crosswhite in Volume 90, Number 6, October 1990. I used a long section from pages 455-456.

If permission is granted, please fax to.

Lynn Futch
912-587-5181 or 912-823-9057

If you need further information, you can contact me at:

Stilson Elementary School	Home
15569 HWY 119	316 Sassy's Lane
Brooklet, GA 30415	Statesboro, GA 30458
(912) 823-3160	(912) 587-5181

Sincerely,

Lynn Futch

Lynn Futch

2/28/96

Permission Granted

Donald L Pratt

Executive Secretary, SSMA