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Preparation for High School Mathematics Reform in the Northeast Georgia Resa District: A Stage of Concerns Approach to Examining Professional Learning

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PREPARATION FOR HIGH SCHOOL MATHEMATICS REFORM IN THE NORTHEAST GEORGIA RESA DISTRICT: A "STAGES OF CONCERNS" APPROACH TO EXAMINING PROFESSIONAL LEARNING

by

KAY SMITH HAUGEN

(Under the Direction of Gregory Chamblee)

ABSTRACT

The purpose of this study was two-fold. The first purpose was to examine the longitudinal concerns of a cohort of high school mathematics teachers in the Northeast Georgia Regional Educational Services Agency (RESA) district about implementation of the Georgia Performance Standards. The second purpose was to explore relationships among their Stages of Concerns profiles, demographic factors, and professional learning experiences provided by institute instructors. The study examined Implementation of Georgia Performance Standards in High School Mathematics as a change innovation using the Concerns-Based Adoption Model. The study utilized a mixed methods time-series research design. Quantitative data were collected using the Stages of Concern Questionnaire. Qualitative data were collected from the workshop participants using an open-ended question of concern and from the institute instructors using interviews. Results of the quantitative analysis showed participants moving from the information stage to the management stage to the awareness stage. Results are consistent with new users of an innovation whose management concerns are not being met. Individual participants' scores at the information stage decreased significantly. Group stages of concern profiles were analyzed based on selected demographic variables. There were no

significant differences in mean stages of concern scores among groups of workshop participants categorized by years of teaching experience. Participants who chose a traditional textbook had significantly higher information concerns than participants who chose a reform-based textbook and participants who remained undecided about a textbook choice. Participants who participated in other professional learning activities scored significantly higher on collaboration concerns than did participants who were involved in Math I training only. Qualitative analysis of the open ended question of concern revealed concerns about materials such as textbooks and learning tasks, concerns about time management, concerns about readiness of students for a more rigorous curriculum, and concerns about educational change in general. Analysis of the interview data from institute instructors revealed that instructors' awareness of participants' concerns was on target and that they were working to address the concerns to the best of their ability. Results of the study were used to make recommendations for further professional development and collaborative efforts for teachers acting as change agents.

INDEX WORDS: Dissertation, Concerns Based Adoption Model, Mathematics Education, Mathematics Reform, Curriculum Reform, Professional Learning

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DEDICATION

This dissertation is dedicated to my husband of 33 years, David Robert Haugen. Dave: This work would not have been possible without your loving support and willingness to keep the home fires burning for four long years. Thank you for seeing that I had clean clothes to wear and food to eat. Thank you for putting up with my papers and books all over the house. Thank you for not laughing when I put my research in the bathtub during the tornado warning. Lastly, thank you for your calm and soothing reassurances in the midst of the storms of my making. You are an incredible husband and the love of my life.

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CHAPTER 1

INTRODUCTION

Sustainable system change is the agenda,
and we are at the very early stages of an exciting journey.
(Fullan, 2003, p. xiii)

At any given time and place, policymakers contemplate introducing a new innovation to teachers, who, in turn, are expected to introduce the innovation to their students. This change process typically begins with promises such as school improvement, enhanced student learning, and increased student achievement. Mathematics teachers in Georgia are currently involved in such a change as they prepare to implement a major curriculum reform –*The Georgia Performance Standards* (GPS).

According to Amit and Fried (2002), "a reform movement is both an agent of change and a response to it" (p. 375). Curriculum reform in Georgia is an *agent of change* for the teachers and administrators who are being required to implement it. State leaders envision Georgia as a national change agent, as evidenced by the stated mission of the Georgia Department of Education: "Leading the nation in improving student achievement" (Cox, 2007d). Georgia curriculum reform is also a *response to change* brought about by the federal No Child Left Behind legislation passed in 2001 which "brought accountability to a new level" (Lodico, Spaulding, & Voegtle, 2006, p. 2) in the United States.

Any reform effort will result in new demands on the teachers expected to implement the reform (Charambous, Philippou, & Kyriakides, 2004). The teachers will play an important role in the success of the reform effort.

Context of Study

This study focuses on Georgia high school math teachers' concerns related to implementation of a standards-based curriculum and the teachers' journeys through a state sponsored professional learning experience. The topic fits into the realm of educational change in the broader field of curriculum studies. The context of the study is developed by discussing the following major areas: change theory, defining concerns, the Concerns Based Adoption Model, educational change in mathematics education, Georgia curriculum changes, and professional development of teachers.

Change Theory

The philosophy of educational change can be traced to two traditions. The first, commonly referred to as the *Diffusion of Innovations* (Rogers, 2003) tradition began in the 1940s with a study of the diffusion of hybrid seed corn. The *general systems theory tradition* emerged in the 1950s. Systems theory originally focused on management science but began to be applied to educational research in the 1970s (Ellsworth, 2000).

Various educational change models emphasize different aspects of the change process. For example, Fullan (1982; 1993; 1999; 2003) writes about the characteristics of the "change agent" at a particular level of implementation. External change agents include state and national policy setters and outside consultants. District administrators, principals, and classroom teachers are examples of change agents at the local level. The Concerns-Based Adoption Model (CBAM) (Hall & Hord, 1987, 2006; Hord, Rutherford, Huling-Austin, & Hall, 1987) focuses on the people who are expected to adopt the innovation. Ely (in Ellsworth, 2000) concentrates on why so many educational initiatives fail.

The purpose of a research study dictates which model best serves as a framework for the study. If any innovation is going to be a success, then the framework of change theory must guide the facilitators of change. The concerns of the individuals expected to adopt the change are critical because the individuals have a great deal of control over the innovation (Hall & Hord, 2006). Change is by nature a slow, evolutionary process. While some individuals will readily embrace change, others will strongly resist it. Change is accomplished one individual at a time, but it can be facilitated by principals, department heads, and consultants who understand the nature of change and the culture of the individuals responsible for the change. If the change facilitators understand the needs of the individual change adopters, then they can plan and deliver appropriate interventions to bring about change (Anderson, 1997).

Defining Concerns

Any time a group of individuals is required to undergo change for the alleged purpose of school improvement, the individuals exhibit concerns in a predictable manner (Guskey, 2000). Conway and Clark (2003) give credit to Frances Fuller (1969) for being the first researcher to use the word "concerns" in conjunction with teachers' feelings, worries, and attitudes about teaching. Developers of the Concerns Based Adoption Model (Hall & Hord, 2006) identified and sorted concerns about implementation of an innovation into four categories they called awareness, self, task, and impact. They further divided the categories into seven stages: awareness, information, personal, management, consequence, collaboration, and refocusing. The CBAM team (Hall et al.) has conducted extensive research using their model for change. Their research documents that

"interventions to facilitate change need to be aligned with the concerns of those who are engaged with the change" (Hall & Hord, 2006, p. 138).

Concerns Based Adoption Model

The Concerns Based Adoption Model (CBAM) is a diagnostic tool used to track adopters' concerns and behaviors related to the use of an innovation (Ellsworth, 2000). Anderson (1997) called CBAM "the most robust and empirically grounded theoretical model for the implementation of education innovations to come out of education change research in the 1970s and 1980s" (p. 331). CBAM consists of three components, each with a specific use in measuring and conceptualizing individual change. The three components are Stages of Concern, Levels of Use, and Innovation Configurations. The current study utilized the Stages of Concerns Questionnaire to gather quantitative data and compile Stages of Concern profiles of the participants.

Educational Change in Mathematics Education

In recent years, there has been a shift in the philosophy of mathematics education from thinking about mathematics as a rigid set of rules and procedures to one that views mathematics as a creative and dynamic process. With the introduction of a recommended set of national standards for mathematics education (NCTM, 1989, 2000), the National Council of Teachers of Mathematics presented a vision of a mathematics classroom where students were actively involved in constructing their own meaning of mathematics. Current research indicates that standards-based classrooms provide the optimal climate for best instructional practice and increased student achievement (Kramarski, Mevarech, & Arami, 2002; Reys, Reys, Lapan, & Holliday, 2003; Riordan & Noyce, 2001).

Georgia Curriculum Changes

In 2001, the Georgia Department of Education (*Georgia Performance Standards*, 2005) began a process that resulted in a major revision of its curriculum from the Quality Core Curriculum (QCC) to the Georgia Performance Standards (GPS). Implementation for sixth grade math began in the 2005-2006 school year. Seventh grade math standards were implemented in 2006-2007. Implementation of math standards in eighth grade as well as all elementary grades from Kindergarten to fifth grade followed in 2007-2008.

Middle and elementary school teachers were trained during the year preceding their grade's implementation. High school teachers began training in the summer of 2007 followed by more training during the 2007-2008 school year. Freshmen entering high school in 2008 will have been taught under GPS since their sixth grade year. GPS implementation will follow them throughout their high school careers with full implementation for all students occurring during the 2011-2012 school year.

The QCC was a curriculum where content was repeated in different grade levels with no indication of differences in depth of understanding. According to a 2002 Phi Delta Kappa Audit (Jacobson, 2002), the QCC lacked rigor and depth. The audit estimated that it would take 23 years of instruction before students could achieve true understanding of the mathematics found in the curriculum objectives. Typical textbooks contained more topics than teachers could realistically cover in a given year. As a result, many teachers would simply teach to the state test by presenting bits and pieces of disconnected mathematical topics. Consequently, students received only a superficial knowledge of mathematics, and much of that was forgotten as soon as they took the state

test. Furthermore, the QCC did not meet recommended national standards (*Executive Summary*, 2006).

The GPS is designed to correct the deficiencies of the QCC. It follows a ladder approach to teaching mathematics which means that the concepts build on each other from grade to grade. For example, if the same topic is taught in two different grades, it is taught with a different level of understanding and different information. The number of topics per grade level has been reduced to a more manageable level to give teachers more time to develop and implement meaningful learning tasks that should enable students to gain a deeper knowledge of mathematics (*Executive Summary*, 2006).

The GPS mathematics curriculum contains content strands and process strands. Standards for grades K-2 contain four content strands: numbers and operations, measurement, geometry, and data analysis. An algebra strand is added in third grade. The content standards for grades 7-12 include number and operations, geometry, algebra, and data analysis and probability. Process strands of problem solving, reasoning, representation, connections, and communication are interwoven throughout the curriculum. The content is presented in contextual situations where students are expected to apply the mathematics rather than to merely follow a sequence of procedures. Active engagement in learning mathematics is fostered with manipulatives and technology. Students are encouraged to use multiple representations, to work independently and cooperatively, and to conduct investigations and record findings (Cox, 2008a). This is a change from the QCC which simply contained a listing of individual content objectives. Although expectations of reasoning and connections could probably be inferred from QCC objectives, problem solving was the only process standard explicitly mentioned.

Major changes to the elementary and middle school math curriculum included the introduction of algebra topics as early as third grade and the movement of many algebra and geometry topics from high school to middle school. Some of the most extensive changes have occurred at the high school level where the traditional Algebra I, Geometry, Algebra II, and Trigonometry sequence were replaced with an integrated approach to mathematics. An integrated approach to mathematics at the high school level means that all five content standards will be interwoven throughout the high school courses. This approach is more consistent with the top performing nations of the world such as Japan, Korea, and Singapore (Taylor & Tarr, 2003). Since a single math course will contain topics from several branches of mathematics (algebra, geometry, trigonometry, statistics, etc.), the courses were renamed Math I, Math II, Math III, and Math IV.

There will only be two levels of mathematics for high school students. Both levels are designed to prepare students for college-level mathematics. The mathematically gifted students will take Accelerated Math I, Accelerated Math II, Accelerated Math III, and an Advanced Placement class (either AP Calculus or AP Statistics). All other students will take Math I, Math II, Math III, and Math IV. Research shows that tracking students by ability increases the achievement gap between minority and other students (Oakes, 2005). GPS, implemented correctly, will eliminate academic tracking for all but the students who are gifted in mathematics. This is a change from the three academic tracks associated with the current QCC courses for high school mathematics. The first level, known as the "concepts" strand, is designed for the lowest 25^{th} percentile of students. The second level, called the "applied" or "tech-prep" strand, is designed for the students on the technical track. The third level, designed to prepare students for college,

is usually referred to simply as the "college-prep" sequence. By the controversial nature of the topic, the prospect of eliminating the "low-level" track of mathematics in high school is likely to create a challenge for GPS implementation.

The Georgia Department of Education has identified ten key concepts of a standards-based classroom. In their manual for school improvement (Cox, 2007b), state policymakers posit there is a process that teachers must go through before their classrooms are fully operational as "standards-based." The ten concepts are as follows:

1. The Georgia Performance Standards are utilized as the curriculum in the school (based on the phase-in plan), and there is a shared understanding of the standards.
2. Standards are accessible to all students.
3. Teachers sequence the lesson or their instruction in a logical, predictable manner referencing standards throughout.
4. A variety of delivery models are incorporated into instruction to ensure that all students have access to and meet standards.
5. Students are expected to meet the same standards and instruction is differentiated by content, process, and/or product.
6. Assessments are aligned to the GPS and used frequently to adjust instruction and provide student with feedback.
7. Examples of student work are displayed for student use. Benchmarks are provided to gauge progress over time. Exemplars are provided to exemplify the standards.

8. Student performance tasks require students to show progress toward meeting the standard(s)/element(s).
9. Students receive feedback through written or verbal commentary aligned with the standards that results in revision of work, if needed.
10. Student work reflects understanding of the Georgia Performance Standards. (pp. 258-261)

Professional Development of Teachers

One of the best predictors for successful implementation of change to a standards-based classroom is whether the teachers participated in the professional development opportunities (Schoen, Cebulla, Finn, & Fi, 2003). It is extremely rare to witness notable school improvement taking place without some form of well designed and supported professional development (Guskey, 2000; Philipp, 2007).

Four principles identified as essential for successful professional development are emphasis on content knowledge, opportunities for active learning, consistency with other learning activities, and sustained follow-up (Garet, Porter, Desimone, Birman, & Yoon, 2001). Focus on content knowledge rather than pedagogical issues results in higher student achievement. Opportunities for active learning are essential to enable teachers to experience the type of classroom they are expected to manage (Darling-Hammond & McLaughlin, 1995). Teachers will appreciate the professional development activities if they can link them to prior knowledge and to their state and district standards. Just like educational change, professional development should be viewed as a process, not an event. Therefore, sustained follow-up is crucial to the success of the learning experience.

Theoretical Framework

The theoretical framework for this study is change theory. Research into reform must be concerned with characteristics of change as well as the change process. Fullan (1982) maintains that change usually occurs for one of two reasons. The first reason is because there is no choice. A reform initiative could mandate change, or change may be necessary because of natural events that occur. The second reason is a more elective change because it results from dissatisfaction with current circumstances. In the second case, a person seeks change to make life easier or more tolerable. The new high school mathematics curriculum using Georgia Performance Standards is a mandated change. Teachers have no choice in the matter if they want to continue in their chosen careers.

The Concerns Based Adoption Model (CBAM) (Hall & Hord, 1987, 2006; Hord et al., 1987) provides a specific blueprint for studying change over time from both an individual and a group perspective. CBAM can be used as a framework for studying change in any setting. As a tool for studying change in an educational setting, it is "concerned with measuring, describing, and explaining the process of change experienced by teachers involved in attempts to implement new curriculum materials and instructional practices, and with how that process is affected by interventions from persons acting in change-facilitating roles" (Anderson, 1997, p. 331).

Rationale for Study

Research indicates that teachers follow steps when implementing educational innovations, and this step-by-step change process is developmental in nature (Donnelly, Dove, Tiffany-Morales, Adelman, & Zucker, 2002; Fuller, 1969; Hall & Hord, 1987; Sandholtz, Ringstaff, & Dwyer, 1997). Implementation can take three to five years or

more to achieve a high level of success (Fullan, 2001; Hall & Hord, 2006). A 2002 Phi-Delta Kappa audit gave Georgia high marks for its reform efforts but found their timeline for training teachers to implement the standards to be too short (Jacobson, 2004). If education leaders in Georgia are going to avoid mistakes like rushing the process and underestimating teacher concerns, then understanding the nature of the change process is imperative.

Research also shows that teachers are pivotal to the success of any extensive reform effort such as implementing the Georgia Performance Standards. Darling-Hammond and McLaughlin (1995) identify the major obstacle that policymakers face in accomplishing systemic reform as follows:

> The vision of practice that underlies the nation's reform agenda requires most teachers to rethink their own practice, to construct new classroom roles and expectations about student outcomes, and to teach in ways they have never taught before – and probably never experienced as students. (p. 597)

Successful professional development must model the behavior that teachers should use with their students. Just as students learn by doing, teachers learn in a similar fashion. Furthermore, the professional development must link to classroom practice. According to Guskey (2000), "*Teacher knowledge and practices* are the most immediate and most significant outcomes of any professional development effort. They also are the primary factor influencing the relationship between professional development and improvements in student learning" (p. 75, [emphasis in original]). Research shows that implementation of new curriculum can vary greatly from one classroom to another (Hall & Hord, 1987; Ross, McDougall, & Hogaboam-Gray, 2003). Therefore it will be

important for Georgia mathematics leaders and policymakers to assess the use of the knowledge and skills that the participants acquire in their GPS training sessions.

Studying teachers' concerns provides valuable information for both formative and summative evaluation of the professional development (Guskey, 2000). Hall and Hord (2006) assert that knowledge of teacher concerns must guide instruction in the formative stage of evaluation. A workshop that is purely informational in nature will not be beneficial if teachers are already knowledgeable about the innovation and are more concerned about how they are going to manage implementation. Likewise, a workshop focusing on the benefits to students will be wasted on teachers who are still at the information stage. Knowledge of teacher concerns at the summative stage can answer questions related to the use of the innovation. For example, lack of implementation may be explained by high concerns about management. If teachers have unresolved management issues, they are not likely to have fully implemented the innovation. Therefore it is important for planned professional learning activities to coincide with the concerns of the workshop participants.

This study was of particular interest to the researcher as a high school mathematics teacher involved in implementation of the Georgia Performance Standards. In her 32-year teaching career, she has seen many educational "innovations" come and go. The curriculum based on the Georgia Performance Standards is the most radical change she has experienced. She was disturbed by some of the attitudes she witnessed and comments she heard as she listened to her colleagues at conferences and other professional gatherings.

A 50-year veteran of the math classroom in a neighboring school system, highly respected with numerous teaching awards, is finally retiring. He said, "What they're doing to mathematics in the State of Georgia is a train wreck, and I want no part of it" (personal communication, February, 2008). The school system in which the researcher teaches lost 100% of its middle school math staff and 50% of its high school mathematics faculty to retirement over the last three years. GPS played a big role in the decision to retire for most of these teachers. One sixth grade teacher retired mid-year during the first year of implementation. She said, "I don't need the money, and I can't take this anymore" (personal communication, December, 2005). A high school geometry teacher said, "I'm just too old and set in my ways to change now" (personal communication, May, 2006).

From these personal observations and communications with colleagues, the researcher became aware of much opposition to the curriculum changes in Georgia. Understanding the process of change and identifying the concerns of the mathematics teachers in Georgia would better prepare the researcher for becoming a positive advocate for change in her school and in her RESA (Regional Educational Services Agency) district.

Purpose of the Study

The purpose of this study was two-fold. The first purpose was to examine the longitudinal concerns of a cohort of high school mathematics teachers in the Northeast Georgia RESA district about implementation of the Georgia Performance Standards in their classrooms. The second purpose was to explore relationships among their Stages of

Concerns profiles, demographic factors, and professional learning experiences provided by institute instructors.

Research Questions

The study was guided by the following research questions.

1. What are the longitudinal Stages of Concern profiles of the workshop participants?
2. Are there significant changes in the Stages of Concern profiles as workshop participants experience professional learning activities over time?
3. Are there relationships among workshop participants' demographic data (years of teaching experience, professional development experiences, choice of textbook) and Stages of Concern profiles?
4. How do the institute instructors' expectations of workshop participant concerns and the planned professional learning experiences correspond to the workshop participants' Stages of Concern profiles?

Significance of the Study

This study adds to the current body of literature regarding professional development evaluation and the role of interventions used by change facilitators in the success of implementation of educational innovations. Information obtained in this study regarding teachers' longitudinal Stages of Concerns about implementing Math I Georgia Performance Standards provides evaluative information for policymakers in Georgia as they plan initial and follow-up professional development for high school mathematics teachers. Knowledge of teachers' various Stages of Concern aids institute instructors in sequencing follow-up professional learning opportunities to better meet teachers' needs.

The comparison of Stages of Concerns profiles with demographic data provides a means for explaining and interpreting the concerns data. Institute instructor interviews provided the institute instructors with a venue for reflection and self-evaluation of the training program. Furthermore, this study adds to the national research on educational change.

Assumptions of the Study

It was assumed that the workshop participants were current mathematics teachers in the Northeast Georgia RESA area and that the institute instructors were qualified for training them in the Georgia Performance Standards. It was also assumed that workshop participants were truthful in their Stages of Concerns responses and that institute instructors were honest in their answers to interview questions. Another important assumption of this study was that teachers are key change agents who must have long-term support and adequate resources for changes to occur.

Limitations of the Study

There were several limitations of the study. First, teachers were not randomly selected for this professional development opportunity. They were selected by their principals.

Second, this study only surveyed teachers in the Northeast Georgia RESA district; therefore it may not be representative of teachers in other areas of Georgia or nationally.

Third, this study used one component of the Concerns Based Adoption Model to assess change (Stages of Concern). Studies utilizing the Levels of Use and Innovation Configuration aspects would provide additional information. However, it was too early in the process of implementing the Georgia Performance Standards for Levels of Use or Innovation Configuration to be studied.

Fourth, because the Stages of Concern Questionnaire was administered to a group comprised of first-time users of the Georgia Performance Standards, the results cannot be expected to be the same as survey results for users who were further into implementation.

Fifth, the group of participants from one training session to the next did not remain stable. Some math departments sent substitutes when conflicts kept the original teachers from attending. Some school administrators sent additional algebra teachers rather than sending statistics and/or special education teachers.

Finally, the researcher was a participant in the Northeast Georgia Math I training. She did not complete the Stages of Concern questionnaires or the demographic survey.

Definitions of Terms

Change Facilitator – A person who assists various other individuals or groups to develop "the competence and confidence needed to use a particular innovation" (Hall & Hord, 1987, p. 11). The specific change facilitators identified in this study are the professional development instructors.

Concern – "The composite representation of the feelings, preoccupation, thought, and consideration given to a particular issue or task" (Hall & Hord, 2006, p. 138)

Concerns-Based Adoption Model (CBAM) – "A framework for measuring implementation and for facilitating change in schools" (George, Hall, & Stiegelbauer, 2006, p. xi). CBAM contains three components: Stages of Concern, Levels of Use, and Innovation Configuration.

Georgia Performance Standards – The K-12 curriculum in Georgia. It contains four essential elements: content standards, suggested tasks, sample student work, and teacher commentary on that work (*Georgia Performance Standards*, 2005).

Innovation - "An idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 2003, p. 12).

Intervention – Various actions and events that change facilitators and others take to influence the process of change (Hall & Hord, 2006). The particular interventions of interest to this study are the professional learning experiences planned by the institute instructors.

Stages of Concern – A component of the Concerns Based Adoption Model that describes developmental patterns of a user's feelings and perceptions as the change process evolves.

Standards-based Classroom – A classroom in which teachers and students articulate a common understanding of what they are expected to know, understand and be able to do based on an established set of learning standards (Cox, 2007b).

Summary

Math teachers in Georgia are preparing to implement a major curriculum reform called the Georgia Performance Standards. While some teachers embrace this opportunity for change, many others are highly resistant to the changes. The success or failure of this implementation rests in the hands of the classroom teachers.

This study utilized the Stages of Concern component of the Concerns Based Adoption Model to examine individual and group Stages of Concern profiles of high school mathematics teachers undergoing Math I training in the Northeast Georgia RESA district.

CHAPTER 2

REVIEW OF THE LITERATURE

> There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things. Because the innovator has for enemies all those who have done well under the old conditions and lukewarm (indifferent, uninterested) defenders in those who may do well under the new. (Machiavelli, 1532, ¶5)

The theoretical framework of this study is change theory. Situated broadly in the field of curriculum studies and specifically in the context of mathematics education reform, the study uses the Concerns Based Adoption Model (CBAM) to investigate the change process as it applies to high school math teachers implementing a new standards-based mathematics curriculum in the State of Georgia. The literature review examines change theory in general and CBAM in particular. An overview of educational changes in mathematics education leads into a discussion of the influence of the National Council of Teachers of Mathematics on mathematics reform and professional learning. The development of major mathematical curricular changes in Georgia is presented. Research of specific professional learning experiences shown to be effective in bringing about positive change in teaching practice is summarized. The chapter concludes with a discussion of Georgia's professional learning plan for high school mathematics.

Change Theory

Ellsworth (2000) traced the philosophy of educational change to two traditions. The *Diffusion of Innovations* tradition began in 1943 when Ryan and Gross studied the diffusion of hybrid corn. This study "set forth the basic paradigm for studying diffusion"

(Rogers, 2003, p. 46). Diffusion refers to the way an innovation spreads throughout a social system. Whether the innovation relates to agriculture as in the hybrid corn study or the use of a new antibiotic by doctors or the use of a new technology by teachers, the process by which the innovation spreads is notably similar.

A second tradition began in the 1950s with the *general systems theory* described in von Bertalanffy's journal. Systems theory focused on management science at first, but was introduced into education research in the 1970s by Banathy. The two traditions do overlap. For example, Hall, Wallace and Dossett used adaptive systems theory in their early works considered to belong in the diffusion tradition (Ellsworth, 2000).

Although Ellsworth traced the theory of educational change to the 1940s, Rogers placed the beginning of change theory in Europe a century earlier. Gabriel Tarde from France and Georg Simmel from Germany were social scientists. Tarde viewed diffusion of innovations as a way to explain human behavior change. Simmels was best known for the concept of a "stranger" as a member of a system who is not strongly attached to the system. Since a stranger was more likely to deviate from the norms of a system, he would be more willing to adopt new ideas (Rogers, 2003). This early work by Simmel led to work by other social scientists in studying communication networks.

There are several current educational change models presented in the literature. Each provides a slightly different perspective on the process of change in education. The primary models, their principle authors, and their primary focus are summarized in Table 1. While no certain model can be viewed as better than another, some are better suited than others to serve as the framework for a particular piece of research, depending on the aspect of educational change it is intended to study (Ellsworth, 2000).

Table 1

Educational Change Models

Author(s)	Major Work	Focus
Ely	*Conditions of Change*	Social system's receptiveness to change
Fullan and Stiegelbauer	*New Meaning of Educational Change*	Change agents
Hall, Wallace and Dossett	*Concerns Based Adoption Model*	Adopters of the innovation
Havelock and Zlotolow	*The Change Agent's Guide*	Change process
Reigeluth and Garfinkle	*Systemic Change in Education*	System
Rogers	*Diffusion of Innovation*	Innovation attributes
Zaltman and Duncan	*Strategies for Planned Change*	Resistance to innovation

Change is not an easy process and is often fraught with controversy. Fullan (2001) maintains that change in general usually occurs for one of two reasons. The first reason is because there is no choice. A reform initiative could mandate change, or change may be necessary because of natural events that occur. The second reason is a more elective change because it results from dissatisfaction with current circumstances. In the second case, a person seeks change to make life easier or more tolerable. Regardless of the reason for change, the process will involve concern, loss, and effort. If this part of the change process is not acknowledged, the change effort is likely to fail.

Ultimately the fate of any educational reform effort will rest in the hands of the classroom teachers (Henry & Clements, 1999). Teachers will make fundamental decisions regarding how the innovation will be implemented in the classrooms (Sandholtz et al., 1997). Furthermore, the greatest obstacle to implementation will be teachers' beliefs about teaching and learning (Philipp, 2007; Ross et al., 2003).

According to Fullan (1993), "the more complex the change, the less you can force it" (p. 22). The problem with mandated change is that policymakers can tell us what we must do, but they cannot mandate what we consider important (Fullan, 1993). Neither can the change process be rushed. Sarason (1990) states, "Nothing will be more subversive of the [change] process than an unhistorical, unrealistic conception of the relationship between time perspective and institutional change" (p. 63). According to Fullan (2001), "you can turn around an elementary school in about 3 years, a high school in about 6 years, and a school district (depending on size) in about 8 years" (p. 17). Even then the results of the change are fragile. They can fall apart quickly with the loss of just one or two key leaders.

In *Implementing Change: Patterns, Principles and Potholes* (Hall & Hord, 2006), the authors list 12 principles of change. The first principle they name is "change is a process, not an event" (p. 4). Fullan (1993) has a similar principle: "Change is a journey, not a blueprint" (p. 21). The second principle given by Hall and Hord (2006) is "there are significant differences in what is entailed in development and implementation of an innovation" (p. 5). The general pattern is for policymakers to invest heavily in the development portion of an innovation to the expense of the implementation side of the equation. This imbalance does not provide the level of support necessary for teachers at

the grassroots level who must bear the brunt of the implementation. Their third principle states, “An organization does not change until the individuals within it change”(Hall & Hord, 2006, p. 7). Research shows that individuals respond to change in predictable patterns. It behooves the policymakers to pay attention to these patterns and be prepared for the appropriate interventions.

The fourth principle named by Hall and Hord (2006) is that “innovations come in different sizes” (p. 7). Size can relate to the scale of the project or the implications of the innovation. For example, the introduction of a new textbook series to continue with the same curriculum standards is a relatively small-scale change. Introduction of a new state-wide curriculum that varies drastically from the old curriculum is an example of a large-scale change.

The fifth principle, “Interventions are the actions and events that are key to the success of the change process” (Hall & Hord, 2006, p. 8) speaks to the notion of training. Hall and Hord use the term “intervention” to describe “any *action* or *event* that influences the individuals involved or expected to be involved in the process” (p. 186). An action is defined as a deliberate or planned act such as purchasing curriculum materials or denying funding for additional staff development. Conversely, an event is an unplanned happening. Examples are a fire in a warehouse causing delayed delivery of curriculum materials or a principal’s sudden illness, causing a school-wide faculty meeting to be canceled while freeing up time for departmental collaboration. Interventions can affect implementation of an innovation negatively or positively. They can be obvious (such as a workshop) or subtle (such as a brief conversation in the hallway). Hall and Hord (2006)

found that the degree of success of innovation implementation was correlated with the number of small, individualized interventions.

The sixth principle states, “There will be no change in outcomes until new practices are implemented” (Hall & Hord, 2006, p. 9). School systems are under immense pressure to improve standardized test scores. According to Hall and Hord, there is a bridge between current practice and changes in practice that teachers must cross. Their research indicates that the further along this bridge the teachers are, the higher the test scores of their students.

The seventh principle concerns administrative leadership. Hall and Hord state, “Administrator leadership is essential to long-term change success” (Hall & Hord, 2006, p. 10). Hall and Hord (1987) reviewed literature on change from three perspectives. They studied work from industrial and organizational psychology, sociology, organizational management, and behavioral psychology. They studied change, knowledge utilization, school improvement, and dissemination literature. Finally, they looked at studies in educational administration. The theme that emerged from their review of literature was that the school principal is a key leader and change agent. The primary job of principals as change agents is to facilitate the process for change in their schools. Hall and Hord maintain that the work of the principals is most successful when they consider the concerns of their teachers. Teachers and principals who often engage in “one-legged interviews” provide a model of open communication that has proven successful. The term one-legged interview refers to the conversations teachers and principals have in the hallway when one leg is already in position to hurry on to the next task. Success strategies of communication and training have proved the eighth principle of change that

"mandates can work" (Hall & Hord, 2006, p. 11) when appropriate steps are taken to achieve success.

Principle nine states that "the school is the primary unit for change" (Hall & Hord, 2006, p. 12). Although it is important for individual teachers to want to change, it is hard to see results if the school is not on board. This brings us to principle ten which says "facilitating change is a team effort" (Hall & Hord, 2006, p. 12). This is true regardless of the innovation. For example, research regarding implementation of technology shows that schools which have the most success have principals who are dedicated to seeing the technology work and who make sure their teachers are working toward the same goal (Pflaum, 2004; Sandholtz et al., 1997).

The eleventh principle says that "appropriate interventions reduce resistance to change" (Hall & Hord, 2006, p. 13). The authors mention that sometimes what seems to be resistance is actually teachers working through the grieving process for the loss of something that was very comfortable to them. Resistance could be grounded in a belief that the change is not really an improvement. It could be a clash of educational philosophies. Regardless of the reason, change is a painful process for most people involved, and leaders must recognize and acknowledge this pain. With Georgia's new curriculum, for example, geometry teachers are going to see the demise of geometry as a separate course of study in high school mathematics. This is going to be extremely painful for them to accept. Algebra teachers, who have traditionally avoided teaching geometry, will be asked to integrate it into their algebra lessons, and this will be painful for the algebra teachers. However, the grieving process cannot be rushed. There must be interventions to acknowledge teachers' pain yet guide them to move on.

The final principle of change that Hall and Hord (2006) enumerate is that "the context of the school influences the process of change" (p. 14). Research supports the claim that we must consider the culture of the school. Stein, Smith, and Silver (1999), for example, studied two staff development models in two different schools and determined different results. One school was able to develop a learning community based on "a shared vision of mathematical competence for their students," while "the notion of community never took" (p. 266) at the other school. The cultures of the schools played a significant role.

Change is never easy. If an innovation is going to be successful, it is important to learn from the mistakes of previous failures (Sarason, 1990). Did the innovations fail because they were not really improvements, or did they fail because the leaders did not pay attention to the concerns of the people expected to carry out the change? Did they fail because there was not enough time allotted to give the innovation a chance? Change theory looks at failures and successes and notes what it takes to successfully implement an innovation. For any innovation to be a success, the framework of change theory must guide the facilitators. In the schools, the brunt of the work will fall upon the teachers. As one group of researchers noted after observing one successful case study and one unsuccessful case study:

> In order to take on the burden of change, teachers need to know that the reform is valued in their school, that they will be supported in their efforts to change, and that their colleagues in other subject matters also feel accountable for making change. (Stein et al., 1999, p. 267)

Focusing on individual teachers personalizes the change model. Some individuals readily embrace change. Others take time to understand, accept and implement changes. Still others will never accept change. Hall and Hord (2006) maintain that "if change-facilitating interventions are appropriate, timely, and address the client's particular concerns, the process can be successful for all" (p. 258).

Defining Concerns

Peers (1990) found that "one factor to emerge from evaluation studies as being a crucial element in successful educational innovations, and subsequently verified by other researchers and reviewers, is the attention paid to staff attitudes and concerns about the innovation" (p. 180). Frances Fuller was the first person to use the word "concerns" to describe teachers' feelings and worries about teaching (Conway & Clark, 2003). Prior to her use of the word concerns, researchers had used the word "attitudes."

According to McLeod (1992), the term attitude "refers to affective responses that involve positive or negative feelings of moderate intensity and reasonable stability" (p. 581). Attitude is one of three specific terms that McLeod uses to describe the affective domain. The other two terms he uses are "emotions" and "beliefs." Emotions are the least stable in nature while beliefs are the most stable. Likewise, emotions are the least cognitive in nature, beliefs are the most cognitive, while attitudes fall somewhere in between.

Fuller (1969) used the term "concerns" in the context of pre-service teachers about to embark on their student teaching journeys. Fuller first studied a small group of student teachers participating in a group seminar throughout their student teaching practice. For her second study, she collected written concern statements from a larger

group of student teachers at two-week intervals during their student teaching experiences. Finally, Fuller analyzed data received from other researchers in eight additional studies, some published and some not, from various places in the United States and from teachers in various stages of their careers. Without fail, the research revealed the same pattern. Student teachers and beginning teachers were most concerned with matters related to self. Teachers with a few years of experience were most concerned with task management. Only after teachers acquired several years of experience did students' progress become their major concern.

Fuller's initial work diverged into two different strands. One strand focused on the forces that shape the development of pre-service and beginning teachers. The other strand focused on teacher concerns in the context of adopting educational innovations. Fuller and her colleagues worked for the Research and Development Center for Teacher Education at the University of Texas at Austin. She laid the groundwork for future work at the same institution for Gene Hall and his colleagues. The work of Dossett, Hall, Hord, Huling-Austin, Loucks, Newlove, Rutherford, and Wallace resulted in the Concerns Based Adoption Model (CBAM) (Conway & Clark, 2003; Hall & Hord, 1987).

Concerns Based Adoption Model

The Concerns Based Adoption Model (Hall & Hord, 2006, p. 182) contains three components used for diagnostic purposes to measure and conceptualize individual change. These components are Stages of Concern, Levels of Use, and Innovation Configurations. The individuals that comprise the change model include users, non-users, and change facilitators.

The Stages of Concern component measures the affective side of teacher change. The Levels of Use component parallels the Stages of Concern, but it measures the behavioral side. The Levels of Use component describes how teachers are implementing the innovation in their classrooms. The model contains eight levels of use. The lowest level is nonuse. The teacher does not use the innovation and probably has never heard of it. Still in the category of nonusers are the next two levels, orientation and preparation. These levels indicate that the teacher has been made aware of the innovation but is still learning about it and preparing to use it. With mechanical use, the teacher uses a superficial application of the innovation with no reflection. Routine users implement the change without thought to improving the innovation or to the consequences of the innovation. Refinement is the stage in which the teacher varies the implementation with consideration being given to the consequences to the students. When the teacher reaches the integration stage, he or she is collaborating with colleagues to make a bigger impact on student learning. The final stage, renewal, is when the teacher is ready to re-evaluate the innovation and look for possible ways to improve it.

The necessity for a third dimension to the Concerns Based Adoption Model arose from the tendency of people implementing change to "adapt, modify, and/or mutate aspects of innovations" (Hall & Hord, 2006, p. 113). Whether deliberate or resulting from not fully understanding the nature of the innovation, the way the innovation is implemented from classroom to classroom or school to school can vary greatly. An Innovation Configuration is a map that describes the different configurations of innovation implementation. An Innovation Configuration map resembles a rubric for

evaluation. It is a continuum that describes the way the implementation might look from a picture of an ideal situation to one where the innovation is not being implemented at all.

In the Concerns Based Adoption Model, events or actions that might "pop up" during implementation of a change are called "mushrooms." Just like their namesake, the events might add flavor and be "nutritious" for the change process. On the other hand, they could also be "poisonous" and destructive to the change process. It is critical to the success of the implementation of the innovation that change facilitators be skilled in the "detection of mushrooms" (Hall & Hord, 2006, p. 248). They need to be able to tell the difference between the two types of mushrooms, encouraging the growth of the positive ones while quickly squelching the negative ones.

CBAM identifies seven stages of concern that users, or potential users, of an innovation may have during the adoption process (Hall & Hord, 2006). The seven stages of concerns (see Table 2) are awareness, information, personal, management, consequence, collaboration, and refocusing.

Any change process will see individuals at various stages along the continuum. As Peers (1990) explains it, people implementing an innovation "may experience many types and levels of concern concurrently but an individual will perceive certain demands of an innovation as being more salient than others at a given time and hence some concerns will be more intense than others" (p. 180). While the seven stages of concern (see Table 2) are not mutually exclusive, they do have distinguishing features. The stages can be grouped into the three dimensions of self, task, and impact that were first identified in the Fuller (1969) model.

Table 2

Stages of Concern: Typical Expressions of Concern about the Innovation

Stages of Concern			Expressions of Concern
Impact	6	Refocusing	I have some ideas about something that would work even better.
	5	Collaboration	I am concerned about relating what I am doing with what my co-workers are doing.
	4	Consequence	How is my use affecting clients?
Task	3	Management	I seem to be spending all of my time getting materials ready.
Self	2	Personal	How will using it affect me?
	1	Information	I would like to know more about it.
Unrelated	0	Awareness	I am not concerned about it.

Note. From *Measuring Implementation in Schools: The Stages of Concern Questionnaire* by A. A. George, G. E. Hall, and S. M. Stiegelbauer, 2006, p. 4, Copyright © 2006 by SEDL. Reprinted with permission.

The dimensions identified as "self" include stage 0 (awareness), stage 1 (information), and stage 2 (personal). Teachers at stage 0 are unaware of an innovation, therefore not concerned about it. At stage 1, they are aware of the innovation and would like to know more about it. At stage 2, they begin to wonder how the innovation will

affect them personally. Teachers at stage 3 will wonder how they are going to implement the changes. They will worry about possible mistakes that they might make. They may express the opinion that this innovation is really no different from what they are already doing, therefore convincing themselves that they do not have to change.

Although teachers may still have intense feelings at the personal stage, as time draws close for implementation, they reach the task-oriented stage. For example, teachers at stage 3 of implementing the GPS will wonder how they are going to manage the materials, the lesson planning, the assessment, and the differentiation of instruction. The final stages of the continuum are the impact stages. Stage 4 is consequences. Teachers will wonder how their actions will affect the student. Many staff development facilitators are upset to find that teachers are not at this stage when they come to training. The staff development can be more effective if the leaders accept the teachers at the stage where they are and deliver the training accordingly. Stage 5 is collaboration. Teachers at this stage will begin to think about working with other teachers to share ideas and work to make the innovation better. At stage 6, the refocusing stage, teachers begin to get original ideas to try and improve the innovation.

Teachers can have concerns at all stages at all times as they progress through implementation of an innovation, but different stages tend to be more intense at various times. For example, self concerns are greatest at the beginning of training while task concerns intensify a short while into the innovation. Impact concerns become more intense with experience. People generally tend to move through the stages of concern in a linear manner, although it is not uncommon for them to cycle back, especially if intense management concerns go unresolved (Hord et al., 1987). Some people never reach the

upper stages. In fact, some have no desire to do so. Effective facilitators will address concerns of teachers wherever they are on the continuum and try to help them move to a higher level.

There are many applications of CBAM and other concerns theory models in the research literature. In the field of education, concerns theory has been used to study staff development (Dass, 2001; Peers, 1990), to investigate curriculum development (Christou, Eliophotou-Menon, & Philippou, 2004; Crawford, Chamblee, & Rowlett, 1998), to follow implementation of technology (Chamblee & Slough, 2002; Donovan, Hartley, & Strudler, 2007; Giancola, 2001), and to facilitate curriculum evaluation (Fenton, 2002; Loucks & Pratt, 1979).

The Stages of Concern Questionnaire (SoCQ) has been used to measure levels of concern in the implementation of innovations in educational settings in a number of contexts. Christou et al. (2004) researched teachers' concerns regarding adoption of a new elementary mathematics curriculum in Cyprus, Greece. The study found no significant differences in teachers' concerns across years of implementation with most teachers focused on the task stage. The biggest variable in determining the stages of concerns in this study turned out to be years of teaching experience. Experienced teachers had much fewer informational type concerns than teachers with little or no teaching experience. Experienced teachers had more concerns regarding student outcomes and had more ideas about improving the innovation. A follow-up study 5 years into the innovation (Charambous et al., 2004) found teachers were still mainly exhibiting self-concerns. That is, many were still expressing intense concerns to learn more about the innovation. The findings of their second study led Charambous, Philippou, and Kyriakides to recommend

that policymakers advance teachers' efficacy by providing sufficient information relating to an innovation before asking them to implement it.

Crawford, Chamblee, and Rowlett (1998) used the SoCQ to study teacher concerns as they related to staff development for an "Algebra for Everyone" mandate from the state of North Carolina. The purpose of this study was to monitor how teachers' levels of concerns changed after one year of a state-mandated curriculum change. North Carolina mathematics teachers attended one of several 7-day workshops to prepare them to teach algebra to all students. Using the Concerns Based Adoption Model (Hall & Hord, in Crawford et al., 1998) as a framework, the researchers administered the Stages of Concerns Questionnaire to 248 teachers who attended the first workshop and 128 of those same teachers who elected to attend a follow-up workshop after a year of implementing the new curriculum. Crawford, Chamblee, and Rowlett also analyzed demographic data and participants' workshop evaluations. The pre-test revealed the highest levels of concern to be at the awareness, information, and personal stages. The only level of concern that yielded a significant difference between teachers with minor in-service experience to those with extensive in-service experience was at the level of collaboration. This finding suggested that teachers with previous in-service experience should be encouraged to be leaders in implementing change in their respective schools. Post-tests revealed significant decreases in awareness and information concerns and a significant increase in refocusing. Their findings were consistent with the Fuller model. Teachers in their study had not reached the stage where student outcomes were a major focus. These findings led the researchers to suggest that "staff developers need to place less emphasis upon Phase I in-service, with more emphasis upon effective support methods for

implementation such as peer coaching or use of action research" (Crawford et al., 1998, p. 324).

Dass (2001) studied implementation of a professional development program which was designed to promote constructivist principles for science teaching and learning in grades K-8. The professional development model studied included a summer institute with follow-up support meetings throughout the school year. Using a combination of qualitative and quantitative research techniques to study 24 science teachers, Dass found that teachers had major concerns about how to implement constructivist techniques when they were not modeled for them in the professional development setting.

Dass found that teachers expressed four major management concerns as they moved into the implementation phase. First, they realized that constructivist teaching required a much greater expenditure of their time than traditional teaching had done. Second, materials and other resources were not always readily available. The standard resources provided by the textbook publishers were not helpful because they focused on traditional non-constructivist methods. Third, elementary teachers expressed management concerns regarding the difficulty of different teachers from the same grade level staying together on the same topic. The constructivist approach required teachers to deviate from the standard curriculum sequence. Dass suggested that the concern could be alleviated by planning together by grade level or by removing the assumption that grade level teachers need to be on the same topic at the same time. The fourth management concern expressed by the teachers in this study was related to classroom management. More active involvement by the students coupled with a less structured environment created noise and

transition issues that were troubling to teachers used to a quieter, more controlled classroom.

The study found that teachers expressed impact concerns as the year progressed. Many worried that students were having fun but they were not learning. Upper level teachers worried about impact on SAT scores. It became evident to the teachers that new methods of evaluation were needed to better determine if learning was occurring. Collaboration and refocusing concerns that emerged were related to the management concern of staying on the same topic at the same time. Teachers feared alienation from colleagues who resisted changing their "tried-and-true" non-constructivist units that they had used for years with apparent success. Teachers expressed a need to refocus by changing the way that units were planned to incorporate more collaborative efforts among colleagues.

Using the Levels of Use component of the CBAM framework, Giancola (2001) found many factors influenced whether or not teachers implemented a Delaware technology initiative including "curriculum alignment, teacher interest and capacity, teachers' expectations of students, classroom management, community involvement, and teachers' beliefs about the value of the software itself" (p. 383). The results of her study showed, however, that the most critical component of the project's implementation was professional development. Failure of the professional development to address the complexity of true integration of the technology into the curriculum proved to be a serious deterrent to successful implementation. Giancola's findings were consistent with those of Dass (2001) and Crawford et al. (1998).

Chamblee and Slough (2002) also researched implementation of technology. Chamblee used CBAM to study high school mathematics teachers' concerns regarding the use of graphing calculators to teach first-year algebra. Slough used a modified version of CBAM to do a qualitative study with secondary science teachers implementing telecommunications. In Slough's study, the science teachers' profiles were more consistent with experienced users of the innovation. The journal article compared and contrasted the individual studies conducted by each author. Similarities included the use of CBAM to assess teachers' concerns and levels of use of technology. One major difference was in the profiles of the research participants. Chamblee's study found that teachers who perceived themselves as competent users of the graphing calculator had Stages of Concerns profiles that were more consistent with non-users. Chamblee and Slough observed that CBAM assumes a static environment. Both researchers were studying implementation of technology – an environment that is constantly changing. The authors concluded that pattern of concerns may not follow the traditional linear map of the CBAM when studying a changing environment.

Conversely, the findings of Donovan, Hartley, and Strudler (2007) regarding implementation of a one-to-one laptop initiative at the middle school level were fairly consistent with Hall and Hord's (2006) model. As a result of their study, Donovan et al. recommended differentiated professional development to meet the needs of the teachers at their level of concern. Consistent with other studies (Crawford et al., 1998; Dass, 2001; Giancola, 2001), professional development emerged as a critical component of successful implementation.

Schools that are several years into the adoption of a new curriculum can use CBAM techniques to determine where their teachers stand in the adoption process. Fenton (2002) surveyed teachers in an Anchorage, Alaska school district to examine the status of the adoption of a standards-based curriculum in math and science. Fenton found the Anchorage teachers to be in the third and fourth stages. The Anchorage school district used the results of Fenton's study to assess professional development needs for the teachers.

CBAM research supports the theory that "support for teachers at the building level is vital for successful change" (Loucks & Pratt, 1979, p. 214). Educational leaders and policymakers have an obligation to foster the chances of success by acknowledging and identifying the concerns of classroom teachers (Christou et al., 2004).

Educational Change in Mathematics Education

Influenced by the educational movement of the moment throughout history, the field of mathematics education has experienced its share of reform efforts and change initiatives. According to Kilpatrick (1992), writing about mathematics teaching and learning can be traced all the way back to the time of Socrates. Kilpatrick relates a story, as told in Plato's *Meno*, which described how Socrates used carefully chosen questions to lead a slave boy to discover that the area of a square drawn on the diagonal of another square had an area twice that of the smaller square. Mathematics education, however, did not emerge as a significant field of study until the turn of the twentieth century.

Kilpatrick (1992) asserts that two separate disciplines strongly influenced mathematics education. Not surprisingly, one is mathematics. The other is psychology. The scientific movement heavily influenced education in the early 20th century, and

psychologists were extremely interested in studying how people think about mathematics. Thorndike (1919) and his colleagues used scientific methods to argue that drill-and-practice was the best way to teach mathematics. Because their philosophy had an objective epistemology, Thorndike et al. argued that children do not reason about why they do math the way they do. They do it that way because it's the way their teachers showed them how to do it (Ellis & Berry, 2005).

According to Ellis and Berry (2005), the primary implication of the Progressive movement on mathematics education came with the outgrowth of the Social Efficiency movement. The Progressives maintained that the needs of the child should be at the center of curriculum decisions. Therefore, the only math that should be taught was math that the child expressly needed. Although it seems contradictory, the Social Efficiency Progressives used the standardized tests from Thorndike's era to determine which students were best suited to learn higher level mathematics. Academic tracking, or grouping by ability, became commonplace in the 1940s. The number of students taking algebra at the high school level declined, while the numbers in vocational and consumer math grew.

By the 1950s, many groups were beginning to call for mathematics reform. Colleges were complaining that students were not prepared for college-level work, while businesses and the military complained that workers lacked basic computational skills (Kilpatrick, 1992). The report, *A Survey of Mathematical Education: The Causes of Student Dropout, Failure, and Incompetence at the Elementary and Secondary Levels*, came about as a result of the Carnegie Corporation asking the Educational Testing Service to develop a plan for improving mathematics instruction. The authors of the

report gave kudos to the current reform efforts but stated that more needed to be done in the way of analyzing the mental processes of the students as learners of mathematics. When the Russians launched Sputnik in 1957, the United States government used National Science Foundation funding to establish even more study groups. The result was the "New Math" movement of the 1960s, a reform effort that most agree "failed miserably" (Ellis & Berry, 2005, p. 10). According to Ellis and Berry, many place the blame of the failure of the New Math on the developers who targeted a specific audience of white males of European descent.

The failure of the New Math movement led to a "back-to-basics" cry for the 1970s. The basic skills nature of mathematics teaching dominated the textbooks throughout the 1970s and much of the 1980s. Despite efforts to reform mathematics teaching and learning, the classrooms continued to look much like they did 100 years earlier. The teacher was still the central authority figure, and drill-and-practice was the predominant teaching strategy. The beginning of the 1980s, however, began to see a paradigm shift in mathematics education. The introduction of computers to the scene played no small role. In 1977, Appel and Haken used a computer experiment to prove the Four-Color Theorem, a conjecture that posits that only four colors are needed to color a map in such a way that adjacent regions are of different colors. The computer proof submitted by Appel and Haken marked a huge departure from the traditional deductive method of proof so respected and revered in the mathematics community. It more closely resembles the post-positivist realist position that something is generally accepted to be true because to date efforts to find a counterexample have failed (Crotty, 1998; Gall, Gall, & Borg, 2007). According to Tymoczko (in Cooney & Shealy, 1997), the proof of

this theorem was generally accepted by mathematicians to be true, a phenomenon that would not have happened 25 years earlier.

What began to happen in the mathematics education community was a shift from thinking of math as timeless and unchanging to thinking of it "as a way of thinking about the external world, a category of constructing meaning" (Cooney & Shealy, 1997, p. 89). Nowhere was this paradigm shift more evident than in the work of the National Council of Teachers of Mathematics (NCTM). It was around this same time that an NCTM task force funded by the National Science Foundation presented its recommendations for school mathematics in a booklet entitled *An Agenda for Action* (NCTM, 1980). It was the recommendation of this task force that problem solving be the main focus in the mathematics classroom and that math students be allowed to take full advantage of calculators and computers. The work began by NCTM with *An Agenda for Action* resulted in the introduction of the *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989) and its subsequent revision, *Principles and Standards for School Mathematics* (NCTM, 2000). The vision of reform proposed by NCTM requires a constructivist view of mathematics where students are actively engaged in creating their own meanings of mathematics. Constructivists view mathematics as a creative and dynamic process. This view is in direct contrast to a competing reform view of mathematics calling for more explicit instruction in computation and an increased emphasis in standardized testing. Davis, Maher, and Noddings (1990) called the situation "a war on two fronts" (p. 1) as they expressed concern that one reform was threatening to cancel out the other. A side effect of the "math wars" of the 1980s was that interest in

researching teachers' beliefs about mathematics and mathematics teaching increased (A. G. Thompson, 1992).

Ellis and Berry (2005) call the two paradigms the *procedural-formalist paradigm* (PFP) and the *cognitive-cultural paradigm* (CCP). They describe the paradigms as follows: "The PFP holds that mathematics is an objective set of logically organized facts, skills, and procedures that have been optimized over centuries" (p. 11). Conversely, "the CCP takes mathematics to be a set of logically organized and interconnected concepts that come out of human experience, thought, and interaction" (p. 12). The PFP view of mathematics is difficult to learn because it occurs outside the realm of human experience. The CCP view, on the other hand, should be "accessible to all students if learned in a cognitively connected and culturally relevant way" (p. 12). Constructivists would fall into the CCP category, while the PFP category fits a behaviorist paradigm.

A teacher who views students as empty vessels waiting to be filled with knowledge would be more likely to subscribe to the belief that math is a collection of procedures and best taught by direct instruction. A constructivist teacher would be more likely to believe that math is a creative endeavor and that students should be encouraged to try multiple approaches to solving problems (Davis et al., 1990). Teachers' perceptions of math as either a "process-oriented activity" or a "skills-oriented activity" (Andrews & Hatch, 1999, p. 213) determine their membership in the constructivist or behaviorist camp. To further illustrate the complexity of teachers' belief systems, researchers have found that teachers' belief systems include seemingly conflicting viewpoints (Andrews & Hatch, 1999; Cooney, Shealy, & Arvold, 1998; Raymond, 1997; A. G. Thompson, 1992).

Seaman, Szydlik, Szydlik, and Beam (2005) sorted teachers' beliefs into four main categories or themes:

1. Mathematics is a collection of rules, formulas, and procedures.
2. Mathematics is a creative endeavor.
3. Mathematical problem-solving allows for multiple approaches.
4. Mathematics is best taught by direct instruction. (p. 200)

The first two categories reflect contrasting views about the nature of mathematics. The last two categories represent opposing views about how mathematics should be taught. Research regarding change in the field of mathematics education (Cooney & Shealy, 1997; Goldsmith & Shifter, 1997; Henry & Clements, 1999; Macnab & Payne, 2003) suggests that mathematics teachers must often undergo a shift in their basic belief system regarding how students learn mathematics before effective change takes place.

Teachers' views on best instructional practices have been found to be highly correlated with their views on how students learn mathematics (Frykholm, 2005; D. R. Thompson & Senk, 2001). Researchers also discovered that teachers use instructional methods similar to the ones their teachers used with them (Cooney et al., 1998; Lubinski & Otto, 2004). The research findings have made it evident that reform as it relates to instructional practice must necessarily be a slow evolutionary process.

Ross, McDougall, and Hogaboam-Gray (2003) found that teachers identified as "low-reform" teachers will find ways to adapt reform teaching methods to fit their more traditional styles. Studies have also found correlations between student achievement and whether or not teachers followed reform teaching methods (McCaffrey et al., 2001; Schoen et al., 2003). Numerous studies have found that experimental groups following a

standards-based curriculum significantly out-performed their counterparts in traditional classrooms (Kramarski et al., 2002; Reys et al., 2003; Riordan & Noyce, 2001; D. R. Thompson & Senk, 2001). As evidenced by the research, standards-based curricula have resulted in improved student achievement when implemented correctly.

Schoen et al. (2003) studied teacher variables that related to student achievement when using a standards-based curriculum. The best predictors for success, according to their study, were whether or not teachers had participated in the staff development training and whether or not the teachers followed the curriculum assessments properly. Numerous studies (Cooney et al., 1998; Hart, 2002, 2004; McGinnis, Kramer, Roth-McDuffie, & Watanabe, 1998, April) have shown that teacher education programs have been highly successful in changing the beliefs of pre-service teachers to constructivist philosophies consistent with the mathematics education reform movement. Crawford, Chamblee, and Rowlett (1998) identified three phases in the learning process as teachers were involved in implementation of a curriculum innovation: "(1) New knowledge; (2) Classroom implementation; and (3) Institutional change" (p. 319). Staff development of in-service teachers and university training of pre-service teachers was only the first step.

Datnow (2005) and Cobb, McClain, de Silva Lamberg, and Dean (2003) found that reform efforts mandated by district, state, and federal guidelines were more sustainable than individual school reform efforts. Classroom implementation of reform based curricula was frequently put aside to prepare students for state tests. If the reform efforts did not support the high-stakes, state-mandated tests, then the efforts were abandoned quickly, especially in schools with a history of low-performing students. Another way that reform efforts were found to be supported or thwarted at the school or

district level was through adoption of curriculum materials (Middleton, 1999; Remillard, 1999). Teachers were often presented with a textbook that approached math in a way that conflicted with their own belief system. Whether the textbook changed their beliefs or not, it influenced their instructional decisions and broadened their perspectives. The National Science Foundation (NSF) has funded several "reform-based" mathematics textbooks in recent years. Research has found no significant difference between test scores of students taught with traditional curricular materials and those taught with NSF funded materials. On the other hand, the number of students who take higher-level math classes is considerably higher in schools that have adopted NSF textbooks (Harwell et al., 2007).

Georgia Curriculum Changes

The Georgia Performance Standards in mathematics (*Georgia Performance Standards*, 2005) are based largely on the content and process standards of the *Principles and Standards of School Mathematics* (NCTM, 2000). Because the math standards are not scheduled to be implemented in Georgia high schools until the 2008-2009 school year, there is no existing research on teacher perceptions of the new math curriculum. In a related study, however, Futch and Stephens (1997) surveyed Georgia middle school teachers and principals about their beliefs regarding the *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989). They found that teachers and principals appeared to support the global beliefs of the NCTM standards on a philosophical level but rejected more than one-third of the statements representing underlying beliefs of the standards. Futch and Stephens concluded that "slogan-like standards are acceptable, whereas the practice and process standards are more

problematic" (p. 247). This study supported findings of researchers in other parts of the United States (Raymond, 1997; Roehrig & Kruse, 2005) who found that teachers' stated beliefs about mathematics and mathematics teaching were often in conflict with their classroom practice.

The Georgia Department of Education gave several reasons for a need for a new curriculum (Cox, 2007a). The Quality Core Curriculum (QCC) was written in 1985 and only slightly revised in 1997. The QCC objectives were not aligned to national or international standards. Georgia SAT scores were among the lowest in the nation. The achievement gap between White, Black, and Hispanic students was widening from grade 5 to grade 11. Based on analysis of recent student achievement data, "the State Board of Education mandated that the Department of Education develop a curriculum that was rigorous, deep, provided clear expectations for students, was an instructional guide for teachers, [and] was student focused rather than teacher focused" (Cox, 2007c, p. 15).

The Georgia Performance Standards were developed by teams of teachers, national and state experts, and consultants. This panel studied standards from states and nations considered "high-performing" such as North Carolina, Texas, Michigan and Japan. The panel consulted the National Council of Teachers of Mathematics and the American Association for the Advancement of Science for advice on national standards in their respective subjects (*Georgia Performance Standards*, 2005).

Teachers with experience in standards based teaching were solicited to become members of a teacher writing team. The high school advisory committee was formed in the summer of 2004. This committee was comprised of teachers, mathematics coordinators, and state and national leaders in both K-12 and higher education. After an

intensive training session, the writing team developed a curriculum. The curriculum went through an extensive public review process and was reviewed by a British research scientist internationally known for her work in mathematics assessment. The final revisions were unanimously adopted in May of 2005. The standards were "endorsed by the Board of Georgia Council of Teachers of Mathematics, the Senior Vice Chancellor for Academic Affairs of the Board of Regents, and the Regents Academic Advisory Committee on Mathematical Subjects as well as high school department chairs from numerous school systems across the state" (Cox, 2007c, p. 17).

The Georgia Department of Education continues to collaborate with several state agencies as well as Georgia Public Broadcasting. The K-12 Math Standards were aligned with standards from the National Council of Teachers of Mathematics, the College Board, the American Statistical Association, and Achieve (an agency which sponsors the American Diploma Project). The curriculum was designed to have a student-centered approach with a balance of concepts, skills, and problem solving.

The biggest difference between Georgia's new curriculum and its old is the use of performance standards. According to the executive summary on the State Board of Education website, "A performance standard has four components: a content standard, illustrative tasks, examples of student work, and a commentary for teachers" (*Executive Summary*, 2006, p. 1). The new standards eliminate extensive review of previously learned topics and address fewer topics at each grade level. The high school math curriculum is designed to have all students ready for college level mathematics upon graduation from high school. Designers of the curriculum adapted the format from one used by North Carolina. The performance standards "draw on the strengths of the

Japanese school mathematics curriculum: coherence, leanness, and rigor" (*Executive Summary*, 2006, p. 2).

A comparison of Quality Core Curriculum (QCC) content and Georgia Performance Standards (GPS) content (Cox, 2008a) reveals that 80% of the QCC Algebra I content and 50% of the geometry concepts are now taught in the middle school. Evaluating algebraic expressions, writing and solving one-step equations and proportions, volume of rectangular prisms, cylinders, pyramids and cones, and surface area of rectangular prisms and cylinders are taught in sixth grade. Absolute value, computing and solving problems with integers, operations with algebraic expressions, understanding and applying linear equations, analyzing relationships between two variables using tables, graphs, and formulas, direct and inverse proportion, and basic geometric constructions and transformations are all part of the seventh grade GPS content. In eighth grade, students are expected to learn to distinguish between rational and irrational numbers, simplify expressions with integral exponents, solve inequalities in one variable, solve problems with relations and linear functions, know the properties of parallel and perpendicular lines, explain the meaning of congruence, and apply the Pythagorean Theorem. Statistical concepts such as posing questions, collecting and representing data, finding measures of central tendency, and basic probability are also taught in the middle school.

The former curriculum in Georgia called for extensive re-teaching and review. The new curriculum is designed to eliminate widespread repetition and address fewer topics at each grade level. For example, the sixth grade QCC contained 53 objectives. The sixth grade GPS has 18 objectives. The seventh grade numbers dropped from 43 to

15 while the eighth grade numbers changed from 45 to 18. There are similar reductions in the number of objectives for each high school course. Using mathematics to solve problems with more rigor and depth will provide a natural opportunity for review. In Math I, students will study radical and polynomial equations and functions, inductive and deductive reasoning, coordinate and transformational geometry, permutations and combinations, and summary statistics including mean absolute deviation. Math II will contain right triangle trigonometry, properties of circles and spheres, complex numbers, quadratic equations and inequalities, piecewise, exponential, and inverse functions, population mean, standard deviation, and statistical inferences. The content for Math III includes exponential and logarithmic functions, higher degree polynomial functions, solving a variety of equations and inequalities, conic sections, matrices, vertex-edge graphs, probability histograms, and normal distributions. Math IV will include circular trigonometry, trigonometric functions and their inverses, trigonometric identities and equations, rational functions, vectors, sequences and series, the central limit theorem, and confidence intervals. Students will be given the opportunity to accelerate the four high school math courses into three if they wish to take an advanced placement class in calculus or statistics during their senior year. Students who struggle in mathematics will have the opportunity to take a support class in addition to their regular math class to provide extra time and help in achieving the standards (Cox, 2008a).

The revised high school math curriculum in Georgia is an integrated curriculum. The term “integrated curriculum” can mean different things in different situations. Usiskin (2003) describes five areas in which math can be integrated: “using unifying concepts, merging different areas of mathematics into broader areas, removing

distinctions entirely between areas of mathematics, teaching different strands of mathematics each year, and interdisciplinary integration of mathematics with other subjects" (p. 16).

Unifying concepts are found in most if not all branches of mathematics. Examples of unifying concepts include deduction, set theory, problem solving, and functions. Merging areas of school mathematics such as algebra, geometry and statistics into broader areas is another method of integration. Mathematics curriculum changes since the 1960s have seen some of this integration already with solid geometry merging with plane geometry and trigonometry becoming commonplace in Algebra II.

When all distinctions between areas of mathematics are merged, then topics from probability and statistics, geometry, algebra, and functions are found in every year of high school mathematics. The mathematics is taught in the context of real world applications with unifying concepts such as set theory, logical reasoning, and transformation continually emphasized. This is the type of integration that Georgia is attempting to implement.

Integration by strands is the most common form of integration world-wide. According to Usiskin (2003), the traditional United States and world-wide elementary school curriculum fits this description. Most of the time, however, these strands are taught with only a superficial (if any) connection among them.

Interdisciplinary integration attempts to show connections between various subject areas such as math and science, or math and social studies. Proponents of this approach argue that separation of learning is artificial. Those who disagree with an

interdisciplinary approach in mathematics claim it is too difficult to give the mathematics the attention it needs and still connect it in a logical way.

One can break integration down further if the sizes of the curriculum are considered (Usiskin, 2003). From smallest to largest, the sizes of the curriculum can be placed in the following hierarchy: individual problem, lesson or problem set, unit, course, school mathematics curriculum, and school curriculum. Teachers usually have control over the first three sizes, but the school district controls the last three. A curriculum could very well be integrated at one size of the curriculum but not at another size.

Integration takes on different characteristics depending on the size of the curriculum. Georgia's *High School Mathematics Research and Resource Manual* (Cox, 2007a) borrowed the following list from House (2003):

> An integrated mathematics program is a holistic mathematics curriculum that –
>
> - Consists of topics from a wide variety of mathematical fields and blends those topics to emphasize the connections and unity among those fields;
> - Emphasizes the relationships among topics within mathematics as well as between mathematics and other disciplines;
> - Each year, includes those topics at levels appropriate to students' abilities;
> - Is problem centered and application based;
> - Emphasizes problem solving and mathematical reasoning;
> - Provides multiple contexts for students to learn mathematics concepts;
> - Provides continual reinforcements of concepts through successively expanding treatment of these concepts;
> - Makes appropriate use of technology. (House, 2003, p. 5)

The Thomas Fordham Institute's report, *The State of State Standards 2006* (Klein, Braams, & Parker, 2005), gave Georgia a grade of B+ for its new curriculum. The only states receiving a higher grade than Georgia were California and Indiana. The report gave the mathematics standards a grade of B. The K-8 standards were praised for being clear and concise. The high school standards, still in revision at the time of the review, were criticized for being vague in places. The sample lesson plans were said to be of poor quality with too much emphasis on graphing calculator use. Nevertheless, the high school standards were called "a solid start and, we hope, just a way station on the road to excellence" (Finn, Petrilli, & Julian, 2006, ¶ 2).

Professional Development of Teachers

While the work of the National Council of Teachers of Mathematics has had a major impact on mathematics reform efforts not only in Georgia but across the nation, it has had less of an impact on what is taking place in actual classrooms (Philipp, 2007). Meaningful and lasting changes in the schools will not occur without "sustained professional development designed to change teachers' beliefs" (Philipp, 2007, p. 263). According to Guskey (2000), "notable improvements in education almost never take place in the absence of professional development. At the core of each and every successful educational improvement effort is a thoroughly conceived, well-designed, and well-supported professional development component" (p. 4). The operative words are thoroughly conceived and well-designed. It is important that an evaluation process be in place to determine the success of professional development efforts.

Guskey gives four reasons that evaluation of staff development is important. The first reason is that professional development has come to be recognized as a process, not

a one-time event. The second reason is that not only is professional development a process, it is an *intentional* process designed to bring about school improvement. The third reason evaluation of profession development is so important is because it is being used to guide reform efforts. Without a valid and reliable method of evaluation in place, there is room for false claims of success from the plethora of reform initiatives vying for school systems to adopt them. The last reason is the current call for accountability. This reason is closely tied to the third reason. Schools under tremendous pressure to make "adequate yearly progress" are grasping at programs that claim to raise student achievement.

Guskey identifies five levels of professional development evaluation. The lowest level, and the one used most often, is participant's reactions. Easily obtained by a quick evaluation form at the end of the session, this level of evaluation asks questions about how well the participants liked the session and what they learned. Factors such as room temperature and choice of refreshments can often affect these evaluations. The second level is participants' learning. The third level is organizational support and change. Sometimes factors outside the immediate control of the participants affect whether or not the professional development experience can bring about a positive change. The example Guskey uses is one in which teachers cannot implement cooperative learning strategies successfully because of the spirit of competitiveness among the students that is encouraged by the school. The fourth level of professional development evaluation is the participants' use of new knowledge and skills. Guskey promotes the Concerns Based Adoption Model as an example of an instrument for evaluating this level. The fifth and highest level in Guskey's hierarchy is student learning outcomes. It is very difficult to

evaluate professional development at this level, because student learning can be affected by so many different variables. Guskey acknowledges that the vast majority of professional development is only evaluated at the first level. Others usually stop at the second level.

School improvement efforts often focus on staff development to train teachers to implement some new reform. Little (2001) observes that "explanations for the success or failure of reform commonly point to the contributions or shortcomings of formal staff development" (p. 23). In light of professional development in pursuit of reform, Little offers the following considerations. Some teachers embrace change while others fight it every step of the way (with or without good reason). Little advises that it is important to realize "reforms have the potential to enhance or threaten the intellectual, moral, and emotional satisfactions of classroom teaching" (p. 26). Little cautions that reform efforts can strain friendships and other bonds of professional community. Colleagues can find themselves at odds with each other when they are on opposite sides of the fence with a reform issue. Finally, Little states that it is necessary to acknowledge just how much time and energy that reform efforts are going to take out of teachers. Reform efforts have the potential to consume all of a teacher's spare time, often at the expense of personal relationships.

Garet, Porter, Desimone, Birman, and Yoon (2001) analyzed data collected for a national evaluation of a federal program aimed specifically at math and science teachers, the Eisenhower Professional Development program. They compared data collected from over 1000 science and math teachers with features identified from a review of the literature on professional development of teachers. Garet et al. identified four principles

that should be present in order for successful professional development to occur. These principles were focused on content knowledge, opportunities for active learning, consistency with other learning activities, and sustained follow-up.

After synthesizing results from many studies, Garet et al. concluded that the research shows professional learning activities focusing on specific content knowledge resulted in higher student achievement while activities concentrating on pedagogical issues did not. This was especially true at the elementary level, where many teachers lack a strong content-specific knowledge base.

Opportunities for active learning can take many forms. Professional learning activities that model active learning prove especially helpful (Darling-Hammond & McLaughlin, 1995). It is difficult for teachers to change their teaching methods from the traditional "explain-practice-memorize paradigm" (Greenwood, 1984, p. 663) if they have never experienced active learning. Researchers verify that teachers use instructional methods similar to the ones their teachers used with them (Cooney et al., 1998; Lubinski & Otto, 2004). In addition, Garet et al. (2001) found that observation of expert teachers as well as the opportunity to be observed provided teachers with reflective opportunities that resulted in positive changes in teaching practices. Other types of active learning identified by Garet et al. included reviewing student work and opportunities for presenting, leading discussions, and writing.

A third feature of a successful professional learning experience concerns coherency with other learning activities. To be successful, the experience should be perceived as connected to the overarching educational goals of the participants. The activities should build on prior experiences and be followed up with more advanced work

at a later date. Teachers also take their professional learning experiences more seriously if they can see a tie to their state and district standards and assessment instruments. One final measure of coherence is the extent to which the professional learning experience encourages participants to communicate and collaborate with each other.

Finally, if a professional learning experience is to be viewed as a "process rather than an event" (Hall & Hord, 2006), then sustained follow-up is essential (Guskey, 2000). Using least-squares regression techniques, Garet et al. found the success of a particular professional learning experience to be positively correlated to the duration of the experience.

The National Council of Teachers of Mathematics (NCTM) has identified six standards for the professional development of mathematics teachers (NCTM, 1991). These standards were written to apply to teacher education programs from college teacher preparation programs to workshops and seminars for veteran teachers.

The first standard for professional development of math teachers states that teachers should experience good mathematics teaching. Pre-service and in-service opportunities for teachers should model best practices in mathematics teaching. Among other things, the professional development leaders should pose worthwhile tasks, engage the participants in mathematical discourse, use a variety of tools including technology and manipulatives, and encourage teachers to take intellectual risks.

The second standard is that teachers should know mathematics and school mathematics. By understanding the broader context of mathematics, teachers are better able to situate school mathematics for themselves and for their students. This means not only understanding specific mathematical content and processes, but understanding the

connectedness of mathematical topics. The teachers should understand the dynamic nature of mathematics as well as the relationship to mathematics and other school subjects. They should know how to solve problems and reason mathematically.

The third standard involves knowing students as learners of mathematics. Teachers should know the effects of various factors such as age, ability, interest and experience on learning mathematics. They should be aware of the current research on how students learn mathematics. Teachers need to understand the influence of race, gender, and socioeconomic status on learning mathematics. They have an obligation to strive for full participation from all students in the learning process.

The fourth standard relates to knowledge of mathematical pedagogy. Teachers should know how to teach math for understanding. Professional learning opportunities should provide teachers with the knowledge to evaluate instructional materials and resources as well as instructional strategies. Teachers should know how to promote mathematical discourse. They should correctly represent mathematical content and procedures, and they should have the skills to evaluate student understanding.

The fifth standard states that pre-service and in-service opportunities should enable a teacher to develop as a teacher of mathematics. Teachers should be able to work with a diverse group of students with assorted approaches for solving problems. The teachers should be able to work both in small group and large group settings. This standard gets to the heart of teaching mathematics:

> It is the practice of teaching, the growing sense of self as teacher, and the continual inquisitiveness about new and better ways to teach and learn that serve

> teachers in their quest to understand and change the practice of teaching. (NCTM, 1991, p. 160)

Finally, the sixth standard addresses the teacher's role in professional development. It is the responsibility of the teachers to take advantage of the many opportunities to reflect on their teaching, read professional journals, discuss new research findings with colleagues, and participate in efforts to facilitate positive change in mathematics.

Recognizing the scope of change that implementation of the Georgia Performance Standards encompasses, the Georgia Department of Education is committed to offering professional development to as many teachers as possible. The state used a train-the-trainer model for grades K-8 math but decided that a more face-to-face model was needed for high school. The high school summer workshop included a half-day of training for administrators. Math I training began in the summer of 2007 with teams of four teachers each. The three-day summer training was followed by two more days of training during the school year – one day in October and one day in February. The training manual is available online along with other resources such as concept maps and sample unit plans (*Mathematics frameworks*, 2006). The state department is also working with the Georgia Virtual School (Cox, 2008b) to provide information to administrators and counselors. Math II training will begin in the summer of 2008 and will continue in the same manner as Math I training. The training emphasizes that fundamental to the success of the implementation is the belief that all students can learn mathematics. Continual formative and summative assessment is essential for student success. Inquiry-based instruction is modeled throughout the training.

Summary

The ultimate responsibility of implementing educational reform lies with the classroom teachers. Attention to individual concerns will provide needed support to teachers in their efforts. The Concerns Based Adoption Model has proven to be a reliable and popular method of studying teacher concerns regarding implementation of educational innovations and the professional learning experiences that correspond to the innovation. Research has shown that if in-service professional development is going to facilitate teachers in bringing about significant change, then the professional development planners must be proactive in considering the individual needs and concerns of the teachers.

Much of today's reform efforts, including those in the State of Georgia, are based on constructivist philosophy. Since teachers ultimately teach in a manner similar to how they were taught, professional learning opportunities should model the desired teaching behavior. Research indicates that teachers need time and resources to be able to construct understanding of what it means to teach using an innovation.

CHAPTER 3

METHODOLOGY

Teachers react to change. They do not initiate it.
(Sarason, 1995, p. 82)

This chapter presents a description of the research method and procedures that were used to study how one cohort of Georgia teachers prepared to implement a state-mandated mathematics curriculum change. This chapter includes the purpose of the study, population to be studied, research design, instrumentation, data collection procedures, and data analysis methods.

Purpose Statement and Research Questions

The purpose of this study was to examine the concerns of a group of high school mathematics teachers in the Northeast Georgia RESA district about implementation of the Math I Georgia Performance Standards and to explore the relationships among their Stages of Concerns profiles, demographic factors, and professional learning experiences provided by institute instructors.

The study was guided by the following research questions.

1. What are the longitudinal Stages of Concern profiles of the workshop participants?
2. Are there significant changes in the Stages of Concern profiles as workshop participants experience professional learning activities over time?

3. Are there relationships among workshop participants' demographic data (years of teaching experience, professional development experiences, choice of textbook) and Stages of Concern profiles?
4. How do the institute instructors' expectations of workshop participant concerns and the planned professional learning experiences correspond to the workshop participants' Stages of Concern profiles?

Participants

The participants for this study were divided into two categories. One category consisted of Georgia high school math teachers in the Northeast Georgia Regional Educational Services Agency (RESA) area. The second category contained the three institute instructors.

Eighteen high schools from 13 different school districts sent teams of up to four teachers each to the training (n = 72). The suggested composition of the team from each school was an algebra teacher, a geometry teacher, a statistics teacher, and a special education teacher. The special education teachers who attended the training were math inclusion teachers and/or highly qualified in mathematics as defined by the No Child Left Behind Legislation (Bush, n.d.). The teachers trained during May of 2007 were the first cohort of high school mathematics teachers to receive this training. The Georgia Department of Education will continue to offer this training through the various Regional Educational Service Agencies with a different cohort from the high schools for the next four to five years until all veteran teachers have participated.

The specially trained institute instructors consisted of RESA personnel and other leading mathematics educators in Georgia. According to the Georgia Department of

Education, the trainers were individuals who have "articulated a clear and strong understanding of standards-based classrooms and research-based instructional strategies" and who "share enthusiasm for changes that are occurring in mathematics education in Georgia" (John Wight, personal communication, January, 2008).

Research Design

This study utilized a mixed-methods design with a greater emphasis given to the quantitative data. Data from the workshop participants was in the form of survey data, and data from the instructors came from personal interviews. Quantitative results of the participants' surveys were compared with the qualitative analysis of the interviews of the instructors to determine the role of the instructors as change facilitators and to examine the presence of factors related to the change process.

When it is not possible to study more than one group or when the researcher desires to study every member of a group, a within-group time series design is the best approach (Creswell, 2002). With this design, the researcher administers multiple pretests and posttests. The researcher chose this design for the study because she wanted to study the group of teachers attending the Northeast Georgia RESA workshop. The model for the equivalent time series design of the study is as follows: measure (SoCQ), intervention (summer workshop), measure (SoCQ), intervention (classroom implementation and follow-up workshop), measure (SoCQ), intervention (classroom implementation and follow-up workshop), and measure (SoCQ). According to Hall and Hord (2006), this "time series set of snapshots" (p. 145) is the best way to document how the change process is evolving.

The intended goal for the qualitative component of this study was to increase the interpretability and meaningfulness of the quantitative study. Morgan (2002) posits that interview data can provide specific knowledge that benefits formative evaluation during the development of programs and summative evaluation to assess programs. Because of their knowledge about the Georgia Performance Standards and their expertise in conducting professional development workshops, the institute instructors provide an overall view of the innovation being implemented from a different perspective than that gathered by the surveys of the workshop participants. The researcher selected this method of inquiry because combining quantitative research with qualitative methods often results in a more powerful and meaningful study.

A term often used by qualitative researchers to address issues of reliability and validity is "trustworthiness." One method for determining trustworthiness of qualitative research is the use of triangulation techniques. Originally a navigation term, triangulation referred to the way two points and the angles at those points could be used to determine the location of a third point. In research, the term has come to mean combining two or more data sources to study a single phenomenon (Tashakkori & Teddlie, 1998). In order to determine both reliability and validity, it is necessary to collect multiple measurements for comparison. Mixed methods research, with its multiple means of collecting data, is "almost by definition the very essence of what is needed to assess the validity of research" (Hunter & Brewer, 2003, p. 581). The institute instructors' interviews added a dimension to this research that further served the research purpose of explaining the change process as it applies to high school math teachers' Stages of Concerns regarding implementation of the Georgia Performance Standards. Furthermore, information on

relationships among demographic factors provided another source of data for comparison.

The dependent variables in this study were the Stages of Concerns profiles. The independent variables were years of teaching experience, professional development experiences (GPS training only or professional learning community and GPS training), and choice of textbook (reform or traditional). The independent variables were analyzed to determine which variables, if any, were associated with a raw score that determined a peak Stage of Concern.

The information in Table 3 correlates the variables included in the study to the research questions. Related research studies for each variable are cited in the table.

Instrumentation

Three types of instruments were used in this study. The Concerns Based Adoption Model (CBAM) Stages of Concern Questionnaire (SoCQ) (see Appendix A) is a quantitative survey instrument. A demographic survey (see Appendix B) was utilized to collect descriptive information about the sample. Qualitative data was collected from the institute instructors through face-to-face and email interview questions (see Appendix C).

Stages of Concern Questionnaire

The Stages of Concern Questionnaire (see Appendix A) from the Concerns Based Adoption Model (CBAM) was used to measure teacher concerns. The SoCQ is a 35 question, 8-point Likert scale. A rating of 0 means “irrelevant;” a rating of 1 or 2 means “not true of me now.” A rating of 3, 4, or 5 means “somewhat true of me now,” and a rating of 6 or 7 means “very true of me now.”

Table 3

Selected Variable Analysis

Item	Research	Research Question
Stages of Concerns Profiles	Conway & Clark (2003) Donovan, Hartley, & Strudler (2007) Fenton (2002) Hall and Hord (2006) Peers (1990)	1
Changes in Stages of Concerns Profiles	Dass (2001) Crawford, Chamblee & Rowlett (1998) Hord, Rutherford, Huling-Austin, & Hall (1987)	2
Years of Teaching Experience	Conway & Clark (2003) Charambous, Philippou, & Kyriakides (2004) Christou, Eliophotou-Menon, & Philippou (2004)	3
Profession Learning Experiences	Dass (2001) Peers (1990) Crawford, Chamblee & Rowlett (1998) Fenton (2002) Garet, Porter, Desimone, Birman, & Yoon (2001) Guskey (2000) Schoen, Cebulla, Finn, & Fi (2003)	3
Choice of Textbook	Harwell, Post, Maeda, Davis, Butler, Andersen, et al. (2007) Middleton (1999) Remillard (1999) Ross, McDougall, & Hogaboam-Gray (2003)	3
Instructor Expectations	Christou, Eliophotou-Menon, & Philippou (2004) Cooney & Shealy (1997) Crawford, Chamblee & Rowlett (1998) Garet, Porter, Desimone, Birman, & Yoon (2001) Goldsmith & Shifter (1997) Guskey (2000) Henry & Clements (1999) Little (2001) Macnab & Payne (2003)	4

Each of the seven stages of concern (awareness, information, personal, management, consequence, collaboration, and refocusing) has five items on the survey that relate back to that stage (see Appendix D). The raw score at each stage of concern was found by totaling the scores for each of the five questions related to that stage and could range from 0 to 35 points. Each administration of the survey took about 15 minutes to administer and was scored by hand using the Stages of Concern Quick Scoring Device (George et al., 2006). The SoCQ contained an open-ended question at the end which gave participants an opportunity to voice any other concerns they had regarding the innovation.

Research is only as good as the reliability of the instruments used. According to Creswell (2002), "Reliability means that individual scores from an instrument should be nearly the same or stable on repeated administrations of the instrument, they should be free from sources of measurement error, and they should be consistent" (p. 180). If an instrument is valid, then the researcher can "draw meaningful and justifiable inferences from scores about a sample or population" (Creswell, 2002, p. 183).

The original CBAM development team put the SoCQ through a rigorous series of reliability and validity studies. The instrument is continually being examined and revised, with the latest revisions made in 2005. The team determined the SoCQ to be "psychometrically rigorous and reliable enough to provide both meaningful research data and information for planning change strategies" (Hall & Loucks, 1978, p. 44). The researchers used several different samples with a total of 11 different innovations to test reliability, internal consistency, and validity. They concluded that "item correlation and factor analyses indicated that seven factors explained more than 60% of the common

variance among the 195 items and that the hypothesized scales corresponded to the factor scales" (George et al., 2006, p. 12).

Demographic Survey

The demographic survey (see Appendix B) contained general questions about years of teaching experience, sex, ethnicity, Math I teaching assignment for the first year of GPS implementation, choice of textbook, and other professional learning experiences related to GPS.

Institute Instructor Interview Questions

The institute instructor interview questions (see Appendix C) were designed to spark conversation among the institute instructors. Interview participants will usually participate enthusiastically and without much prompting from the group moderator when they have a high level of commitment or emotional involvement in the topic being studied (Morgan, 2002). Ideally, the answers to most of the interview questions would come up naturally in the conversation without them having to be specifically asked. The questions were there as guides, however, for the moderator to use in case there was a lull in the conversation or if the questions were not answered in the general conversation.

There were three sets of interview questions: one interview was held before the 3-day summer workshop, one set of questions was asked immediately after the fourth day of training in October, and the last set of questions was asked after the fifth day of training in February.

Procedures

Georgia Southern University has specific guidelines for research involving human subjects. To ensure compliance with the guidelines set forth by the Institutional Review

Board (IRB), an application was submitted to the IRB and approval was granted before research began (see Appendix E).

In addition, written permission was obtained from each of the following outside agencies:

1. Permission to reproduce the SoCQ was obtained from Gene Hall and from Southwest Educational Development Laboratories (see Appendix F).
2. Permission to reprint several tables and charts from *Measuring Implementation in Schools: The Stages of Concern Questionnaire* (George et al., 2006) was obtained from Southwest Educational Development Laboratories (see Appendix F).
3. Permission to administer the surveys to workshop participants and to interview the institute instructors was obtained from Northeast Georgia RESA (see Appendix G).
4. Informed consent letters were provided to workshop participants and institute instructors (see Appendix H and Appendix I).

Although written permission to administer the surveys on-site to institute participants was acquired, permission was reversed after one of the institute instructors expressed concerns about two of the questions on the SoCQ. By the time the mix-up was straightened out and permission was reacquired, the original surveys had already been mailed to the 75 workshop participants scheduled to attend the summer 2007 workshop.

The researcher coded questionnaires with a personal identification number that allowed tracking of individual surveys to determine changes in concern profiles. A mathematics specialist at Northeast Georgia RESA kept the master list with names

corresponding to identification numbers. The researcher did not have access to this list. Names did not appear on individual surveys.

The respondents returned the first administration of surveys to the researcher in self-addressed stamped envelopes that were provided by the researcher. There was a 38.67% (n = 29) response rate to the survey. The researcher prepared new surveys for the non-respondents but was not able to administer them prior to the training. The institute instructors were busy dealing with a last minute technology glitch and did not have time to match the numbers to the names. To preserve the anonymity of the study participants, the researcher chose to work with the responses that she had. The researcher mailed follow-up surveys to each of the 29 respondents who completed the first round of surveys. There was a 62.1% (n = 18) response rate to the second administration of the survey.

The researcher administered the questionnaires on-site at the end of Day 4 training in October of 2007 and at the end of Day 5 training in February. The surveys were placed into file folders with the participants' names on the file folders only. The participants removed the surveys from the file folders, completed the surveys, and returned them to their institute instructor. The institute instructors gave the completed surveys to the researcher. This method of administering the surveys was developed to ensure confidentiality and anonymity.

The updated version of the original 1978 SoCQ manual entitled *Measuring Implementation in the Schools: The Stages of Concern Questionnaire* (George et al., 2006) was used to guide data analysis.

The researcher interviewed the instructors at three different intervals of the training: before the workshop, between Day 4 and Day 5 training, and after Day 5 training. She recorded the first interview using a digital audio recorder. The researcher asked the institute instructors specific questions related to their planned interventions and their perceptions of the effectiveness of the professional development workshops (see Appendix C). The audio data was stored on the researcher's personal computer in her home office and was destroyed at the completion of this dissertation. The researcher transcribed the data personally and stored the transcriptions on her personal computer. Pseudonyms were used to ensure anonymity of the institute instructors. The last two rounds of interviews were done via email. A final personal interview was held with the principal instructor (Maddie) at the conclusion of the study.

Data Analysis

Research Question One: What are the longitudinal Stages of Concern profiles of the workshop participants?

To answer this question, the researcher completed three analyses. The first analysis consisted of noting the stage of concern that received the highest percentile score at each stage of data collection. This number identified the intensity of the concerns at various stages of implementation of the Georgia Performance Standards. The highest percentile score for each participant was labeled the "peak Stage of Concern" for that individual participant. The data was represented graphically with the Stages of Concern on the horizontal axis and the percentage of respondents who had that level as their peak stage of concern on the vertical axis. If a respondent had two Stages of Concern with the same relative intensity, then each was counted as a separate piece of data. The same

process was used for each administration of the survey. The results were graphed on the same coordinate axis to illustrate the changes in the peak levels of concern over time.

To further represent the longitudinal Stages of Concerns Profiles, the researcher computed the Stages of Concerns Profile for the group for each administration of the survey. The raw score totals for each respondent for each stage of concern was averaged to get a group raw score for each stage. This group raw score average was converted to a percentile to determine the relative intensity of the score. This data was represented by a graph with the stage of concern on the horizontal axis and the group relative intensity (percentile) on the vertical axis.

The SoCQ Quick Scoring Device was used to determine the peak stages of concern (awareness, information, personal, management, consequence, collaboration, refocusing). A raw score for each level of concern was computed by adding the scores for each question related to that level of concern. See Appendix D for a breakdown of the questionnaire by level of concern. If a question was omitted, then the average of the marked responses for that category was used. The raw scores were converted to percentile scores representing the relative intensity of the scores. The Concerns Based Adoption Model team developed the percentiles based on responses of a carefully selected stratified random sample for a study done in 1974. The percentiles have since been validated with other studies about other innovations (George et al., 2006).

Research Question Two: Are there significant changes in the Stages of Concern profiles as the workshop participants experience professional learning activities over time?

The Stages of Concern Questionnaire is based on an 8-point Likert scale. Although Likert Scales are technically ordinal in nature, they are often treated as

interval/ratio data "when the amount of agreement or disagreement is assumed to vary in equal intervals along the points of measure" (Nardi, 2003, p. 46). The appropriate statistical test for comparing two distributions of interval data from a repeated measures research design is the paired t-test (Sprinthall, 2003).

The numbers used for the paired t-test were the individual raw score totals for each stage of concern for the first and the fourth administration of the SoCQ. There were 16 participants who completed the first questionnaire who were also present for the final administration. The individual raw score total for each stage of concern for the first administration was subtracted from the individual raw score total for the corresponding stage of concern for the fourth administration to determine if a change occurred at the .05 level of significance.

Research Question Three: Are there relationships among workshop participants' demographic data and Stages of Concern profiles?

This question was answered using the data collected at Day 5 training (administration 4, n = 56). Each participant at this workshop provided demographic information regarding gender, age, years of experience, ethnicity, Math I teaching assignment, area of expertise for purposes of GPS training, preferred textbook for adoption, and types of professional learning involvement related to GPS. Descriptive statistics of the participants based on their answers to these questions provided a portrait of the demographic makeup of the research participants at the Day 5 training. Furthermore, one-way analysis of variance using some of the demographic data provided the answer to the third research question. For each test, the independent variable was the demographic information for the participant (years of teaching experience, choice of

textbook or professional learning involvement with GPS). Mean raw scores for each stage of concern were the dependent variables. The participants were grouped by demographic variable, and the group means were compared for each stage of concern using Analysis of Variance (ANOVA). This analysis was conducted on the final administration of the Stages of Concerns Questionnaire.

Research Question Four: How do the institute instructors' expectations of workshop participant concerns and the planned professional learning experiences correspond to the workshop participants' Stages of Concern profiles?

The SoCQ administered to the workshop participants contained one open-ended question at the end: What other concerns, if any, do you have at this time? Although many participants opted to leave this question blank, several respondents did take the time to answer the question. The answers given were analyzed by looking for emerging themes and "grounded categories of meaning" (Marshall & Rossman, 1999, p. 154). The data from the institute instructors' interviews were considered separately and holistically for themes across all three. Finally, the results of the analysis of the responses from the workshop participants were compared to the data obtained from interviewing the institute instructors.

Summary

In this chapter the researcher described the methods and procedures used in studying the Stages of Concerns profiles of participants in a Math I training workshop offered through Northeast Georgia RESA. The researcher sought to present individual and holistic portraits of the participants as they moved through the professional learning experience. The Concerns Based Adoption Model for implementation of an innovation

provided the framework for the investigation. In addition, the researcher wanted to determine if particular Stages of Concern were more characteristic of participants possessing certain demographic variables (years of teaching experience, choice of textbook and professional learning experiences) than others. Lastly, the researcher looked for emerging themes among the workshop participants' concerns and the planned professional learning experiences presented by the institute instructors.

The mixed-methods research employed a time series design. Data collection from the workshop participants and the institute instructors occurred over a 9 month period. The researcher administered the Stages of Concerns Questionnaire four times. The demographic data was collected one time only and represented participants who attended Day 5 of training. The researcher interviewed the institute instructors three different times.

The method to determine the peak Stage of Concern was explained, and the procedure for determining the group profiles was given. Analysis for each research question was described.

CHAPTER 4

DATA PRESENTATION

It is truly what happens at the individual level
that determines the extent of change success.
(Hall & Hord, 2006, p. 258)

The purpose of this study was to examine the longitudinal concerns of a cohort of high school mathematics teachers in the Northeast Georgia RESA district about implementation of the Georgia Performance Standards in their classrooms and to explore relationships among the Stages of Concerns profiles, demographic factors, and professional learning experiences provided by institute instructors. The Stages of Concern toward implementation of the Georgia Performance Standards were measured using the Stages of Concern Questionnaire (George et al., 2006, p. 41).

This chapter describes the findings generated through a quantitative analysis of the returned surveys and a qualitative analysis of the open-ended responses from the workshop participants and the interviews of the institute instructors. The major areas addressed in this chapter include a description of the workshop participants and institute instructors and an analysis of the research questions.

Description of the Sample

The members of the sample were participants in five days of training for Math I in the Northeast Georgia Regional Educational Service Agency. At the final administration of the Stages of Concern Questionnaire, the respondents provided information regarding age, gender, ethnicity, years of teaching experience, area of mathematics expertise, textbook adoption, teaching assignment, and other involvement in Georgia Performance

Standards implementation (see Appendix B). Fifty-six participants completed the demographic questionnaire (see Appendix B), which was administered at the same time as the fourth administration of the SoCQ.

Because this group represented the largest sample surveyed, it gave the most accurate portraiture of the group as a whole. The participants were primarily female (n = 43, 76.79%), white (n = 50, 89.29%), algebra teachers (n = 26, 50.00%), and had ten or less years of teaching experience (n = 30, 53.57%). Many did not know if they would be teaching Math I in its first year of implementation (n = 24, 42.86%), but almost as many were sure they would be teaching Math I (n = 23, 41.07%). Many remained uncommitted to a particular textbook (n = 11, 19.64%). From those who expressed a textbook choice, more respondents chose a reform-based textbook such as Carnegie Learning, Core-Plus, Math Connections, or SIMMS (n = 34, 60.71%) than those who chose a traditional textbook such as McDougall-Littell. The majority of participants were present for all five days of training (n = 49, 87.5%), although less than one-third of them mailed back the first survey (n = 16, 28.57%). Slightly more than 50% of the participants were also involved in other professional learning communities such as the Math I learning community established by Northeast Georgia RESA and PRISM (Partnership for Reform in Science and Mathematics) and/or departmental learning communities in their local schools (n = 29, 51.79%). The demographic information is summarized in Table 4 and was used to answer the third research question.

Table 4

Description of Participants – Administration 4 and Research Question 3

	n	%
Age		
21-30	15	26.79
31-40	18	32.14
41-50	19	33.93
51+	4	7.14
Years of Teaching Experience		
1-5	15	26.79
6-10	15	26.79
11-20	13	23.21
21+	13	23.21
Gender		
Female	43	76.79
Male	13	23.21
Ethnicity		
African American	4	7.14
Latino	2	3.57
White	50	89.29
Math I Teaching Assignment		
Yes	23	41.07
No	9	16.07
Unsure	24	42.86
Textbook Choice		
Reform-based	33	58.92
Traditional	12	21.43
Unsure	11	19.64
Professional Learning Experiences		
RESA or local PLC	29	51.78
Math I Training Only	27	48.21

Although the percentages for the demographics of the participants whose results were analyzed for the second research question were different, the group still closely resembled that of the larger sample. The participants were still primarily female (n = 11, 69%), white (n = 15, 94%), algebra teachers (n = 9, 56%), with 1-5 years of experience (n = 7, 44%). The demographic information for the second research question is summarized in Table 5.

Table 5

Description of Participants – Research Question 2

	n	%
Age		
21-30	8	50.00
31-40	1	6.25
41-50	4	25.00
51+	3	18.75
Years of Teaching Experience		
1-5	7	43.75
6-10	4	25.00
11-20	4	25.00
21+	1	6.25
Gender		
Female	11	68.75
Male	5	31.25
Ethnicity		
African American	1	6.25
Latino	0	0.00
White	15	93.75
Math I Teaching Assignment		
Yes	6	37.50
No	3	18.75
Unsure	7	43.75
Textbook Choice		
Reform-based	9	56.25
Traditional	4	25.00
Unsure	3	18.75
Professional Learning Experiences		
RESA or local PLC	8	50.00
Math I Training Only	8	50.00

Description of the Institute Instructors

Maddie

Maddie is a mathematics support specialist for one of the state Regional Educational Service Agencies (RESA). She was a high school mathematics teacher for 26 years before working for RESA. It was common for Maddie's algebra and geometry classes to have a 50% failure rate before she made a concentrated effort to change her teaching practice. She focused on more student-centered activities and planned questions and assessments that required higher-order thinking skills. As a result of these changes in her teaching strategies, she saw many students succeed in math class for the first time. Maddie was a member of the High School Advisory Committee charged with advising and guiding the implementation of the K-12 Georgia Performance Standards (GPS) curriculum.

George

George is a high school mathematics teacher. He piloted a Math I class with a group of freshmen using the SIMMS textbook during the 2007-2008 school year. George has taught mathematics at the college level, including a problem-based college algebra course called "Earth Algebra." George is a 25 year veteran of the classroom and prides himself on being willing to try new things with his students. Prior to his current teaching assignment, George served as an assistant principal of instruction and as a principal of an alternative school.

Lorraine

Lorraine is a high school mathematics teacher on loan to the state department of education to assist in the implementation of the GPS in high school mathematics. Like

Maddie and George, she has more than 25 years of classroom experience. Lorraine was a member of the secondary writing team charged with writing the first draft of the GPS secondary mathematics curriculum and a member of the High School Advisory Committee. Lorraine was initially reluctant to participate in this study. She expressed concerns about the Stages of Concern Questionnaire and even asked if some of the questions could be re-worded. As a result of Lorraine's concerns, the first two rounds of surveys were mailed to participants instead of administered on site as originally planned. In spite of the issues Lorraine had with the study, she was friendly and cooperative during the interview process.

Analysis of Research Questions

Participants were asked to complete the Stages of Concerns Questionnaire (SoCQ) (see Appendix A). The SoCQ consisted of 35 statements expressing a level of concern about an innovation, the implementation of the Georgia Performance Standards in high school mathematics. Respondents marked an 8-point Likert-type scale indicating the degree to which each concern was true. High numbers indicate high intensity concerns; low numbers indicate low intensity concerns while zero indicates an extremely low concern. Respondents were asked to leave an item blank if they did not feel that it applied to them. Scores had a possible range of 0-35 for each of the seven Stages of Concern. Items that were left blank were given a score equivalent to the average of the other responses in that Stage of Concern as described in *Measuring Implementation in Schools: The Stages of Concern Questionnaire* (George et al., 2006).

A raw score for each stage was calculated by adding the individual's response to the five items that address each stage (see Appendix D). The raw scores were converted

into percentile scores representing the relative intensity of the scores. The highest relative intensity score was identified as the respondent's peak Stage of Concern. For respondents who had a tie for the peak stage, both stages were tallied.

Research Question One

What are the longitudinal Stages of Concern profiles of the workshop participants?

George, Hall and Stiegelbauer (2006) recommend two ways to display group data. One way is to tally individual scores to determine the number of individuals with peak scores at each stage. For this analysis, the frequencies were converted to percentages since the number of respondents was different for each administration of the survey (see Figure 1).

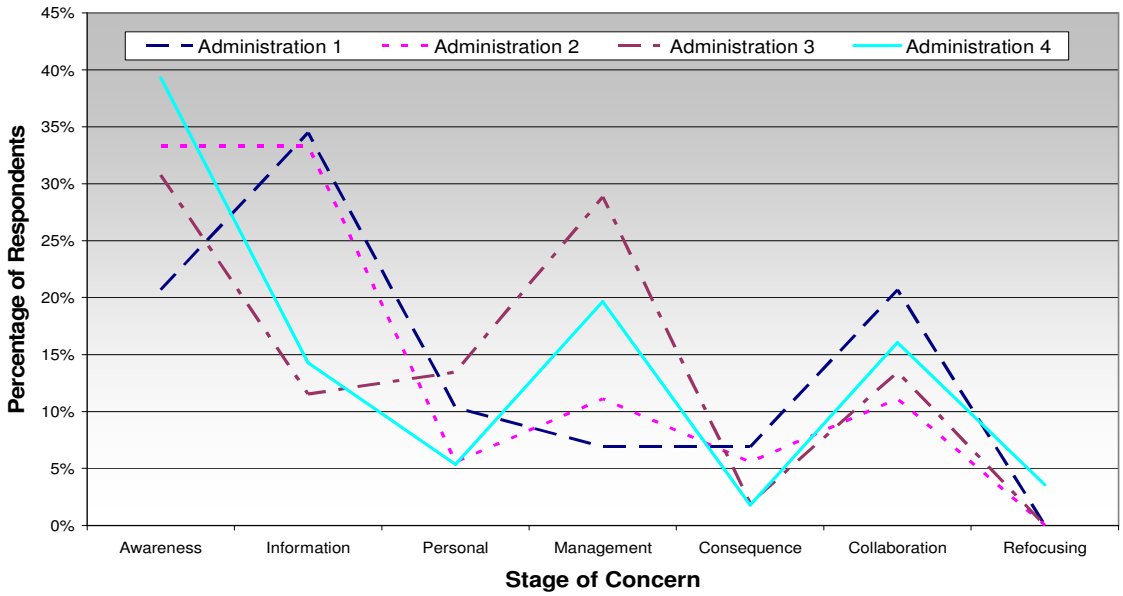

Figure 1

Peak Stages of Concern for Individual Respondents

Table 6

Peak Stages of Concern for Individual Respondents

Peak Stage of Concern	Administration 1		Administration 2		Administration 3		Administration 4	
	n	%	n	%	n	%	n	%
Awareness	6	20.69	6	33.33	16	30.77	22	39.29
Information	10	34.48	6	33.33	6	11.54	8	14.29
Personal	3	10.34	1	5.56	7	13.46	3	5.36
Management	2	6.90	2	11.11	15	28.85	11	19.64
Consequence	2	6.90	1	5.56	1	1.92	1	1.80
Collaboration	6	20.69	2	11.11	7	13.46	9	16.07
Refocusing	0	0.00	0	0.00	0	0.00	2	3.57
Totals	29	100.00	18	100.00	52	100.00	56	100.00

The highest peak Stage of Concern for the first administration of the questionnaire (n = 29) was the Information Stage (Stage 1) with 34.48% of the respondents having this stage as their peak stage. The Information Stage and the Awareness Stage (Stages 1 and 0) tied for the stage with the most scores for the second administration (n = 18) with 33.33% each. For the third (n = 52) and fourth (n = 56) administrations of the questionnaire, the greatest percentage of respondents was in the Awareness Stage (Stage 0) with 30.77% and 39.29% respectively. With the exception of the first administration which revealed concerns about information (Stage 1), each administration revealed second and third peak areas in management (Stage 3) and collaboration (Stage 5). A high Stage 0 score indicates a person who is a non-user or who is not concerned about the

innovation. High Stage 3 scores indicate concerns about logistics, time, and management. High Stage 5 scores coupled with high scores in other areas indicate concerns about a collaborative effort in relation to the other stages with high scores. Lowest areas of concern across all four administrations of the questionnaire were consistently in the Personal Stage (Stage 2) and the Consequence Stage (Stage 4). Table 6 more clearly illustrates the different values for n for each administration of the SoCQ.

A second way to describe group data is to develop a group profile based on the average raw scores of the individual respondents (See Figure 2). The recommended procedure for compiling a group profile is "to average raw scores for each Stage of Concern and refer those averages to the percentile score table" (George et al., 2006, p. 34).

The group profile for the pre-institute questionnaire indicated a peak score in the Information Stage (Stage 1) with a secondary peak in the Collaboration Stage (Stage 5). This profile suggests a group of participants who are eager to learn more information about implementation of the Georgia Performance Standards and are interested in collaborating with their peers to gather information concerning how others plan to handle implementation.

The group profile for the second administration of the questionnaire, administered after participants had completed three consecutive days of Math I training, remained practically identical to the original group profile. The peak Stage of Concern for the group remained Stage 1 (information) with a secondary peak at Stage 5 (collaboration).

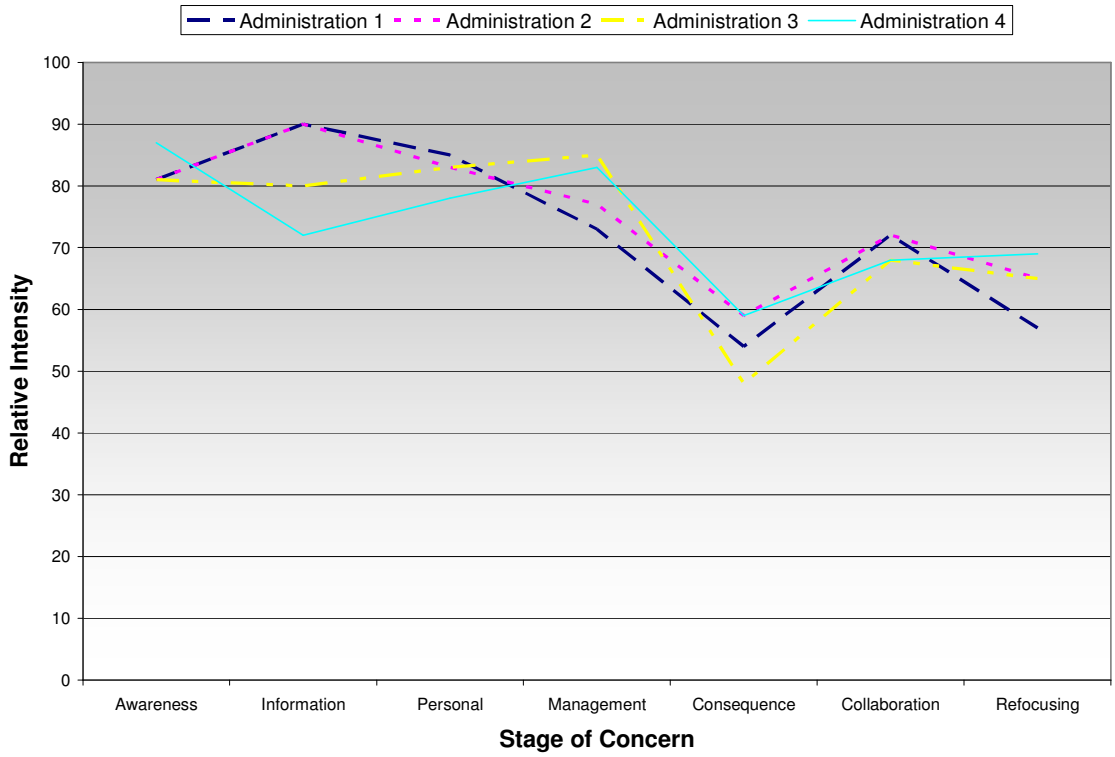

Figure 2

Group Profiles for Respondents

The third administration of the Stages of Concern Questionnaire was given to participants at the end of Day 4 Math I Training. Between the second and third administrations of the survey, participants were expected to implement standards-based strategies learned during the 3-day institute. Although concerns for Stages 0, 1, and 2 remained high, the peak Stage of Concern for the group for this administration was Stage 3 (Management). A high score in Stage 3 indicates concerns about the logistics of implementation. Once again there was a secondary peak at Stage 5 (collaboration) indicating desires to know what peers are doing to implement this innovation.

The fourth and final administration of the SoCQ was administered at the end of Day 5 training in February. Between Day 4 Training and Day 5 Training, it was expected

that participants continue to implement standards-based strategies in the classrooms. Many were also involved in textbook adoption for Math I. Awareness (Stage 0) was the peak Stage of Concern at 87% relative intensity. Management (Stage 3) was a close second at 83% relative intensity. The high awareness score indicated that many participants still fit the profile of a non-user while the secondary peak score indicated high management concerns. The slight "tailing up" (George et al., 2006) at Stage 6 in non-users indicated a resistance to the innovation. In an individual profile, the tailing-up means that the respondent has ideas that he or she perceives as being better than the current innovation. This rise in concern at Stage 6 indicated that there were enough individuals with resistance to the innovation to affect the group profile.

Research Question Two

Are there significant changes in the Stages of Concern profiles as the workshop participants experience professional learning activities over time?

Sixteen of the respondents completed both the pre-institute SoCQ and the post-institute SoCQ. A paired t-test was performed to determine if the raw scores for each Stage of Concern changed over the course of the professional development for implementation of Math I GPS (see Table 7). For the information stage of concern (Stage 1), the mean difference (M_{A-B} = -4.8750, SD = 8.500, N = 16) was significantly different from zero, t (15) = -2.294, two-tail p = .037, providing evidence that the information concerns were reduced from the beginning of the professional development in May (pre-institute) to the end of the training the following February (post-institute). The differences in mean raw scores for the other six Stages of Concern were not significantly different from zero. There were slight increases in mean scores for Awareness (Stage 0),

Management (Stage 3), and Consequence (Stage 4). There were slight decreases in mean scores for Personal (Stage 2) and Collaboration (Stage 5). There was no change in the mean score for Refocusing (Stage 6).

Table 7

Paired t-test for Differences in Raw Score Totals

Stage of Concern	df	Mean	Std. Deviation	t	p
Awareness	15	.563	7.339	.307	.763
Information	15	-4.875	8.500	-2.294	.037
Personal	15	-3.313	7.846	-1.689	.112
Management	15	2.125	10.639	.799	.437
Consequence	15	1.438	9.598	.599	.558
Collaboration	15	-1.688	8.048	-.839	.415
Refocusing	15	.000	9.136	.000	1.000

Research Question Three

Are there relationships among workshop participants' demographic data (years of teaching experience, professional learning experiences, choice of textbook) and Stages of Concern profiles?

The demographic data was compared to the SoCQ data from the fourth and final administration. There were 53 Stages of Concerns Questionnaires that corresponded to the 56 demographic surveys. One participant failed to complete the back side of the SoCQ, and two chose to complete the demographic survey only. An analysis of variance

was used to compare the means of concern stages with three factors identified in past research as correlating significantly: years of experience (Charambous et al., 2004; Christou et al., 2004; Conway & Clark, 2003); choice of textbook (Harwell et al., 2007; Middleton, 1999; Middleton & Spanias, 1999; Remillard, 1999; Ross et al., 2003); and professional learning experiences (Crawford et al., 1998; Dass, 2001; Fenton, 2002; Peers, 1990).

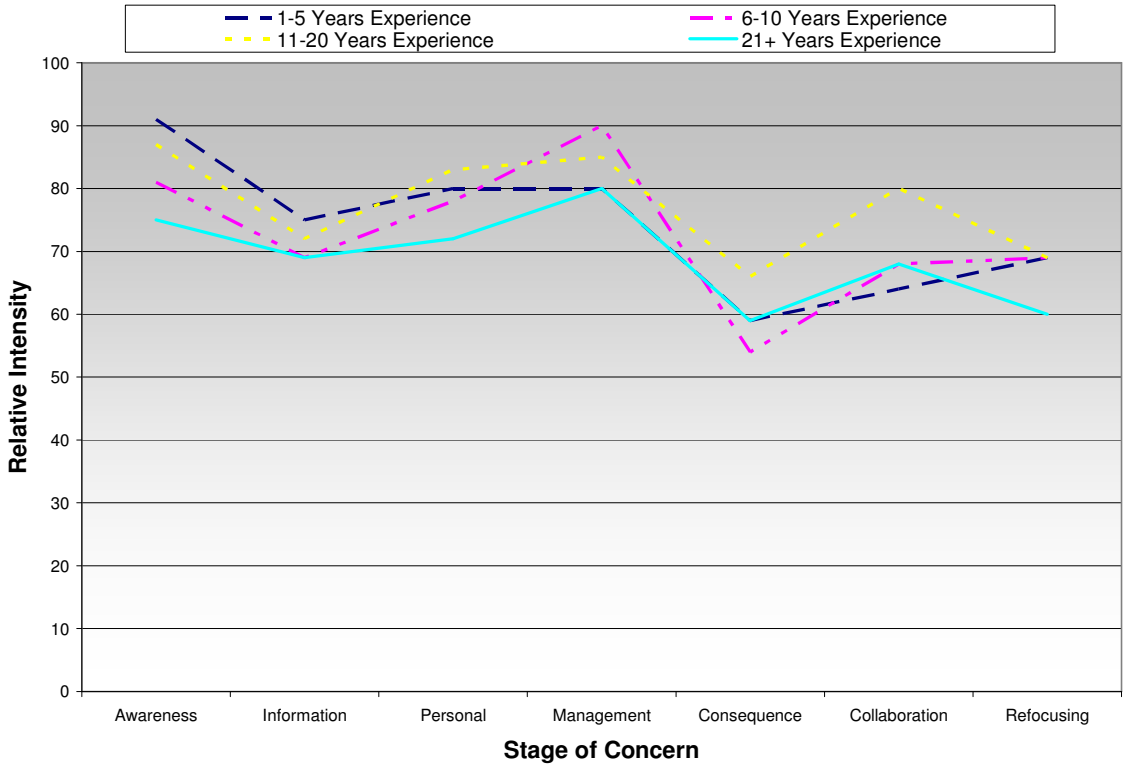

Figure 3

Group Profiles for Participants According to Teaching Experience

Years of Experience

A one-way analysis of variance (ANOVA) was used to determine whether there was a statistically significant difference between the mean raw scores of each Stage of

Concern and years of teaching experience. The ANOVA table for this analysis is shown in Appendix J. The analysis revealed no significant differences between the groups.

The group profile for each category of years of experience is presented in Figure 3. Teachers with 1-5 years of experience and those with 11-20 years of experience scored highest on awareness while those with 6-10 years of experience and those with 21 or more years of experience scored highest on management. Those who scored highest on awareness had management as their second highest stage of concern. The teachers who scored highest on management had awareness as their second highest stage of concern.

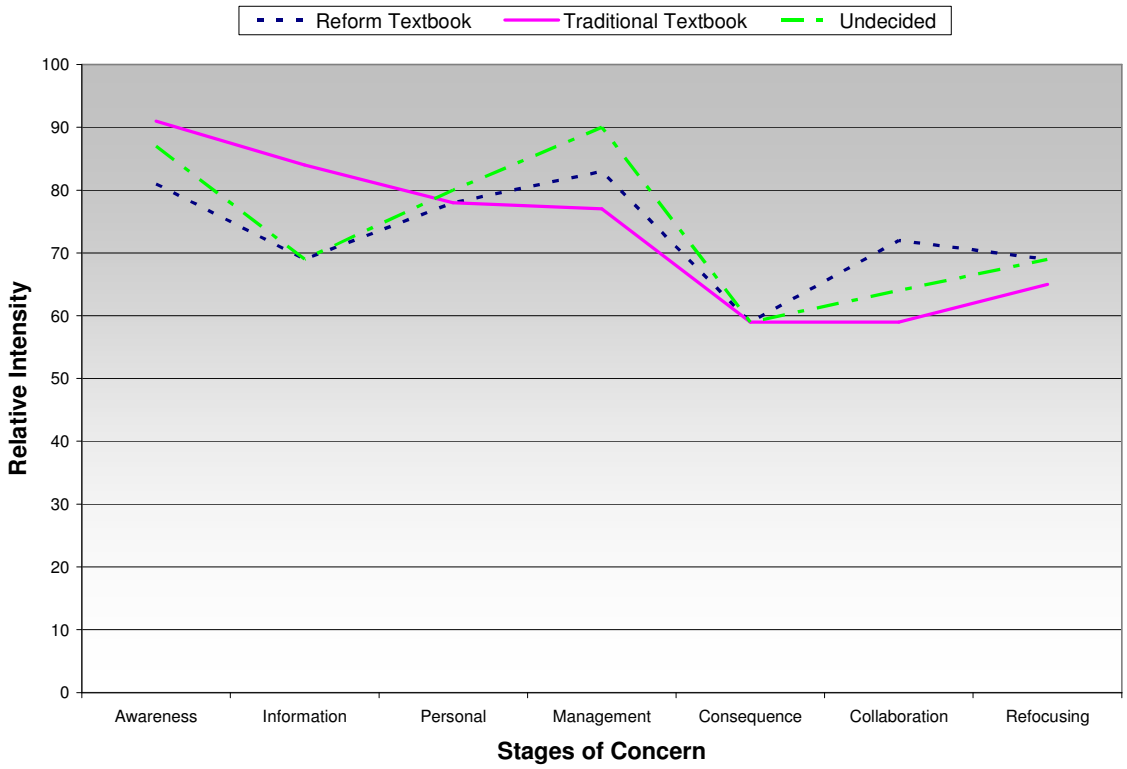

Figure 4

Group Profile of Participants According to Textbook Preference

Choice of Textbook

There were 33 participants who chose a textbook classified as "reform" or "standards-based." The textbooks included in this category included Core-Plus, Carnegie Learning, Math Connections, and SIMMS. Twelve participants chose a traditional skills-based textbook. In the case of the Georgia Math I adoption, McDougall-Littell offered the only skills-based textbook. Eleven participants remained undecided about their first choice for a textbook. Three of those who remained undecided did not complete the SoCQ.

A one-way analysis of variance (ANOVA) was used to determine whether there was a statistically significant difference between the mean raw scores of each Stage of Concern and the type of textbook chosen to use with Math I. The ANOVA table for this analysis is shown in Appendix K. The analysis revealed a significant difference ($p = .033$) between the choice of textbook and the mean raw score at the information stage. There were no significant differences between the categories of textbook choice and the other stages.

The group profile for each category is presented in Figure 4. Teachers who chose a reform textbook and teachers who had not yet made a textbook decision scored highest on management concerns. Teachers who chose a traditional textbook scored highest on awareness. The group profiles for teachers who chose a traditional textbook and teachers who had not yet made a decision showed a slight "tailing up" on the refocusing stage. This indicates resistance to GPS implementation. The group profile of the traditional group most closely resembled that of a non-user with a continuous decline in concern until the slight rise at the refocusing stage.

Professional Learning Experiences

There were 27 participants whose sole professional learning experience related to Math I implementation was the five days of training provided by Northeast Georgia RESA. Three of those did not complete the SoCQ. There were 29 participants who were also involved in other professional learning communities (PLC). Several were involved in the PLC started by Northeast Georgia RESA. Many others were involved in a local PLC at their schools.

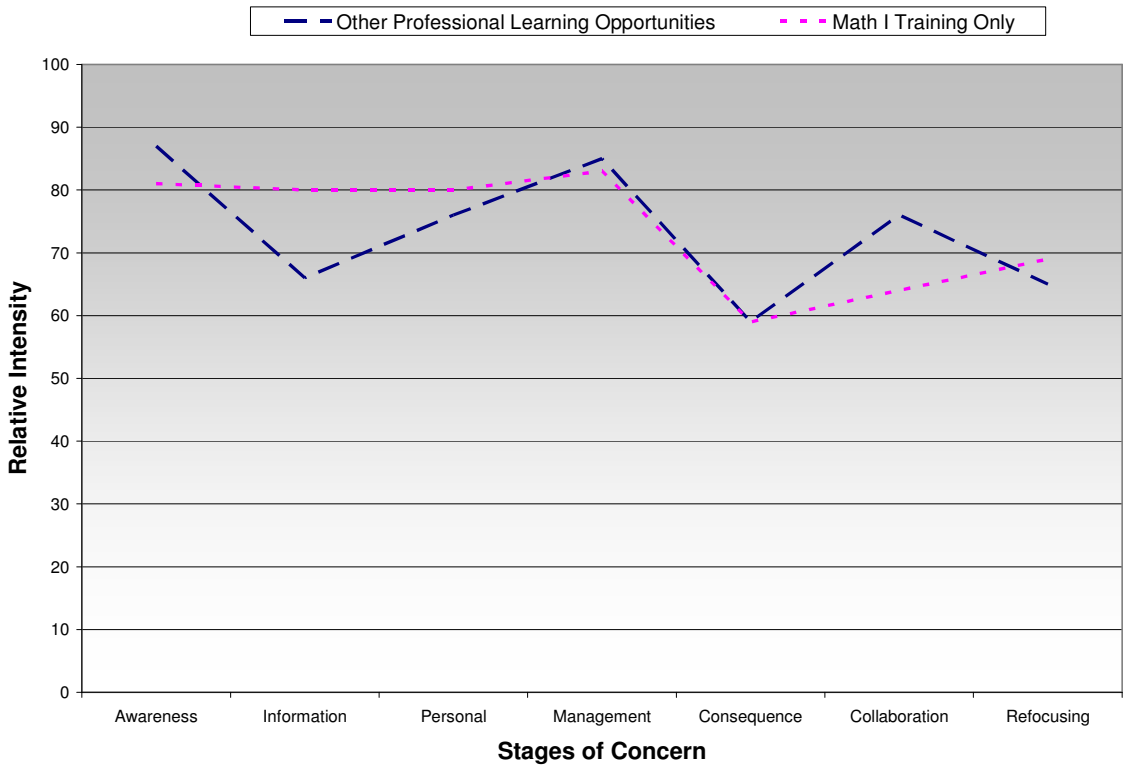

Figure 5

Group Profiles for Participants According to Professional Learning Experiences

A one-way analysis of variance (ANOVA) was used to determine whether there was a statistically significant difference between the mean raw scores of each Stage of

Concern and professional learning experiences with Math I. The ANOVA table for this analysis is shown in Appendix L. The analysis revealed a significant difference between the two groups at the collaboration stage. There were no significant differences between the types of professional learning experiences and the other stages.

The group profile for each category is presented in Figure 5. Teachers who participated in other profession learning opportunities in addition to Math I training scored highest on Awareness, but they also had high management and collaboration concerns. Teachers who were only involved in Math I training scored highest on Management. Their Awareness, Information, and Personal concerns were almost as high as their Management concerns. In addition, this group's profile showed a slight "tailing up" at the end indicative of resistance to the innovation.

Research Question Four

How do the institute instructors' expectations of workshop participant concerns and the planned professional learning experiences correspond to the workshop participants' Stages of Concern profiles?

The Stages of Concern Questionnaire administered to workshop participants contained one open-ended question: What other concerns, if any, do you have at this time? Many participants opted to leave this question unanswered, but four themes emerged from the answers of those who chose to respond.

The first theme that emerged was a desire for more information. What materials will be available? Will there be a textbook that meets the needs of the teachers? Where can we find resources for activities? What does a unit look like from start to finish? For example, one participant wrote "materials, materials, materials" on his response to the

open-ended question on the first survey. His concern was still present on the second survey as he wrote “textbook, textbook, textbook.” On the surface these concerns seemed to be related to Stage 1 (information). On closer examination, some appeared to be more closely related to Stage 5 (collaboration). For example, one participant wrote the following: “I am hoping to get resources to help teach – great questions and activities to use. Obviously we, individually, don’t have the time create everything [emphasis in original].” Another wrote, “Lesson plans take a long time to make. I hope there’s a pool to draw from.”

The second theme recurrent through many responses dealt with the issue of management. The issue of too much to do with too little time to do it was repeated often. There were concerns that the state would not be able to meet fundamental needs such as supplying money for technology and getting the frameworks finished in time for lesson planning. Other management issues mentioned included physical space for collaborative learning and obtaining support from the administration and community. One participant wrote, “I do not feel that the training has prepared me to teach the class. I needed to do more unit planning and preparation of assessments.” Another respondent expressed her concerns by saying, “I don’t see how giving low level student some colored pencils and other office supplies is supposed to make them do math (vs. play around).”

A third theme expressed by many respondents was concern regarding readiness of students. Time and time again, the question was asked, “What about our lower-level students?” A frequently expressed sentiment was that lower-level student would not be successful in Math I. One teacher wrote, “Since we have so many students struggling to get through Algebra One, I am concerned about the apparent increase in difficulty and the

effect it will have on students' attitudes and math phobias as well as their prospects of graduation." Another concern related to student achievement had to do with students who transfer from another state. These concerns relate directly to Stage 4 (Consequence). One teacher summed up her consequence concerns by saying, "Will this innovation really raise student achievement?"

The final recurring theme was skepticism about change in education in general. The fact that other states have tried similar approaches only to go back to a more traditional approach was mentioned by several respondents. One teacher complained that we are always "trying to reinvent the wheel" in education instead of refining and improving what we already have. Another respondent grumbled, "I don't like the innovation! I have absolutely no idea how I'm going to do cooperative learning lesson plans when I've never done them before. I'm considering moving to another state to just not deal with it. It sounds awful!"

Institute Instructor's Responses – Pre-Institute Interview

The specific questions asked at each stage of the interview process can be found in Appendix C. The institute instructors viewed their role in the development of the Georgia Performance Standards as one of facilitators. They described three opportunities for training to be institute instructors. There were two opportunities through a collaborative between RESA and PRISM (a federally funded reform initiative) and one through the State of Georgia at Georgia Public Broadcasting (GPB). The instructors were excited about the video-taping done at GPB that would be available on the Georgia Math Frameworks website at a later date.

When asked to describe the outcome they expected from the 3-day training institute, the instructors mentioned several ideas related to Stage 1 (Information). They wanted to explain to teachers the changes that were coming in the math classroom and what these changes would mean for the teachers and the students. Maddie indicated that she wanted the teachers to leave knowing what a standards-based classroom should look like and willing to make some changes in their current teaching practices. She said, "We want them to have some level of maneuverability about standards-based classrooms – what they look like, what they entail, and even begin to make some changes in their teaching practices before Math I is implemented. We want them to try some questioning techniques, some rearranging in groups, some tasks and multiple representations." Lorraine added, "We would also like for them to be able to take, if not these tasks, some other exemplary kinds of tasks that they could put into a QCC course this coming year and try it to see what it looks like." George referred to the training as a "launch pad" for teachers to begin making changes.

The institute instructors predicted concerns from the participants regarding making the mathematics accessible to all students regardless of ability level. They anticipated there would be concerns about how to support the lower-level students, especially from the special education teachers in the group. Lorraine mentioned concerns about assessment and grading. Maddie mentioned that teachers might fear this was too much change all at once and that they would be expected to change their entire teaching practice overnight. George echoed her sentiments: "They are afraid they have to do all the changes at the same time. They have to suddenly metamorphose into a whole different kind of teacher instead of slowly changing." The instructors planned to address

and validate concerns by listening, being generally positive, and giving the participants many examples of teachers who had been successful with this approach to teaching. Although these concerns could be categorized as Stage 4 (Consequence), they seem to be more closely related to Stage 3 (Management). The instructors think the teachers are worried about how GPS will impact their students, but they are more worried about how they are going to manage the instruction to make their students successful.

The institute instructors expressed expectations that the workshop participants would go back to their schools and be a catalyst for planning for implementation. Maddie hoped they would be able to relieve some of the anxiety of the teachers who were not able to attend the training. Lorraine stated that she wanted the participants to be a positive voice for change and a resource for others who have questions. George said he would be happy if they just went back to school and tried some of the new things they learned.

Institute Instructor's Responses – Mid-Institute Interview

The second round of interview questions was presented to the institute instructors immediately after the day 4 training in October. All felt that the training was going well thus far. They were surprised at the resistance of many of the workshop participants to the GPS implementation. George described one group in his room as "openly fighting" and being "in denial." Maddie's group was particularly resistant to solving problems using multiple representations. She said, "Even when various methods of using multiple representations were modeled for them, this was still quite the challenge. Many of the participants wanted to approach every situation algebraically and only algebraically." Lorraine's group, on the other hand, embraced multiple representations and had a good time coming up with different ways to solve the same problem.

None of the instructors were surprised at the results of the first two administrations of the Stages of Concerns Questionnaire. Maddie expressed the theory that belief will only come after practice and that this may take up to four years. She stated:

> I think the dual shift to Georgia Performance Standards for an entirely reshuffled curriculum for high school as well as to performance-based, student-focused instructional models implemented simultaneously is quite overwhelming to the majority of high school mathematics teachers. This is clearly an example of a three-alarm fire raging through the halls of all we have practiced traditionally in secondary mathematics education with little if any confidence in the new construction now known as the GPS.

There were some changes made to the Day 4 training based on the state professional evaluation forms completed at the end of the 3-day summer workshop. One of the major focuses of Day 4 training was to provide video-taped examples of best teaching practices versus practices that were not as effective. The instructors often used the phrase “standards-based classroom” to describe a constructivist classroom where students discovered the mathematical concepts as contrasted with a classroom where students were told the mathematical concepts through direct instruction from the teacher. For example, the teacher in the student-centered classroom walked around with her hands behind her back and led students to answers by artful questioning. The teacher modeled a teacher-centered classroom by taking a pencil from a child’s hand and working the problem for him on his paper.

The institute instructors stated that this aspect of the Day 4 training was very well received by the workshop participants. Two quotes from the instructors that illustrate their happiness with Day 4 follow:

> I think the training went well in that it served as a survey of what Mathematics I is all about as well as a glimpse into how these tasks can be best facilitated. I do not think that there will be massive buy-in in this new process until teachers have actually lived the results with students.
>
> The plans for Day 4 training focused on the characteristics of the standards-based classroom for mathematics in high school. The videos used highlight the differences in performance-based, student-focused instruction versus students working in groups with the teacher remaining the major focus were wonderfully produced and pointed out those differences so that every participant could clearly see the difference. This part went exceptionally well.

The videos were designed to address possible classroom management (Stage 3) concerns. George noted less "open hostility" during Day 4. George also predicted that teachers still had concerns about "what does a typical day look like?"

Concerns that instructors anticipate teachers would still have at this point in the Math I training included assessment, unit writing, and using the frameworks (all Stage 3 concerns). They predicted that teachers would want to know what is representative of a typical day in the classroom and what a unit should look like from start to finish. The instructors anticipated that the Day 5 training focusing on assessment should alleviate some of these concerns.

Institute Instructor's Responses – Post-Institute Interview

The final interview questions were asked approximately one week after the completion of the Day 5 training in February. Neither Lorraine nor Maddie were present at the Day 5 training. As a result, Lorraine did not complete the last survey. Since Maddie had been instrumental in the professional learning experiences of the teachers in the Northeast Georgia RESA district, she participated in the interview by email. Maddie and George indicated that many teachers were becoming more comfortable with the upcoming changes in mathematics in Georgia. One particular workshop participant, who is one of Maddie's former colleagues, is a particularly vocal opponent to GPS. When the process began back in May, this teacher's vocal complaints would encourage other teachers to join in the criticism. By February, others would chime in with examples of how they had solved a problem when this teacher would complain.

The instructors were asked to describe how their perception of where teachers were in the process compared to their original expectations of where they would be. George stated that he felt most teachers have accepted the change and will do their best to make it work. Maddie disagreed. She said she believes teachers are still quite concerned about how this implementation will "play out" in the fall. Her hopes that teachers would be prepared and confident when they began implementation were probably optimistic, but she is pleased with the planning and collaboration that has taken place thus far.

The researcher shared the results of her study with Maddie and George. Maddie was pleased with the correlation between collaboration concerns and participation in professional learning communities. Both of them thought the results reflected their

perceptions of the groups they worked with and with the results they saw on the state professional evaluation forms. George stated:

> The results seem to mirror my observations of the groups I worked with. The management of the curriculum and its ripples is the number one concern that was continuously expressed. The "I have a better idea" trend may be a result of the "there is no way *my* students can do this" line that also keeps coming through. [Emphasis in original].

When asked to describe their plans for the next stage of GPS professional development, the instructors plan to stay involved. They will participate in the upcoming Math II training, and Maddie will continue her monthly meetings with the High School Professional Learning Community. George is going to be a "transition coordinator" at his school, collaborating with the middle school to work on content and instructional issues as students enter ninth grade. Comparing the future plans of the institute instructors to the Stages of Concern model, it appears they plan to actively work toward addressing Stage 5 (Collaboration) concerns.

Summary

This chapter presented quantitative and descriptive analyses of data from the Stages of Concern Questionnaire administered to participants in Math I training in the Northeast Georgia RESA district. Qualitative data were collected from the workshop participants and the institute instructors.

Group and sub-group profiles were presented to illustrate peak stages of concern. The peak stages of concern for the whole group were information for Administration 1 and Administration 2, management for Administration 3, and Awareness for

Administration 4. There was a significant decrease in information concerns from the first to the final administration of the questionnaire.

Statistical analysis was performed using the demographic variables of years of teaching experience, choice of textbook and professional learning experiences. Based on ANOVA data results, there were no significant differences between workshop participants' mean raw scores when the participants were divided into sub-groups based on years of teaching experience. There was a significant difference at the information stage when the groups were categorized by choice of textbook. Participants who chose a traditional textbook had significantly higher information concerns than either of the other two sub-groups (reform textbook and undecided). When the participants whose only experience with GPS was Math I training were compared with the group who had other professional learning experiences related to GPS, those with more experiences had a significantly higher collaboration concern.

Qualitative analyses revealed four themes of concern for workshop participants: information about instructional materials, management and time for planning, readiness and ability of students, and skepticism about the nature of educational change. Institute instructors were aware of the concerns of the workshop participants and hopeful that belief would follow practice in a few years time.

CHAPTER 5

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

> But if you can't force commitment, what can you do? You can do the same things that a teacher can do to foster genuine learning with students. You can nudge a little here, inspire a little there, provide a role model. (Senge et al., 2000, p. 273)

This chapter presents the conclusions of the study through an analysis of the findings. The major areas addressed in the chapter include a summary of procedures and research questions, a discussion of the research findings, thoughts and observations of the researcher as a participant observer, conclusions based upon the research findings, implications and recommendations for practice, and recommendations for further research.

Summary of Procedures and Research Questions

This study investigated the Stages of Concerns of high school mathematics teachers about the implementation of the Georgia Performance Standards (GPS). The theoretical framework for the study was change theory. The sample for the study consisted of a cohort of mathematics teachers involved in Math I training in the Northeast Georgia RESA district and the institute instructors for the training.

The study was conducted in several phases. The researcher began with a review of literature on educational change in general and standards-based mathematics instruction in particular. This phase of the research also involved reviewing literature on professional development and its impact on teacher change.

The literature base for educational change suggests that the ultimate responsibility of implementing educational reform lies with the classroom teacher. Teachers' beliefs

about teaching and learning can be an obstacle to implementation. Change is a process, not an event. It takes time, sometimes years for change to be successful. Teachers' concerns change as they move through implementation of an innovation in a somewhat predictable fashion. Professional development, adoption of instructional materials, and classroom implementation all play significant roles in bringing about teacher change.

The literature base for mathematics education suggests a definite shift in recent years from a behaviorist philosophy to a constructivist philosophy. The *Principals and Standards for School Mathematics* (NCTM, 2000) provide a vision for reform that has influenced curriculum writing across the nation, including the Georgia curriculum revisions known as the Georgia Performance Standards.

The literature base for professional development suggests that important educational change seldom takes place in the absence of professional development. In order for professional development to bring about change, it must be well-designed and thoroughly conceived. It must be long-term, not a one-time event. There are levels of professional development including participants' reactions, participants' learning, organizational support and change, participants' use of new knowledge and skills, and student learning outcomes. Professional learning activities focusing on specific content knowledge result in higher student achievement than do professional learning activities focusing on pedagogical issues. Four principles that should be present for successful professional development to occur are focus on content knowledge, opportunities for active learning, consistency with other learning activities, and sustained follow-up.

The second phase of the study involved choosing a design for the research to measure concerns of mathematics teachers about implementation of GPS. The Concerns-

Based Adoption Model (George et al., 2006; Hall & Hord, 1987, 2006; Hall & Loucks, 1978) emerged as a well-respected, well-tested diagnostic tool for measuring concerns about an innovation, not only in the field of education but in other disciplines as well. The study focused on the Stages of Concern component of the Concerns-Based Adoption Model. Upon further reflection, the researcher decided to add a qualitative component to the study in order to understand the change process more thoroughly from the perspective of both the institute instructors and the workshop participants.

The third phase of the study involved data collection. Workshop participants were asked to complete the Stages of Concern Questionnaire (SoCQ). The SoCQ was administered four times during the 9 months teachers were involved in Math I training in an attempt to provide a "time series set of snapshots" (Hall & Hord, 2006, p. 145) to document how the change process evolved. Institute instructors were interviewed at the beginning, middle and end of the Math I training.

The fourth phase of the study involved the statistical analysis of data gathered from the questionnaires completed by the workshop participants and from the interviews of the institute instructors. The first research question examined the Stages of Concern profiles of the workshop participants to determine group profiles. The second research question analyzed the individual Stages of Concerns profiles to determine changes over time. The third research question looked for relationships among Stages of Concern mean scores and the demographic variables of years of teaching experience, choice of textbook and professional learning experiences. The fourth and final research question compared institute instructors' expectations of participant concerns with the concerns of the workshop participants.

The specific research questions are as follows:

1. What are the longitudinal Stages of Concern profiles of the workshop participants?
2. Are there significant changes in the Stages of Concern profiles as workshop participants experience professional learning activities over time?
3. Are there relationships among workshop participants' demographic data (years of teaching experience, professional development experiences, choice of textbook) and Stages of Concern profiles?
4. How do the institute instructors' expectations of workshop participant concerns and the planned professional learning experiences correspond to the workshop participants' Stages of Concern profiles?

Discussion of Research Findings

According to the Concerns-Based Adoption Model there are seven stages of concern that users, or potential users, of an innovation may have during the adoption process (Hall & Hord, 2006). The seven stages of concern are awareness, information, personal, management, consequence, collaboration, and refocusing. The innovation this study addresses is implementation of the Georgia Performance Standards in high school mathematics.

Research Question One

What are the longitudinal Stages of Concern profiles of the workshop participants?

In general, people move through the stages of concern in a linear fashion, although it is not uncommon for them to cycle back, especially if intense management concerns go unresolved (Hord et al., 1987). The results of this study appear to fit the

basic model. The peak stage of concern for the first two administrations of the SoCQ was information while the peak stage for the third administration was management. The peak stage of concern for the fourth administration was awareness. The workshop participants were all involved in textbook selection between the third and fourth administrations of the questionnaire. The lack of a textbook that correlated satisfactorily to the units presented on the state frameworks website (Cox, 2008a) and the anxiety this produced could account for the concerns of the participants to cycle back to Stage 0 (Awareness). It is not unusual for this to happen. A reformed primary mathematics curriculum was introduced in Cyprus, Greece in 1998. Five years into the implementation, most teachers concerns were still at Stage 0 (Awareness) or Stage 1 (Information) (Charambous et al., 2004).

Research Question Two

Are there significant changes in the Stages of Concern profiles as the workshop participants experience professional learning activities over time?

The significant decrease in information concerns from Administration 1 to Administration 4 is consistent with the research (Crawford et al., 1998; Fenton, 2002), as were the heightened management concerns at Administration 3 after teachers had a chance to implement strategies learned at the 3-day institute in their classrooms (Dass, 2001). Crawford, Chamblee, and Rowlett, who researched implementation of an "Algebra for Everyone" initiative in North Carolina, also found a significant decrease in awareness concerns and a significant increase in refocusing concerns in teachers after a year of in-service training. Fenton, who studied standards-based curriculum implementation in Alaska, found decreases in awareness and information concerns and

increases in personal and management concerns. Dass reported similar findings from his qualitative analysis of implementation of instructional innovations in K-8 science classrooms.

Research Question Three: Are there relationships among workshop participants' demographic data and Stages of Concern profiles?

Lack of correlation between years of teaching experience and stages of concern differs from previous research (Christou et al., 2004). Given the drastic change in the mathematics curriculum in Georgia, it would not be unreasonable to classify experienced teachers as "non-users" of the innovation. With this assumption in mind, the findings of this study are not surprising.

Workshop participants who chose a traditional textbook had a group Stages of Concern profile that more closely resembled that of a typical non-user. The information concerns of this group were significantly higher than those of the other two groups (reform textbook and undecided) at the conclusion of the Math I training. It is consistent with previous research (Middleton, 1999; Remillard, 1999) that teachers unwilling to change will choose the textbook that more closely resembles the old (and familiar) curriculum.

Concerns-Based Adoption Model (CBAM) research (George et al., 2006) indicates that "interventions and conditions associated with the implementation effort are more critical variables than the user's age, sex, teaching experience, and so forth" (p. 52). Northeast Georgia RESA, in an attempt to serve the teachers in its RESA district better, instigated a high school mathematics learning community that meets monthly to discuss issues and concerns of the teachers. Many school systems across the state, including

school systems within the Northeast Georgia RESA district, have also established whole school learning communities for their math teachers. To determine if these efforts affected mean scores for the various stages of concern, the researcher divided the responses into two sub-groups for comparison. One group indicated that their only professional learning experience with GPS was the Math I training. The other group indicated participation in the RESA learning community, a local school learning community, or both. The sub-group that participated in other professional learning experiences scored significantly higher on collaboration concerns (Stage 5) than the group who had participated in Math I training only. These findings are consistent with other research (Crawford et al., 1998).

Research Question Four

How do the institute instructors' expectations of workshop participant concerns and the planned professional learning experiences correspond to the workshop participants' Stages of Concern profiles?

Four areas of concern emerged from analysis of the open-ended question on the SoCQ: information regarding textbooks and other materials, time management and unit planning, readiness and ability of students, and skepticism about the nature of educational change. Dass (2001) reported similar concerns regarding time management and readiness of students. Dass also reported concerns related to classroom management of student behavior, a concern not explicitly expressed by teachers in this study. Interviews with the institute instructors revealed that they had a fairly good picture of how the teachers participating in the training were feeling and what their concerns were. They anticipated

there would be concerns about how to support the lower-level students and concerns about finding the "perfect" textbook.

The institute instructors seemed cognizant of the characteristics of educational change. Maddie, in particular, cited research to back up her statements that change is a slow, evolutionary process and that change in belief often follows change in instructional practice (Cooney & Shealy, 1997; Guskey, 2000). Although resistance to GPS was expected, the institute instructors were somewhat surprised by the open resistance to change expressed by some teachers. The overall feeling from the institute instructors was that teachers had made progress during the nine months of professional learning. The teachers were beginning to accept the changes and were getting excited about their part in the process. Teachers continued to have management concerns that were not met by the training. Institute instructors stated that time and continued collaboration in the district would help teachers through this transitional period.

Thoughts and Observations of the Researcher as Participant Observer

As a high school mathematics teacher and a participant of the Math I Training Institute, I am experiencing the change process firsthand. I listened to my colleagues who thought it was about time Georgia did something about the mathematics curriculum, and I listened to those who loudly proclaimed their dissatisfaction with the entire process.

From a personal standpoint, I am excited about being a "change agent" for my school and am looking forward to implementing the new curriculum with my students. Student-centered classrooms and teaching strategies that model a constructivist learning paradigm are not new to me or my classroom; therefore those particular aspects of the

change do not worry me. Neither am I concerned about the content knowledge necessary to teach the standards.

On the other hand, I am extremely worried about the time needed for lesson planning and professional collaboration (Stage 3 and Stage 5). The textbook adoption process was extremely stressful for me. At my school we focused on textbooks developed by the National Science Foundation. As we tried to correlate the textbooks to the GPS, we realized that the Georgia Performance Standards seemed to be approximately a year ahead of the available math curricula. That is, the first book of every textbook series correlated with Georgia's eighth grade standards. There was indeed no perfect textbook. We would have to use bits and pieces of two different books for every year. Not only would this add to the expense of textbook adoption, but it would add hours to our preparation time. I began to worry that perhaps Georgia policymakers were a little too ambitious in their attempt to "lead the nation in student achievement" (Cox, 2007d). I wondered if we were perhaps asking students to do mathematics for which they were not developmentally ready. I began to question my support of this reform effort. I began to understand why other teachers in my system chose retirement over implementation.

At this point, I considered the feelings of the teachers in Georgia who are adamantly opposed to the GPS. If I (someone who supports the change) was this stressed, then their frustration levels must be "off the charts." As a result of my reflection, I was not surprised when teacher concerns cycled back to those of a non-user after Day 5 training. Training was over and teachers still did not know what to do. Institute instructors stated that teachers had made progress in accepting the changes. I believe this statement to be correct, but I would add that there remains a long way to go.

From my perspective as a workshop participant, the training met some of my needs but was lacking in others. The videos contrasting student-centered instruction versus teacher-centered instruction were informative and helpful. The act of working tasks and presenting and discussing the solutions served as a very good model of good teaching practice. The missing piece from both of these workshop activities was how to balance the problem solving with the concept development and the practice of skills. I also thought the Math I frameworks, including the teacher's edition, should have been ready for the Math I training. Having a copy of this document for reference would have been both helpful and reassuring to the workshop participants. Because the frameworks were incomplete, the state department appeared to be trying to get teachers ready for a change that they were not ready for themselves. I saw evidence of this concern when one participant wrote on her questionnaire, "Will the frameworks even be ready by the time we need them?"

As I stand on the threshold of Math I implementation, I do not feel totally prepared. Nevertheless, I am eager to begin. I am content that we made the best textbook selection under the circumstances. I feel confident that my administration and my RESA will continue to support us as needed. I remain concerned about the amount of time that will be required for instructional planning and assessment (Stage 3). I remain concerned that students may not be developmentally ready for the math content they are expected to learn (Stage 4). Regardless of my apprehensiveness, I am enthusiastic about the possibility of making higher mathematics accessible to all students and welcome the challenge of trying to make it happen.

Conclusions

The following conclusions were drawn upon the findings and summary in Chapter 4 as well as the review of related literature presented in Chapter 3.

Prior to beginning Math I training, participants exhibited every Stage of Concern except for refocusing. Information was the stage most often exhibited by the teachers. By the third administration of the SoCQ many teachers had moved to the management stage, although many still exhibited awareness and information concerns. After the fourth administration of the SoCQ, the greatest number was once again at the awareness stage with management being the second highest stage of concern. This can be attributed to the participants having intense management concerns that were not met by the Math I training.

With the group of teachers available for individual comparison, information concerns significantly decreased from the first to the fourth administration. None of the other changes in stages of concern were significant.

Math I training participants expressed no significant differences in stages of concern when years of teaching experience was examined. When the group was subdivided according to textbook choice, the group who chose a traditional textbook had significantly higher information concerns at the conclusion of training. Participants who participated in other professional learning opportunities related to Math I had significantly higher collaboration concerns than did participants who attended Math I training only.

High school mathematics teachers are primarily concerned with finding the information and time they need for unit and daily lesson plans and making the curriculum

accessible for all students. Institute instructors are aware of teacher concerns but believe that time is the answer to the concerns. Just as the instructors have embraced a constructivist philosophy for teaching mathematics, they believe the teachers must construct their own meaning for how to best implement this curriculum in their own classrooms.

Implications and Recommendations for Practice

In this study, the Stages of Concern of high school mathematics teachers in the Northeast Georgia RESA district were investigated. While the research was limited to the Northeast Georgia RESA district, the findings and related literature support the following implications and recommendations for practice not only for teachers everywhere in Georgia, but for all teachers implementing a standards-based curriculum.

The best prediction for success related to student achievement when using a standards-based curriculum is whether or not teachers had participated in the staff development (Guskey, 2000; Philipp, 2007; Schoen et al., 2003). Furthermore, state mandated curriculum changes are more sustainable than reform efforts at the school level (Cobb et al., 2003; Datnow, 2005). Georgia has the right idea in offering intensive professional learning experiences to train teachers to implement Georgia Performance Standards. Data from this study indicates, however, that teachers continue to have intense management concerns that have not been met by the training institutes. Hall and Hord (2006) offer the following observation:

> When teachers are in the first year of implementing an innovation such as standards-based education, and they have many task concerns, the most valued and effective facilitator is a teacher or consultant who is highly experienced with

> the details and mechanics of using the innovation and can offer specific "how-to" tips. Teachers with intense task concerns don't want to hear about the philosophy; they want help making the innovation work more smoothly. The more abstract and subtle aspects of innovation use are of greater interest to teachers with impact concerns. (p. 138)

For professional development to be relevant, it must be aligned with the peak stage of concern (Donovan et al., 2007). Implications from the research are that successful implementation depends on a collaborative support system at the school level. Crawford et al. (1998) suggest that "staff developers need to place less emphasis upon Phase I in-service, with more emphasis upon effective support methods for implementation such as peer coaching or use of action research" (p. 324). The institute instructors in this study expressed a similar desire for workshop participants to be advocates for change in their schools. This study found that teachers who were active in more than one professional learning activity had high collaboration concerns. The implication is that these teachers are very interested in what their colleagues are doing to implement GPS. Teachers who had high collaboration concerns should be encouraged to take leadership roles in their schools in regard to GPS implementation.

Teachers use instructional methods similar to the ones used with them (Cooney et al., 1998; Lubinski & Otto, 2004). Most veteran math teachers were taught using traditional, behaviorist techniques. It is important that professional learning experiences model a standards-based approach if effective change in instructional practice is going to take place (Darling-Hammond & McLaughlin, 1995). The most frequent concerns expressed on the open-ended question on the Stages of Concerns Questionnaire were

"What does a unit look like from start to finish?" and "What is a typical day in a GPS classroom?" Follow-up training should address how to fit new instructional and assessment techniques in with existing teaching practices to create a balance of concepts, skills, and problem solving.

Four principles essential for effective professional learning activities include focus on content knowledge, opportunities for active learning, consistency with other learning activities, and sustained follow-up (Garet et al., 2001). With the change to an integrated approach in high school mathematics, many teachers who were once considered experts in algebra, geometry, or trigonometry may need math content instruction. Collaboration among teachers will be crucial. Local school systems should identify where help is needed and provide professional learning experiences and support for their teachers.

The following specific recommendations for practice and professional learning are suggested:

1. Teachers with high impact concerns (consequence, collaboration or refocusing) should be used as mentors/peer coaches for teachers with high task concerns (management).
2. Further GPS workshops should offer participants a choice of sessions based on their individual concerns. Some possibilities for sessions include unit writing, cooperative learning, differentiated instruction, and assessment. Other sessions could focus on specific content knowledge such as statistics or geometry.

3. More sample teaching videos are needed that show the entire spectrum of a GPS classroom from the opening remarks to the closing summary. In addition to showing teachers facilitating learning tasks, workshop participants need to see teachers using student work and teacher commentary. They also need to see examples of occasions where direct instruction is used appropriately.

Recommendations for Further Research

This study only researched a small sample of the high school math teachers in Georgia as they begin the journey of implementing the Georgia Performance Standards. The results showed teachers still very much in the non-user phase of implementation. The introduction of a curriculum as different as the Georgia curriculum raises many interesting research questions. Based upon the findings and conclusions of this research, the following recommendations for further study are made.

1. A case study involving several of the teachers who participated in this study could provide a more in-depth qualitative picture of what it means to implement major curriculum change in mathematics as well as provide a longitudinal follow-up to the current study.
2. The population of this study included only teachers in the Northeast Georgia RESA district. The study could be replicated in other areas of the state. Do teachers in southern Georgia have the same concerns as teachers in northeast Georgia, for example?
3. This study only examined one dimension of the Concerns-Based Adoption Model. The Levels of Use dimension would be a logical next step for study

two to three years into implementation of GPS. This study could utilize data collected from classroom observations and teacher interviews.

4. A quantitative study utilizing the same instrument (Stages of Concern Questionnaire) about implementation of GPS further into implementation would provide a different picture of teacher concerns. Currently all teachers are non-users of the innovation. In a few years, there should be a good mix of users and non-users. Since GPS is being implemented in phases, teachers who traditionally teach seniors will not implement GPS until 2011.

Summary

This chapter presented the conclusions of the study through an analysis of the research findings. The researcher summarized the procedures and discussed the findings in terms of each research question. She presented a first-person account of her experiences as a participant observer in the Math I training institute. The researcher made recommendations for practice as well as for further research.

The Concerns Based Adoption Model provides a framework for studying how teachers react to change. If reform is going to be successful, the concerns of the teachers must be considered. Professional learning experiences must be available to support teachers through implementation and should be tailored to the specific needs of the participating teachers as they progress through the Stages of Concern. This study is significant because it allowed the voices of mathematics teachers in Northeast Georgia to be heard. Information in this study supplies evaluative information for policymakers in Georgia as they plan for further professional development regarding implementation of the Georgia Performance Standards in high school mathematics.

REFERENCES

Amit, M., & Fried, M. N. (2002). Research, reform, and times of change. In L. D. English (Ed.), *Handbook of international research in mathematics education* (pp. 355-382). Mahway, NJ: Lawrence Erlbaum.

Anderson, S. E. (1997). Understanding teacher change: Re-visiting the concerns based adoption model. *Curriculum Inquiry, 27*(3), 331-367.

Andrews, P., & Hatch, G. (1999). A new look at secondary teachers' conceptions of mathematics and its teaching. *British Educational Research Journal, 25*(2), 203-223.

Bush, G. W. (n.d.). *No child left behind*. Retrieved December 22, 2006, from http://www.whitehouse.gov/news/reports/no-child-left-behind.html

Chamblee, G. E., & Slough, S. W. (2002). Implementing technology in secondary science and mathematics classrooms: Is the implementation process the same for both disciplines? *Journal of Computers in Mathematics and Science Teaching, 21*(1), 3-15.

Charambous, C., Philippou, G., & Kyriakides, L. (2004). Towards a unified model on teachers' concerns and efficacy beliefs related to a mathematics reform, *28th Conference of the International Group for the Psychology of Mathematics Education*.

Christou, C., Eliophotou-Menon, M., & Philippou, G. (2004). Teachers' concerns regarding the adoption of a new mathematics curriculum: An application of CBAM. *Educational Studies in Mathematics, 57*, 157-176.

Cobb, P., McClain, K., de Silva Lamberg, T., & Dean, C. (2003). Situating teachers' instructional practices in the institutional setting of the school and district. *Educational Researcher, 32*(6), 13-24.

Conway, P. F., & Clark, C. M. (2003). The journey inward and outward: a re-examination of Fuller's concerns-based model of teacher development. *Teaching and Teacher Education, 19*, 465-482.

Cooney, T. J., & Shealy, B. E. (1997). On understanding the structure of teachers' beliefs and their relationship to change. In E. Fennema & B. S. Nelson (Eds.), *Mathematics teachers in transition* (pp. 87-110). Mahwah, NJ: Lawrence Erlbaum.

Cooney, T. J., Shealy, B. E., & Arvold, B. (1998). Conceptualizing belief structures of preservice secondary mathematics teachers. *Journal for Research in Mathematics Education, 29*(3), 306-333.

Cox, K. (2007a). Georgia performance standards high school mathematics research and resource manual: Georgia Department of Education.

Cox, K. (2007b). *School keys: Unlocking excellence through the Georgia school standards*. Atlanta: Georgia Department of Education.

Cox, K. (2007c). Training for Georgia performance standards: Days 1, 2, and 3: The big picture of the new curriculum, instructional strategies, and planning for change: Georgia Department of Education.

Cox, K. (2007d). *Vision, mission and values*. Retrieved April 4, 2007, from http://public.doe.k12.ga.us/sup.aspx?PageReq=SUPValues

Cox, K. (2008a). *Georgia performance standards - mathematics*. Retrieved January 28, 2008, from www.georgiamath.org

Cox, K. (2008b). *Georgia virtual school*. Retrieved February 12, 2008, from http://www.gavirtualschool.org/

Crawford, A. R., Chamblee, G. E., & Rowlett, R. J. (1998). Assessing concerns of algebra teachers during a curriculum reform: a constructivist approach. *Journal of In-service Education, 24*(2), 317-327.

Creswell, J. W. (2002). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River, NJ: Merrill Prentice Hall.

Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. Thousand Oaks, CA: Sage.

Darling-Hammond, L., & McLaughlin, M. W. (1995). Policies that support professional development in an era of reform. *Phi Delta Kappan, 76*(8), 597-604.

Dass, P. M. (2001). Implementation of instructional innovations in K-8 science classes: Perspectives of inservice teachers. *International Journal of Science Education, 23*(9), 969-984.

Datnow, A. (2005). The sustainability of comprehensive school reform models in changing district and state contexts. *Educational Administration Quarterly, 41*(1), 121-153.

Davis, R. B., Maher, C. A., & Noddings, N. (Eds.). (1990). *Constructivist views on the teaching and learning of mathematics*. Reston, VA: National Council of Teachers of Mathematics.

Donnelly, M. B., Dove, T., Tiffany-Morales, J., Adelman, N., & Zucker, A. (2002). *Technology-related professional development in the context of educational reform: A literature review*. Arlington, VA: SRI International.

Donovan, L., Hartley, K., & Strudler, N. (2007). Teacher concerns during initial implementation of a one-to-one laptop initiative at the middle school level. *Journal of Research on Technology in Education, 39*(3), 263-286.

Ellis, M. W., & Berry, R. Q. (2005). The paradigm shift in mathematics education: Explanations and implications of reforming conceptions of teaching and learning. *The Mathematics Educator, 15*(1), 7-17.

Ellsworth, J. B. (2000). *Surviving change: A survey of educational change models*. Syracuse, NY: Clearinghouse on Information and Technology. (ERIC Document Reproduction Service No. ED 443 417).

Fenton, R. (2002). Status of standards implementation in Anchorage secondary schools: A concerns based acceptance model (CBAM) review, 2001-2002.

Finn, C. E., Petrilli, M. J., & Julian, L. (2006). *The state of state standards 2006*. Retrieved May 10, 2007, from http://www.edexcellence.net/doc/Georgia.pdf

Frykholm, J. A. (2005). Innovative curricula: Catalysts for reform in mathematics teacher education. *Action in Teacher Education, 26*(4), 20-36.

Fullan, M. (1982). *The meaning of educational change*. New York: Teachers College.

Fullan, M. (1993). *Change forces: Probing the depths of educational reform*. Bristol, PA: Falmer.

Fullan, M. (1999). *Change forces: The sequel*. Philadelphia, PA: Falmer.

Fullan, M. (2001). *The new meaning of educational change* (3rd ed.). New York: Teachers College.

Fullan, M. (2003). *Change forces with a vengeance*. New York: Routledge Falmer.

Fuller, F. F. (1969). Concerns of teachers: A developmental conceptualization. *American Educational Research Journal, 6*(2), 207-226.

Futch, L. D., & Stephens, J. C. (1997). The beliefs of Georgia teachers and principals regarding the NCTM Standards: A representative view using the Standards' Belief Instrument (SBI). *School Science and Mathematics, 97*(5), 242-247.

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research: An introduction* (8th ed.). Boston: Pearson.

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*(4), 915-945.

George, A. A., Hall, G. E., & Stiegelbauer, S. M. (2006). *Measuring implementation in schools: The stages of concern questionnaire* (2nd ed.). Austin, TX: Southwest Educational Development Laboratory.

Georgia Performance Standards. (2005). Retrieved June 19, 2006, from http://www.georgiastandards.org/

Giancola, S. P. (2001). Technology programs...for all or for some? *Journal of Science Education and Technology, 10*(4), 369-384.

Goldsmith, L., & Shifter, D. (1997). Understanding teachers in transition: Characteristics of a model for developing teachers. In E. Fennema & B. S. Nelson (Eds.), *Mathematics teachers in transition* (pp. 19-54). Mahwah, NJ: Lawrence Erlbaum.

Greenwood, J. (1984). My anxieties about math anxiety. *Mathematics Teacher, 77*, 662-663.

Guskey, T. (2000). *Evaluating professional development*. Thousand Oaks, CA: Corwin.

Hall, G. E., & Hord, S. M. (1987). *Change in schools: Facilitating the process*. Albany: State University of New York.

Hall, G. E., & Hord, S. M. (2006). *Implementing change: Patterns, principles, and potholes* (2nd ed.). Boston: Pearson.

Hall, G. E., & Loucks, S. (1978). Teacher concerns as a basis for facilitating and personalizing staff development. *Teachers College Record, 80*(1), 36-53.

Hart, L. C. (2002). Preservice teachers' beliefs and practice after participating in an integrated content/methods course. *School Science and Mathematics, 102*(1), 4-14.

Hart, L. C. (2004). Beliefs and perspectives of first-year, alternative preparation, elementary teachers in urban classrooms. *School Science and Mathematics, 104*(2), 79-88.

Harwell, M. R., Post, T. R., Maeda, Y., Davis, J. D., Cutler, A. L., Andersen, E., et al. (2007). Standards-based mathematics curricula and secondary students' performance on standardized achievement tests. *Journal for Research in Mathematics Education, 38*(1), 71-101.

Henry, J. J., & Clements, D. H. (1999). Challenges for teachers attempting to integrate a mathematics innovation. *Journal of Research on Computing in Education, 31*(3), 240-259.

Hord, S. M., Rutherford, W. L., Huling-Austin, L., & Hall, G. E. (1987). *Taking charge of change*. Alexandria, VA: Association for Supervision and Curriculum Development.

House, P. (2003). Integrated Mathematics: An introduction. In S. A. McGraw (Ed.), *Integrated mathematics: Choices and challenges* (pp. 3-12). Reston, VA: National Council of Teachers of Mathematics.

Hunter, A., & Brewer, J. (2003). Multimethod research in sociology. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 577-594). Thousand Oaks, CA: Sage.

Jacobson, L. (2002). Tough audit prompts Ga. chief to seek curriculum rewrite. *Education Week, 21*(28), 20.

Jacobson, L. (2004). Audit gives high marks to Georgia performance standards. *Education Week, 23*(41), 27.

Kilpatrick, J. (1992). A history of research in mathematics education. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 3-38). Reston, VA: National Council of Teachers of Mathematics.

Klein, D., Braams, B. J., & Parker, T. (2005). *The state of state math standards*. Washington, D.C.: Thomas B. Fordham Foundation and Institute.

Kramarski, B., Mevarech, Z. R., & Arami, M. (2002). The effects of metacognitive instruction on solving mathematical authentic tasks. *Educational Studies in Mathematics, 49*, 225-250.

Little, J. W. (2001). Professional development in pursuit of school reform. In A. Lieberman & L. Miller (Eds.), *Teachers caught in the action: Professional development that matters* (pp. 23-44). New York: Teachers College Press.

Lodico, M. G., Spaulding, D. T., & Voegtle, K. H. (2006). *Methods in educational research: From theory to practice*. San Francisco: Jossey-Bass.

Loucks, S., & Pratt, H. (1979). The buck stops here: A concerns-based approach to curriculum change. *Educational Leadership, 37*(3), 212-215.

Lubinski, C. A., & Otto, A. D. (2004). Preparing K-8 preservice teachers in a content course for standards-based mathematics pedagogy. *School Science and Mathematics, 104*(7), 336-350.

Machiavelli, N. (1532). *The prince*. Retrieved April 25, 2007, from http://www.constitution.org/mac/prince06.htm

Macnab, D. S., & Payne, F. (2003). Beliefs, attitudes and practices in mathematics teaching: perceptions of Scottish primary school student teachers. *Journal of Education for Teaching, 29*(1).

Marshall, C., & Rossman, G. B. (1999). *Designing qualitative research* (3rd ed.). Thousand Oaks, CA: Sage.

Mathematics curriculum revision: Executive summary. (2006). Retrieved April 3, 2007, from http://public.doe.k12.ga.us/DMGetDocument.aspx/gps_summary_math.pdf?p=4BE1EECF99CD364EA5554055463F1FBBF5D074D5FB1F2CAEB3B63B3ECB220CDD26C2114F3C57D8D2925C2E80687C2A69&Type=D

Mathematics frameworks. (2006). Retrieved April 3, 2007, from http://public.doe.k12.ga.us/DMGetDocument.aspx/6th,7th,8th%20Grade%20Framework%20Overview%20Sept%202006.pdf?p=6CC6799F8C1371F6409D36EF9A38E54D3DF151824BB9FE472D4045846DB2BAD8&Type=D

McCaffrey, D. F., Hamilton, L. S., Stecher, B. M., Klein, S. P., Bugliari, D., & Robyn, A. (2001). Interactions among instructional practices, curriculum, and student achievement: The case of standards-based high school mathematics. *Journal for Research in Mathematics Education, 32*(5), 493-517.

McGinnis, J. R., Kramer, S., Roth-McDuffie, A., & Watanabe, T. (1998, April). *Charting the attitude and belief: Journeys of teacher candidates in a reform-based mathematics and science teacher preparation program.* Paper presented at the Annual meeting of the American Educational Research Association, San Diego, CA.

McLeod, D. (1992). Research on affect in mathematics education: A reconceptualization. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning: A project of the National Council of Teachers of Mathematics* (pp. 575-596). Reston, VA: National Council of Teachers of Mathematics.

Middleton, J. A. (1999). Curricular influences on the motivational beliefs and practice of two middle school mathematics teachers: A follow-up study. *Journal for Research in Mathematics Education, 30*(3), 349-358.

Middleton, J. A., & Spanias, P. A. (1999). Motivation for achievement in mathematics: Findings, generalizations, and criticisms of the research. *Journal for Research in Mathematics Education, 30*(1), 65-88.

Morgan, D. L. (2002). Focus group interviewing. In J. F. Gubrium & J. A. Holstein (Eds.), *Handbook of interview research: Context and method* (pp. 141-160). Thousand Oaks, CA: Sage.

Nardi, P. M. (2003). *Doing survey research: A guide to quantitative methods*. Boston: Pearson Education.

NCTM. (1980). *An agenda for action: Recommendations for school mathematics of the 1980s*. Reston, VA: Author.

NCTM. (1989). *Curriculum and evaluation standards for school mathematics*. Reston, Va: Author.

NCTM. (1991). *Professional standards for teaching mathematics*. Reston, VA: Author.

NCTM. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

Oakes, J. (2005). *Keeping track: How schools structure inequality* (2nd ed.). New Haven, CT: Yale University Press.

Peers, I. S. (1990). Utility of concerns-based staff development in facilitating education and training about HIV/AIDS in schools and colleges. *British Educational Research Journal, 16*(2), 179-189.

Pflaum, W. D. (2004). *The technology fix: The promise and reality of computers in our schools*. Alexandria, VA: Association for Supervision and Curriculum Development.

Philipp, R. (2007). Mathematics teachers' beliefs and affect. In F. K. Lester (Ed.), *Second handbook of research on mathematics teaching and learning: A project of the National Council of Teachers of Mathematics* (Vol. 1, pp. 257-315). Charlotte, NC: Information Age Publishing.

Raymond, A. M. (1997). Inconsistency between a beginning elementary school teacher's mathematics beliefs and teaching practice. *Journal for Research in Mathematics Education, 28*(5), 550-576.

Remillard, J. T. (1999). Curriculum materials in mathematics education reform: A framework for examining teachers' curriculum development. *Curriculum Inquiry, 29*(3), 315-342.

Reys, R., Reys, B., Lapan, R., & Holliday, G. (2003). Assessing the impact of standards-based middle grades mathematics curriculum materials on student achievement. *Journal for Research in Mathematics Education, 34*(1), 74-95.

Riordan, J. E., & Noyce, P. E. (2001). The impact of two standards-based mathematics curricula on student achievement in Massachusetts. *Journal for Research in Mathematics Education, 32*(4), 368-398.

Roehrig, G. H., & Kruse, R. A. (2005). The role of teachers' beliefs and knowledge in the adoption of reform-based curriculum. *School Science and Mathematics, 105*(8), 412-422.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.

Ross, J. A., McDougall, D., & Hogaboam-Gray, A. (2003). A survey measuring elementary teachers' implementation of standards-based mathematics teaching. *Journal for Research in Mathematics Education, 34*(4), 344-363.

Sandholtz, J. H., Ringstaff, C., & Dwyer, D. C. (1997). *Teaching with technology: Creating student centered classrooms*. New York: Teachers College Press.

Sarason, S. B. (1990). *The predictable failure of educational reform: Can we change course before it's too late?* San Francisco: Jossey-Bass.

Sarason, S. B. (1995). *School change: The personal development of a point of view*. New York: Teachers College Press.

Schoen, H. L., Cebulla, K. J., Finn, K. F., & Fi, C. (2003). Teacher variables that relate to student achievement when using a standards-based curriculum. *Journal for Research in Mathematics Education, 34*(3), 228-259.

Seaman, C. E., Szydlik, J. E., Szydlik, S. D., & Beam, J. E. (2005). A comparison of preservice elementary teachers' beliefs about mathematics and teaching mathematics: 1968 and 1998. *School Science and Mathematics, 105*(4), 197-210.

Senge, P., Cambron-McCabe, N., Lucas, T., Smith, B., Dutton, J., & Kleiner, A. (2000). *Schools that learn: A fifth discipline fieldbook for educators, parents, and everyone who cares about education*. New York: Doubleday.

Sprinthall, R. C. (2003). *Basic Statistical Analysis* (7th ed.). Boston: Allyn and Bacon.

Stein, M. K., Smith, M. S., & Silver, E. A. (1999). The development of professional developers: Learning to assist teachers in new settings in new ways. *Harvard Educational Review, 69*(3), 237-269.

Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches*. Thousand Oaks, CA: Sage.

Taylor, P. M., & Tarr, J. E. (2003). Meeting state standards with integrated problem-solving curricula. In S. A. McGraw (Ed.), *Integrated mathematics: Choices and challenges* (pp. 229-238). Reston, VA: National Council of Teachers of Mathematics.

Thompson, A. G. (1992). Teachers' beliefs and conceptions: A synthesis of the research. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and*

learning (pp. 127-146). Reston, VA: National Council of Teachers of Mathematics.

Thompson, D. R., & Senk, S. L. (2001). The effects of curriculum on achievement in second-year algebra: The example of the University of Chicago School Mathematics Project. *Journal for Research in Mathematics Education, 32*(1), 58-84.

Thorndike, E. L. (1919). *An introduction to the theory of mental and social measurements* (2nd ed.). New York: Teachers College Press.

Usiskin, Z. (2003). The integration of the school mathematics curriculum in the United States: History and meaning. In S. A. McGraw (Ed.), *Integrated mathematics: Choices and challenges* (pp. 13-32). Reston, VA: National Council of Teachers of Mathematics.

APPENDICES

APPENDIX A

STAGES OF CONCERN QUESTIONNAIRE 075

TEACHERS' CONCERNS ABOUT GEORGIA PERFORMANCE STANDARDS

Please carefully read all instructions for each part of this questionnaire. Respond to ALL items. There is no right or wrong answer. Rely on your present views and concerns.

The purpose of this questionnaire is to determine what people who are using or thinking about using various programs are concerned about at various times during the innovation adopting process. **A good part of the items on this questionnaire may appear to be of little relevance or irrelevant to you at this time**. For the completely irrelevant items, please circle "0" on the scale. Other items will represent those concerns you **do** have, in varying degrees of intensity, and should be marked higher on the scale.

For example:

This statement is very true of me at this time.	0	1	2	3	4	5	6	7
This statement is somewhat true of me now.	0	1	2	3	4	5	6	7
This statement is not at all true of me at this time.	0	1	2	3	4	5	6	7
This statement seems irrelevant to me.	0	1	2	3	4	5	6	7

Please respond to the items in terms of **<u>your present concerns</u>**, or how you feel about your involvement or potential involvement with *Implementing the Georgia Performance Standards in High School Mathematics*. We do not hold to any one definition of this innovation, so please think of it in terms of **<u>your own perception</u>** of what it involves. Since this questionnaire is used for a variety of innovations, the name *Implementing the Georgia Performance Standards in High School Mathematics* never appears. However, phrases such as "the innovation", "this approach", and "the new system" all refer to *Implementing the Georgia Performance Standards in High School Mathematics.* Remember to respond to each item in terms of **<u>your present concerns</u>** about your involvement or potential involvement with *Implementing the Georgia Performance Standards in High School Mathematics*.

0	1	2	3	4	5	6	7
Irrelevant	Not true of me now		Somewhat true of me now			Very much true of me now	

1. I am concerned about students' attitudes toward this innovation.	0	1	2	3	4	5	6	7
2. I now know of some other approaches that might work better.	0	1	2	3	4	5	6	7
3. I am more concerned about another innovation.	0	1	2	3	4	5	6	7

4. I am concerned about not having enough time to organize myself each day.	0	1	2	3	4	5	6	7
5. I would like to help other faculty in their use of the innovation.	0	1	2	3	4	5	6	7
6. I have a very limited knowledge of the innovation.	0	1	2	3	4	5	6	7
7. I would like to know the effect of reorganization on my professional status.	0	1	2	3	4	5	6	7
8. I am concerned about conflict between my interests and my responsibilities.	0	1	2	3	4	5	6	7
9. I am concerned about revising my use of the innovation.	0	1	2	3	4	5	6	7
10. I would like to develop working relationships with both our faculty and outside faculty using this innovation.	0	1	2	3	4	5	6	7
11. I am concerned about how the innovation affects students.	0	1	2	3	4	5	6	7
12. I am not concerned about this innovation.	0	1	2	3	4	5	6	7
13. I would like to know who will make the decisions. in the new system.	0	1	2	3	4	5	6	7
14. I would like to discuss the possibility of using the innovation.	0	1	2	3	4	5	6	7
15. I would like to know what resources are available if we decide to adopt this innovation.	0	1	2	3	4	5	6	7
16. I am concerned about my inability to manage all that the innovation requires.	0	1	2	3	4	5	6	7
17. I would like to know how my teaching or administration is supposed to change.	0	1	2	3	4	5	6	7
18. I would like to familiarize other departments or persons with the progress of this new approach.	0	1	2	3	4	5	6	7
19. I am concerned about evaluating my impact on students in relation to the innovation.	0	1	2	3	4	5	6	7

20. I would like to revise the innovation's instructional approach.	0	1	2	3	4	5	6	7
21. I am preoccupied with things other than the innovation.	0	1	2	3	4	5	6	7
22. I would like to modify our use of the innovation based upon the experiences of our students.	0	1	2	3	4	5	6	7
23. I spend little time thinking about the innovation.	0	1	2	3	4	5	6	7
24. I would like to excite my students about their part in this approach.	0	1	2	3	4	5	6	7
25. I am concerned about time spent working with nonacademic problems related to the innovation.	0	1	2	3	4	5	6	7
26. I would like to know what the use of the innovation will require in the immediate future.	0	1	2	3	4	5	6	7
27. I would like to coordinate my efforts with others to maximize the innovation's effects.	0	1	2	3	4	5	6	7
28. I would like to have more information on time and energy commitments required by this innovation.	0	1	2	3	4	5	6	7
29. I would like to know what other faculty are doing in this area.	0	1	2	3	4	5	6	7
30. Currently, other priorities prevent me from focusing my attention on the innovation.	0	1	2	3	4	5	6	7
31. I would like to determine how to supplement, enhance, or replace the innovation.	0	1	2	3	4	5	6	7
32. I would like to use feedback from students to change the program.	0	1	2	3	4	5	6	7
33. I would like to know how my role will change when I am using the innovation.	0	1	2	3	4	5	6	7
34. Coordination of tasks and people is taking too much of my time.	0	1	2	3	4	5	6	7
35. I would like to know how this innovation is better than what we have now.	0	1	2	3	4	5	6	7

PLEASE COMPLETE THE FOLLOWING:

36. What other concerns, if any, do you have at this time?

Note. From *Measuring Implementation in Schools: The Stages of Concern Questionnaire* by A. A. George, G. E. Hall, and S. M. Stiegelbauer, 2006, pp. 79-82.

APPENDIX B

DEMOGRAPHIC SURVEY

Please answer the following demographic questions:

1. How long have you been teaching mathematics (including this year)?
   - □1-5 years
   - □11-15 years
   - □ 21-25 years
   - □More than 30 years
   - □ 6-10 years
   - □16-20 years
   - □ 26-30 years

2. What is your gender?
   - □ male
   - □ female

3. For the purposes of this GPS training, what is your area of expertise?
   - □ Algebra
   - □Geometry
   - □ Statistics
   - □ Special Education

4. What is your ethnicity?
   - □ African-American
   - □ Native American
   - □ Asian/Pacific Islander
   - □ White
   - □ Latino
   - □ Other _____

5. What is your age?
   - □ 21-25
   - □ 31-35
   - □ 41-45
   - □51-55
   - □ 26-30
   - □ 36-40
   - □ 46-50
   - □56 or older

6. Will you be teaching Math I during the first year of implementation (2008-2009)?
   - □ Yes
   - □ No
   - □ Don't Know

7. How many days of GPS Training have you attended (including today)?
   - □ 1
   - □ 2
   - □ 3
   - □ 4
   - □ 5

8. Other than GPS Training, what involvement have you had with the high school GPS?

9. What textbook will your school be adopting for Math I?
   - □ Carnegie Learning
   - □ McDougall-Littell
   - □ Core-Plus
   - □ SIMMS
   - □ Math Connections
   - □ Other _____

10. Which textbook was your first choice for adoption?
   - □ Carnegie Learning
   - □ McDougall-Littell
   - □ Core-Plus
   - □ SIMMS
   - □ Math Connections
   - □ Other _____

APPENDIX C

INSTITUTE INSTRUCTOR INTERVIEW QUESTIONS

Pre-Institute Interview

1. Describe your role in the Georgia Performance Standards professional development.
2. Describe the expected outcome from the 3-day training workshop.
3. Describe the concerns regarding the Math I implementation you believe teachers will bring to this professional development.
4. Describe how you plan to address these expected concerns.
5. What expectations do you have for the teachers attending the workshop? That is, what role do you envision them playing in their schools?

Post-Institute Interview

1. How do you think the 3-day training went?
2. Were there any surprises? How did you address them at the time?
3. (Share the summary results of the first two surveys with the instructors.) Were the results of the Stages of Concerns profiles what you expected?
4. Do the results of the survey confirm your original reflections of how the training went? If not, describe what made you change your mind.
5. Describe your plans and expectations for the follow-up meeting.
6. Do you think you will change anything you had originally planned for the follow-up meeting as a result of the survey findings? If yes, describe the changes and explain why you decided to make them.

7. What concerns do you anticipate teachers having at this stage of GPS professional development? What do you have planned to address the concerns?

Post-Follow-up Interview

1. How do you think the 3-day training went?
2. Were there any surprises? How did you address them at the time?
3. Are the teachers where you expected them to be at this stage of the GPS professional development? Describe where you think they are and where you expected them to be.
4. Describe your plans for the next stage of GPS professional development.

APPENDIX D

STATEMENTS ON THE STAGES OF CONCERN QUESTIONNAIRE ARRANGED ACCORDING TO STAGE

Item	Statement
Stage 0	
3	I am more concerned about another innovation.
12	I am not concerned about this innovation at this time.
21	I am preoccupied with things other than this innovation.
23	I spend little time thinking about this innovation.
30	Currently, other priorities prevent me from focusing my attention on this innovation.
Stage 1	
6	I have a very limited knowledge of the innovation.
14	I would like to discuss the possibility of using the innovation.
15	I would like to know what resources are available if we decide to adopt this innovation.
26	I would like to know what the use of the innovation will require in the immediate future.
35	I would like to know how this innovation is better than what we have now.
Stage 2	
7	I would like to know the effect of the innovation on my professional status.
13	I would like to know who will make the decisions in the new system.
17	I would like to know how my teaching or administration is supposed to change.

28 I would like to have more information on time and energy commitments required by this innovation.

33 I would like to know how my role will change when I am using the innovation.

Stage 3

4 I am concerned about not having enough time to organize myself each day.

8 I am concerned about conflict between my interests and my responsibilities.

16 I am concerned about my inability to manage all the innovation requires.

25 I am concerned about time spent working with nonacademic problems related to this innovation.

34 Coordination of tasks and people is taking too much of my time.

Stage 4

1 I am concerned about students' attitudes toward this innovation.

11 I am concerned about how the innovation affects students.

19 I am concerned about evaluating my impact on students.

24 I would like to excite my students about their part in this approach.

32 I would like to use feedback from students to change the program.

Stage 5

5 I would like to help other faculty in their use of the innovation.

10 I would like to develop working relationships with both our faculty and outside faculty using this innovation.

18 I would like to familiarize other departments or people with the progress of this new approach.

27 I would like to coordinate my effort with others to maximize the innovation's

	effects.
29	I would like to know what other faculty are doing in this area.
Stage 6	
2	I now know of some other approaches that might work better.
9	I am concerned about revising my use of the innovation.
20	I would like to revise the innovation's instructional approach.
22	I would like to modify our use of the innovation based on the experiences of our students.
31	I would like to determine how to supplement, enhance, or replace the innovation.

Note. From *Measuring Implementation in Schools: The Stages of Concern Questionnaire* by A. A. George, G. E. Hall, and S. M. Stiegelbauer, 2006, pp. 27-28, Copyright © 2006 by SEDL. Reprinted with permission.

APPENDIX E

PERMISSION LETTER FROM GEORGIA SOUTHERN UNIVERSITY

INSTITUTIONAL REVIEW BOARD

Georgia Southern University
Office of Research Services & Sponsored Programs

Institutional Review Board (IRB)

Phone: 912-681-5465
Fax: 912-681-0719 Ovrsight@GeorgiaSouthern.edu
Administrative Annex
P.O. Box 8005
Statesboro, GA 30460

To: Kay S. Haugen
131 Ridgewood Lane
Jefferson, GA-30549

CC: Dr. Gregory Chamblee
P.O. Box-8134

From: Office of Research Services and Sponsored Programs
Administrative Support Office for Research Oversight Committees
(IACUC/IBC/IRB)

Date: May 8, 2007

Subject: Status of Application for Approval to Utilize Human Subjects in Research

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After a review of your proposed research project numbered: **H07219**, and titled **"Preparation for High School Mathematics Reform in the Northeast Georgia RESA District: A Stages of Concerns Approach to Examining Professional Learning"**, it appears that (1) the research subjects are at minimal risk, (2) appropriate safeguards are planned, and (3) the research activities involve only procedures which are allowable.

Therefore, as authorized in the Federal Policy for the Protection of Human Subjects, I am pleased to notify you that the Institutional Review Board has approved your proposed research.

This IRB approval is in effect for one year from the date of this letter. If at the end of that time, there have been no changes to the research protocol; you may request an extension of the approval period for an additional year. In the interim, please provide the IRB with any information concerning any significant adverse event, **whether or not it is believed to be related to the study**, within five working days of the event. In addition, if a change or modification of the approved methodology becomes necessary, you must notify the IRB Coordinator **prior** to initiating any such changes or modifications. At that time, an amended application for IRB approval may be submitted. Upon completion of your data collection, you are required to complete a *Research Study Termination* form to notify the IRB Coordinator, so your file may be closed.

Sincerely,

N. Scott Pierce

N. Scott Pierce
Director of Research Services and Sponsored Programs

APPENDIX F

PERMISSION LETTERS FROM SOUTHWESTERN EDUCATIONAL DEVELOPMENT LABORATORIES

Kay Haugen

From: gene.hall@unlv.edu
Sent: Monday, March 19, 2007 4:26 PM
To: Kay Haugen
Subject: Re: CBAM - Stages of Concerns Questionnaire

Thank you for the email. Here are a couple of quick suggestions as you plan your study:

a) Do you have the latest version of the Stages of Concern Questionnaire? It is Form 075. The copy in the Second Edition of *Implementing Change* is out of date!

b) If you do not have the new form or if you do not have the accompanying technical manual you should obtain a copy from the Southwest Educational Development Lab in Austin, TX. The manual is: George, Hall, & Stiegelabuer (2006). *Measuring Implementation in Schools: The Stages of Concern Questionnaire.*

c) If you do not have the Second Edition of Hall and Hord (2006). *Implementing Change: Patterns, Principles and Potholes*. you really should obtain a copy of it, since it is the basic reference to CBAM work.

d) I suggest that you take "CBAM" in your title and instead say "Stages of Concern." Since SoC is the only part of CBAM you are really using.

e) You have my permission to use the SoC Questionnaire in this study. It should be interesting. Please let me know what you find.

f) If you have questions about use of the SoC or interpretation of SoC data please contact me.

Best of success in completing your dissertation study.
"Kay Haugen" <khaugen@alltel.net>

"Kay Haugen" <khaugen@alltel.net>
03/19/2007 03:48 AM

To<gene.hall@unlv.edu>
cc
SubjectCBAM - Stages of Concerns Questionnaire

Dear Dr. Hall,

I am a student at Georgia Southern University, working on my Ed.D. in Curriculum Studies. Dr. Greg Chamblee in the Department of Teaching and Learning is my major professor. My proposed dissertation study - Preparing for Mathematics Reform in Northeast Georgia: A CBAM Approach to Evaluating Professional Development – will focus on the Stages of Concern for high school mathematics teachers who are implementing a new state standards based curriculum (Georgia Performance Standards).

I would like your permission to use the Stages of Concerns Questionnaire to collect the data needed for my study. I would like to administer this survey at various times from May 2007 to May 2008 as the teachers in northeast Georgia go through the state professional development workshops and as they attempt to implement strategies associated with the new curriculum in their classrooms.

I look forward to your reply.

4/10/2007

ADVANCING RESEARCH
SEDL
IMPROVING EDUCATION

SEDL License Agreement

TO: Kay Haugen (Licensee)
131 Ridgewood Lane
Jefferson, GA 30549

FROM: Nancy Reynolds
Information Associate
SEDL
Information Resource Center
4700 Mueller Blvd.
Austin, TX 78723

SUBJECT: License Agreement to reprint and distribute SEDL materials

DATE: April 17, 2008

Thank you for your interest in using the excerpts from the book ***Measuring Implementation in Schools: The Stages of Concern Questionnaire*** written by Archie A. George, Gene E. Hall, and Suzanne M. Stiegelbauer and published by SEDL in 2006. You have asked to use excerpts as follows:

1. **Stages of Concern Questionnaire** (SoCQ) published as Appendix A, pages 79-82 and also available as a PDF document on an accompanying CD-ROM.
2. **Figure 2.1. The Stages of Concern About an Innovation**, page 8
3. **Figure 4.2. Statements on the Stages of Concern Questionnaire Arranged According to Stage**, page 27

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Fax: 512-476-2286
www.sedl.org
4700 MUELLER BLVD., AUSTIN, TX 78723

SEDL License Agreement, p.2

2. No adaptations, deletions, or changes are allowed with the exception in the Stages of Concern Questionnaire to substitute the words "the innovation" with a word or phrase that participants will recognize, such as the name of the innovation or initiative, and questions can be added to identify demographic indicators of participants before or after the instrument, but otherwise, the wording and order of items cannot be changed. No derivative work based on or incorporating the works will be created without the prior written consent of SEDL.

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I'm e-mailing you a PDF of this agreement. Please print and sign one copy below, indicating that you understand and agree to comply with the above terms, conditions and limitations, and send the original back to me. If you wish to keep a copy with original signatures, please also print, sign, and return a second copy and, after I receive and sign it, I'll return it with both of our signatures to you.

Thank you, again, for your interest in using excerpts from SEDL's publication ***Measuring Implementation in Schools: The Stages of Concern Questionnaire.*** If you have any questions, please contact me at 800-476-6861, ext. 6548 or 512-391-6548, or by e-mail at nancy.reynolds@sedl.org.

Sincerely,

Nancy Reynolds — April 21, 2008

Nancy Reynolds for SEDL — Date signed

Agreed and accepted:

Signature: Kay S Haugen — 4-17-2008

Date signed

Printed Name: Kay S Haugen

APPENDIX G

PERMISSION LETTER FROM NORTHEAST GEORGIA REGIONAL EDUCATIONAL SERVICES AGENCY

TO: Kay Haugen

FROM: Russ Cook, Ed.D.
Director, Northeast Georgia Regional Educational Services Agency

SUBJECT: Permission to survey math teachers at GPS training

DATE: March 19, 2007

Thank you for your interest in surveying the high school mathematics teachers attending the training workshops for the Georgia Performance Standards.

We are pleased to grant you permission to survey the workshop attendees for the purpose of determining their stages of concern for your doctoral dissertation for Georgia Southern University We look forward to seeing the results of your study and using these results to make decisions about future professional development regarding implementation of the Georgia Performance Standards.

The following are the terms, conditions, and limitations governing permission to survey workshop participants.

1. You are responsible for obtaining permission to reprint and distribute the Stages of Concerns Questionnaire from Southwest Educational Development Laboratory.
2. The results of this survey shall be solely for educational, non-profit use.
3. RESA personnel will distribute and collect the surveys. You will compile results and analyze data.
4. The results will be used for your doctoral dissertation for Georgia Southern University. You will share the results with RESA for the purpose of making professional development decisions.
5. An exact copy of any reproduction of the work you produce shall be promptly provided to Northeast Georgia Regional Educational Services Agency.
6. Permission to survey will expire on April 30, 2008.

Please sign below indicating that you understand and agree to comply with the above terms, conditions and limitations, and send the original back to us.

Sincerely,

Russell W. Cook

Russ Cook,
Director, Northeast Georgia Regional Educational Services Agency

Agreed and accepted:

Signature: Kay S Haugen Date Signed: 4-10-2007

Kay S Haugen

APPENDIX H

PARTICIPANT INFORMED CONSENT

Dear Northeast Georgia RESA Math I Training Participant:

I am a graduate student at Georgia Southern University conducting dissertation research entitled *Preparation for High School Mathematics Reform in the Northeast Georgia RESA District: A Stages of Concerns Approach to Examining Professional Learning*. The purpose of my study is to determine the concerns of the teachers attending the Northeast Georgia RESA Georgia Performance Standards training and whether or not the concerns change through the training process.

If you give permission, you will have the opportunity to complete two different surveys. One is a demographic survey and will be administered one time at the end of the Math I training institute in February, 2008. The other survey will be a Stages of Concerns Questionnaire that will be administered four different times: at the beginning and end of the summer institute, at the end of Day 4 Training in October of 2007 and at the end of Day 5 Training in February. Completion of each survey will take about 15 minutes of your time. Your participation in this study is completely voluntary. The risks from participating in this study are no more than would be encountered in everyday life; however, you may stop participating at any time without penalty. You may choose to skip any question(s) you do not wish to answer for any reason. Only summary data from the group will be reported in the dissertation and shared with institute instructors and state policymakers.

In order to protect your confidentiality, your name will not appear on any reports or used in any presentation or publications resulting from this study. All information pertaining to this study will be kept in a locked filing cabinet in my personal home office and will be destroyed upon completion of my dissertation. If you have any questions or concerns regarding this study at any time, please feel free to contact me, Kay Haugen, 131 Ridgewood Lane, Jefferson, GA 30549, 706-367-9984, khaugen@windstream.net or my faculty advisor, Dr. Gregory Chamblee, Department of Teaching and Learning, Georgia Southern University, P.O. Box 8134, Statesboro, GA 30460, 912-681-5701, gchamblee@georgiasouthern.edu. For questions concerning the process of the Institutional Review Board in reviewing all projects involving human subjects, contact the Office of Research Services and Sponsored Programs at Georgia Southern University, 912-681-5465, ovrsight@georgiasouthern.edu.

Thank you in advance for your help in studying this question. The results of this study should be helpful to institute instructors and state policymakers as they plan for future professional development. You may keep this copy of this consent form for your records. Return of the surveys will serve as your permission to participate.

Sincerely,

Kay S. Haugen, Ed.D. Candidate
Georgia Southern University

APPENDIX I

INSTRUCTOR INFORMED CONSENT

Dear Northeast Georgia RESA Math I Training Instructor:

I am a graduate student at Georgia Southern University conducting dissertation research entitled *Preparation for High School Mathematics Reform in the Northeast Georgia RESA District: A Stages of Concerns Approach to Examining Professional Learning*. The purpose of my study is to determine the concerns of the teachers attending the Northeast Georgia RESA Georgia Performance Standards training and whether or not the concerns change through the training process.

If you give permission, you will have the opportunity to participate in three interviews. One interview will be conducted before the summer institute in May of 2007. One will be completed between Day 4 and Day 5 Training in October of 2007. The third interview will be completed after Day 5 Training in February of 2008. Completion of each interview will take about 30 minutes of your time. Your participation in this study is completely voluntary. The risks from participating in this study are no more than would be encountered in everyday life; however, you may stop participating at any time without penalty. You may choose to skip any question(s) you do not wish to answer for any reason.

In order to protect your confidentiality, your name will not appear on any reports or used in any presentation or publications resulting from this study. The audio files and transcriptions will be stored on my personal computer in my home office and will be deleted upon completion of my dissertation. If you have any questions or concerns regarding this study at any time, please feel free to contact me, Kay Haugen, 131 Ridgewood Lane, Jefferson, GA 30549, 706-367-9984, khaugen@windstream.net or my faculty advisor, Dr. Gregory Chamblee, Department of Teaching and Learning, Georgia Southern University, P.O. Box 8134, Statesboro, GA 30460, 912-681-5701, gchamblee@georgiasouthern.edu. For questions concerning the process of the Institutional Review Board in reviewing all projects involving human subjects, contact the Office of Research Services and Sponsored Programs at Georgia Southern University, 912-681-5465, ovrsight@georgiasouthern.edu.

Thank you in advance for your help in studying this question. The results of this study should be helpful to institute instructors and state policymakers as they plan for future professional development. You will be given a copy of this consent form to keep for your records.

Sincerely,

Kay S. Haugen, Ed.D. Candidate
Georgia Southern University

_____ _____
Participant Signature Date

I, the undersigned, verify that the above informed consent procedure has been followed.

_____ _____
Investigator Signature Date

APPENDIX J

ANOVA TABLE: YEARS OF TEACHING EXPERIENCE

		Sum of Squares	df	Mean Square	F	Sig.
MSTAGE0	Between Groups	2.357	3	.786	.677	.570
	Within Groups	56.839	49	1.160		
	Total	59.195	52			
MSTAGE1	Between Groups	1.880	3	.627	.309	.819
	Within Groups	99.511	49	2.031		
	Total	101.390	52			
MSTAGE2	Between Groups	3.738	3	1.246	.843	.477
	Within Groups	72.455	49	1.479		
	Total	76.193	52			
MSTAGE3	Between Groups	4.667	3	1.556	1.046	.381
	Within Groups	72.898	49	1.488		
	Total	77.565	52			
MSTAGE4	Between Groups	2.180	3	.727	.776	.513
	Within Groups	45.900	49	.937		
	Total	48.080	52			
MSTAGE5	Between Groups	4.194	3	1.398	1.305	.284
	Within Groups	52.508	49	1.072		
	Total	56.702	52			
MSTAGE6	Between Groups	2.335	3	.778	.550	.651
	Within Groups	69.353	49	1.415		
	Total	71.688	52			

APPENDIX K

ANOVA TABLE: CHOICE OF TEXTBOOK

		Sum of Squares	df	Mean Square	F	Sig.
MSTAGE0	Between Groups	.687	2	.343	.294	.747
	Within Groups	58.508	50	1.170		
	Total	59.195	52			
MSTAGE1	Between Groups	12.945	2	6.473	3.659	.033
	Within Groups	88.445	50	1.769		
	Total	101.390	52			
MSTAGE2	Between Groups	1.594	2	.797	.534	.589
	Within Groups	74.599	50	1.492		
	Total	76.193	52			
MSTAGE3	Between Groups	.855	2	.428	.279	.758
	Within Groups	76.710	50	1.534		
	Total	77.565	52			
MSTAGE4	Between Groups	.620	2	.310	.326	.723
	Within Groups	47.460	50	.949		
	Total	48.080	52			
MSTAGE5	Between Groups	4.510	2	2.255	2.160	.126
	Within Groups	52.192	50	1.044		
	Total	56.702	52			
MSTAGE6	Between Groups	.867	2	.433	.306	.738
	Within Groups	70.821	50	1.416		
	Total	71.688	52			

APPENDIX L

ANOVA TABLE: PROFESSIONAL LEARNING EXPERIENCES

		Sum of Squares	df	Mean Square	F	Sig.
MSTAGE0	Between Groups	.010	1	.010	.009	.925
	Within Groups	59.185	51	1.160		
	Total	59.195	52			
MSTAGE1	Between Groups	5.069	1	5.069	2.684	.108
	Within Groups	96.322	51	1.889		
	Total	101.390	52			
MSTAGE2	Between Groups	.001	1	.001	.001	.977
	Within Groups	76.192	51	1.494		
	Total	76.193	52			
MSTAGE3	Between Groups	.144	1	.144	.095	.760
	Within Groups	77.422	51	1.518		
	Total	77.565	52			
MSTAGE4	Between Groups	.515	1	.515	.552	.461
	Within Groups	47.565	51	.933		
	Total	48.080	52			
MSTAGE5	Between Groups	7.523	1	7.523	7.802	.007
	Within Groups	49.179	51	.964		
	Total	56.702	52			
MSTAGE6	Between Groups	.269	1	.269	.192	.663
	Within Groups	71.419	51	1.400		
	Total	71.688	52			