TEACHER PERCEPTIONS OF THE USE OF MATHEMATICS COACHES FOR THE IMPROVEMENT OF INSTRUCTION

by

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ABSTRACT

The purpose of the study was to examine teacher perceptions of the impact mathematics content coaches have had on instructional practices and on student learning. Data were collected from teachers in Grades 3, 4, and 5 who were teaching in five schools during the 2009-2010 academic school year. The Alabama State Department of Education survey was used to collect data. The survey consisted of two parts. The first part was composed of 41 questions using a 5-point Likert-type scale. The second part consisted of three open-ended questions. Interview data were collected from a purposeful sample of teachers.

Responses to survey items can be grouped into four main themes: performance, collaboration, environment, and attitude. There was little difference found among the responses. Within all four themes, the response type of *almost always* has the highest frequency of occurrence (62%), with *usually* being the second most chosen response (23%). These results demonstrate that participants are very satisfied with the mathematics coaches' performance, collaboration, environment, and attitude. Few respondents chose *usually*, *sometimes*, and *rarely* as their response choice.

Responses to the open-ended questions revolved around three main themes: lesson modeling, which included observation and feedback; lesson development; and frequency of teachers meetings with their coach. A few respondents did not have the opportunity to meet with their coach on a weekly basis. The overwhelming theme suggested by those who responded to the final question revolved around spending more time in the classroom.

Interviewees commented that their content coach had taught them to be reflective thinkers through observation and feedback.

Although survey data were subjected to an exploratory factor analysis, given the relatively small number of survey respondents, these data are of limited value. They are, however, reported because of the wide use of the instrument in Alabama. These data suggest that there were four latent factors underlying the 41 survey questions: performance, collaboration, environment, and attitude. Although Cronbach α coefficients indicated strong internal consistency for all four factors, these should be interpreted cautiously, because of the small sample size.

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CHAPTER 1

INTRODUCTION TO THE STUDY

Background

This study examined teacher perceptions of the impact mathematics content coaches have had on instructional practices and on student learning. The primary research question was: What is the perceived impact mathematics content coaches have had on improving instructional practices of Grades 3, 4, and 5 teachers and what is the perceived impact on student learning? A secondary research question was: What is the validity and reliability of the ALSDE survey and its underlying factor structure? Chapter 1 provides background information on use of instructional content coaches as a staff development initiative and describes the deficits in teaching mathematics, the practices found to improve instruction and student achievement in mathematics, as well as identifying trends within the educational profession in relation to the use of content specialists in schools. This chapter describes the significance of the study, an overview of the study design, the limitations and assumptions within the study, definitions of key terms, and summary.

Statement of the Problem

According to Rowan (2005), after reading and language arts, mathematics is considered by some to be the second most important subject for students to gain competency. Rowan said that funding is provided for reading/language arts specialists and for staff development, despite the fact that teachers are often considered to be better prepared to teach in these areas, than they

are in math. On the other hand, budget constraints are often the reason given for the small amount of money allocated for mathematics content specialists and for staff development (Rowan, 2005). If such an importance is placed on mathematics in this country, it would be easy to argue the need for equality, especially when, according to Rowan (2005), general consensus finds teachers to be less competent in mathematics content knowledge.

Federal legislation, i.e., No Child Left Behind (NCLB) (http://www.nagb.org/about/plaw.html) requires all classroom teachers to be "highly qualified" in their content certification areas. At the elementary school level teachers are expected to be experts, or highly qualified, in all subject areas because they are responsible for teaching all subjects (Mewborn, 2000). With the diverse strands and procedures found within mathematics curricula, it probably comes as no surprise that many teachers find themselves both uncomfortable and unaware of the best methods for teaching students. Teaching has been described as an isolating profession that leaves one individual in control over student experiences and content instruction (Hill, Rowan, & Ball, 2005; Rosenthal, 1989). For this reason these researchers argued that staff development needs to revolve around helping teachers to become more reflective in their teaching, and to provide content experts, just as reading/language arts instruction has long provided.

Several studies conducted over the last decade have found the quality of teacher knowledge and skills to be connected to student achievement (Kain, 1998; Wenglinsky, 2002). Students have been found to perform at higher levels when they are taught by a teacher with a deep understanding of mathematics content and methods (Hill et al., 2005). The National Survey of Science and Mathematics Education conducted in 2000 found only 60% of the participating elementary teachers felt they were qualified to teach mathematics (http://2000survey.horizon-research.com). According to Mewborn (2000), the main reason for this goes back to their

educational experiences. When earning a degree in elementary education, teachers generally have minimal coursework in mathematics and what they are taught tends to be broad and generalized. Mewborn (2000) found one way to combat this is by understanding that teaching is not simply just knowing how to teach, but instead is a process of continued learning.

One instructional challenge has been found to be the teachers' inability to respond to student questions, and the provision of mathematical lessons that go beyond the basics (Wilson, Floden, & Ferrini-Mundy, 2002). In the area of mathematics, teachers have often not been taught how to reflect on their practice nor have they received the instruction needed to have a deep understanding of the constructs and methods within mathematics curricula. Researchers have found site-based professional development to be an effective tool in helping teachers make the much needed changes to their current practices (Fanke, Kazemi, Shih, Biagetti, & Battey, 2005). These researchers found that site-based staff development with mathematics content specialists, or any subject specialists, to be critical for improving student learning and instruction, perhaps because it is job embedded. They further argued that the support of a subject specialist allowed teachers to better reflect on their own mathematical knowledge as well as their students' mathematical knowledge. The gained knowledge was not something taught off-site with hypothetical students, but was instead learned with their own students in real classroom situations.

Purpose of the Study

The purpose of the study was to examine teacher perceptions of the impact mathematics content coaches have had on instructional practices and on student learning. The following research question served to focus the researcher's interest. What is the perceived impact

mathematics content coaches have had on improving instructional practices of Grades 3, 4, and 5 teachers and what is the perceived impact on student learning? A secondary research question was, What is the validity and reliability of the ALSDE survey and its underlying factor structure?

Several researchers have made a link connecting site-based staff development practices to improved teacher instruction, but at this time only a few studies have offered evidence that such coaching may improve student achievement (Neufeld & Roper, 2003a). The researcher hopes to advance knowledge about teacher coaching and its perceived impact on the improvement of instructional practices and on student learning.

Research Design

This study used a survey design. Teachers from five elementary schools in a large county school system in the Southeastern United States were surveyed about their use of mathematics content coaches. The researcher will refer to this county as Jones County. The teacher perceptual data were analyzed using factor analysis and descriptive statistics. The Alabama State Department of Education survey was used to collect perceptual data from Grades 3, 4, and 5 teachers from each of the five schools. Results may be used to help leadership teams understand the perceived impact of their reform choices and make necessary improvements in areas where teachers perceive there to be weaknesses.

Significance and Need for the Study

This study is important in that it builds on prior research conducted about the relationship between professional staff development, instructional practices, and student learning.

Limitations and Assumptions

The idea that staff development support from content specialists in mathematics positively impacts the teaching of mathematics is an assumption of the researcher. The researcher assumes that Grades 3, 4, and 5 student performance in mathematics will improve with higher quality mathematics teaching. The researcher's view is that by analyzing the perceptions of teachers regarding the impact of mathematics coaches on improving instruction and on student learning, improved staff development practices in the area of mathematics will result in quality mathematics instruction and increased student achievement. Discovering the factor structure and examining the internal reliability of the Alabama State Department of Education will also help in providing a sound instrument for continued use in furthering research on this topic.

Some limitations beyond the control of the researcher may have impacted the research study. The Jones County Public School System does not set aside special funding for mathematics content specialists nor does it regulate the hiring of specialists; therefore, inconsistencies in job descriptions, responsibilities, and implementation practices existed.

A major limitation of the study is the small sample size. In a study by Costello and Osborne (2005) the researchers looked at how sample size can affect the likelihood of errors of inference regarding factor structure. An analysis of variance was performed in an effort to examine the number of examples producing correct factor structure as a function of sample size. This analysis found 70% of the larger samples tended to produce solutions that were accurate. In contrast only 10% of the samples with a 2:1 ratio or smaller, as seen in this study, produced correct solutions.

The small sample size found within this study produced little variability within the survey. Although the researcher was aware the sample size was small, it was thought that reporting the results of the factor analysis may be beneficial because the survey is used by at least one state department of education.

Definition of Key Terms

Several key terms are used throughout this research study. Related research has been used to define the following terms.

Academic Knowledge and Skills (AKS) are the Jones County Public Schools learning standards for students in Grades K-12 (www.gwinnett.k12.ga.us/aks.nsf?OpenDatabase& O~QuickLinks).

Coach or Content Specialist, as used within the context of this study, is a person designated as having a formal role of working with teachers to improve their instructional practices (Neufeld & Roper, 2003a).

Georgia Performance Standards are the state developed learning standards for students in Grades K-12 (http://www.georgiastandards.org/math.aspx).

No Child Left Behind Act (NCLB) is the reauthorization of the federal education programs under the Elementary and Secondary Education Act (ESEA) of 1965 (http://www.nagb.org/about/plaw.html).

Summary

As a result of the pressure for students to show continued gains on standardized and local tests (NCLB, 2002; *A Nation at Risk*, 1983; Heubert & Hauser, 1999; Johnson & Johnson, 2002),

schools are looking for ways to align their current instructional practices with accountability measures and standards. For this reason teacher practices and professional staff development have become the primary focus of ways to positively impact student achievement.

In the areas of content knowledge and confidence in their subject knowledge, teachers have been found to be less prepared to teach mathematics than other subjects (Rowan, 2005). With current research suggesting a link between teacher knowledge and student achievement (Hill et al., 2005; Poglinco et al., 2003; Rowan, 2005), school systems have begun to use mathematics coaches in an effort to combat perceived deficits in mathematics instruction (Rowan, 2005). Through the use of mathematics content coaches some schools have provided teachers with site-based, ongoing staff development rooted in a reflective teaching practices model, which may improve student achievement (Poglinco et al., 2003). This study examined how mathematics content specialists have been used in the Jones County Public School System and how teachers perceive their use to have impacted teaching practices and student learning. If research, such as this study, supports the use of mathematics content specialists, it is hoped that one day the funding currently provided for literacy and language arts specialists will also be available for mathematics.

This review will include the use of content specialists and test scores, evidence of other systems using mathematics specialists and their results, studies on staff development, research on mathematics teaching, the state of Georgia mathematics curriculum, the Jones County mathematics curriculum, the Jones County Public School System, Jones County elementary schools currently employing mathematics content specialists, and how mathematics is/has been addressed. Chapter 3 presents the study design and research methods.

CHAPTER 2

REVIEW OF THE RELATED LITERATURE

Introduction

The purpose of the study was to examine teacher perceptions of the impact mathematics content coaches have had on instructional practices and on student learning. The primary research question was, What is the perceived impact mathematics content coaches have had on improving instructional practices of Grades 3, 4, and 5 teachers and what is the perceived impact on student learning? A secondary research question was, What is the validity and reliability of the ALSDE survey and its underlying factor structure? This chapter will present background research, a theoretical framework, definitions of research terminology, information about the use of content specialists, evidence of other systems using mathematics specialists and their results, relevant research and studies on staff development, research on mathematics teaching, the state of Georgia mathematics curriculum, the Jones County mathematics curriculum, the Jones County Public School System, and Jones County elementary schools currently employing mathematics content specialists.

Theoretical Framework

The theoretical framework for this research study on the effectiveness of mathematics content specialists is rooted in research centered on best staff development practices as conducted by researchers such as Neufeld and Roper (2003) and Showers (1982). Research on

staff development practice has shown the traditional models of professional development most used by schools are inadequate for supporting the improvement of classroom practice (Cohen, McLaughlin, & Talbert, 1993; Lieberman, 1994; Saunders, Goldenberg, & Hamann, 1992). Traditional staff development practices often teach new methodology and curricula through a limited number of days of in-service workshops that are most often focused on topics unrelated to issues facing teachers on a daily basis (Fuhrman, 1993). Teachers are then often left alone in their classrooms to interpret this information and to put it into practice. Research has shown that the results of this form of staff development were unchanged instructional practices by teachers and unchanged academic success for students (Cuban, 1990; Darling-Hammond & McLaughlin, 1995; McLaughlin & Zarrow, 2001; Neufeld & Roper, 2003; Powell, Goldenberg, & Cano, 1995; Saunders et al., 1992; Tharp & Gallimore, 1988; Tyack & Tobin, 1994).

A desire for a more effective approach to professional development has created a push for a number of research efforts concentrated on the factors that have been found to be effective in improving classroom practice and student achievement (Darling-Hammond & McLaughlin, 1995; McLaughlin & Zarrow, 2001; Neufeld & Roper, 2003; Powell et al., 1995; Saunders et al., 1992). Effective professional development designs for teachers have been found to be ongoing, sustained, site-based, and to allow for open communication with highly trained and qualified peers about how to change and improve teaching practice (Birman, Reeve, & Sattler, 1998; Bryk & Schneider, 2003; Gamoran, 2003). Stephen Barkly (1999) suggested that time is made and not found. He stated that coaching provides that made time. Similarly Mizell (2006) stated that coaches are a dynamic, positive, and concrete way to embed adult learning in the routine of the regular school day. Showers, Joyce, and Bennett (1987) stated that four components are necessary to the development of the levels of interactive and cognitive skills that foster practice

in the classroom. The four components are theory, demonstration, practice, and feedback. Joyce and Showers (2002) stated that teachers who are provided with continued assistance by their peer experts are more likely to achieve a higher level of implementation of their training.

Showers (1982) was among the first to really examine the concept of peer coaching. She argued that how mathematics specialists learn procedural knowledge should be addressed because it allows for the most immediate and direct outcome of peer coaching. Showers (1985) published a study about how the use of coaches provided teachers with an environment in which they felt safe to experiment with strategies they had just learned, improved their teaching behaviors, and examined the results of these changes. Her original work provided a springboard for other researchers to continue studying the effects of coaching.

In Showers' early research, she demonstrated how coaching facilitates the transfer of training in many different ways (Showers, 1982). She found teachers working with a content specialist coach used instructional objectives and specific teaching models in a more appropriate way than their un-coached counterparts (Showers, 1982, 1984). Principals and classroom teachers who were coached, practiced the newly learned strategies more frequently and became more skilled in their use of those strategies than un-coached principals and teachers (Showers, 1982). Teachers who had been coached explained their newly learned strategies to their students so that they too could understand the purpose of the strategies and the behaviors expected when using the new strategy (Showers, 1984). Most importantly, Showers and Baker (1984) found teachers who had been coached showed an increase in the use of the new strategies and greater long-term retention over time than un-coached teachers.

Joyce and Showers (2002) hypothesized that continued classroom support was critical for the addition of newly learned teaching strategies to be added to existing ones. They continually

designed studies focused on investigating the impact of continued assistance in the form of coaching following the instruction of new content. Their findings indicated that continued assistance, provided by either an outside expert or peer expert, resulted in far greater classroom implementation than was achieved by counterparts who took part in the initial training but who did not have the support of long-term coaching (Joyce & Showers, 2002).

The instructional coaching principles currently being studied are grounded in research on effective professional development and learning communities (Poglinco et al., 2003). According to Poglinco et al. (2003), evidence of increased student learning as a direct result of coaching needs documentation. However, an increasingly supportive body of research suggests that coaching is a promising component of professional development, because it encourages collaboration, reflective practice, promotes positive cultural change, and is embedded in professional learning (Neufeld & Roper, 2003; Poglinco et al., 2003).

Guskey (1999) stated that one consistent finding in the research literature is that marked improvements in the educational world almost never take place in the absence of professional development. Hassel (1999) defined professional development as "the process of improving staff skills and competencies needed to produce outstanding educational results for students" (p. 9). Loucks-Horsley, Hewson, Love, and Stiles (1998) identified coaching and mentoring, institutes, courses for training of professional developers, and replacement units as effective formats of professional learning for teachers.

In the business world the use of coaching has become increasingly more popular (Thomas, 1995; Whitmore, 1992). The intended goal of coaching is for reflection and personal growth. In education, coaching is a way to move teachers in the direction of new instructional strategies and knowledge about teaching/learning. There is, however, a need for research about

the impact of coaching on student learning. Berman and McLaughlin (1975) looked at the role of assistance to teachers and peer observation in their own classrooms as important components of change programs. Fullan and Pomfret (1977) noted the important role administrative support and training also played in the success of change programs.

However, among practitioners, support continues to grow for coaching as a means of increasing or enhancing a teacher's understanding of teaching and learning. Darling-Hammond and McLaughlin (1995) reported that for professional development to be effective, it needs to be sustained, ongoing, intensive, and supported by coaching and collective problem solving around specific forms of practice. Garmston and Wellman (1999) and Costa and Garmston (1994) reported that one of the most powerful means for increasing teachers' knowledge and improving their practice is the coaching of teachers in content areas.

Content Coaching

A coaching position in the educational community is known by many different names. The same is true for the professional literature found on the subject. According to Joyce and Showers (2002), technical coaching, challenge coaching, team coaching, cognitive coaching, peer coaching, lead teachers, and mentoring are just a few of the forms of coaching found within professional literature. Joyce and Showers (2002) stated that peer coaching, team coaching, and technical coaching are concerned with implementing learning innovations in instruction and curriculum, whereas collegial coaching and cognitive coaching aim more at improving existing practices.

Poglinco et al. (2003) identified technical coaching as a use for transferring new teaching practices into teacher repertoires. Collegial coaching is used to help teachers reflect on their

work and increase professional dialogue. Peer coaching is defined as two or more colleagues working together to improve their skills and professional knowledge. Mentoring is defined by these authors as a relationship between novice and experienced teachers.

Sweeny (2003) used both the term coach and instructional coach interchangeably as a means of describing a support person who models new strategies and provides feedback when the new strategies have been put into use. These coaches observe teachers then provide feedback, demonstration lessons, example lesson plans, co-teaching opportunities, and situation-specific assistance focused on the math content.

Costa and Garmston (2002) described a variety of coaching terms including peer assistance, evaluation, coaching, catalyst, consulting, and mentoring. Collaboration, coaching, and consulting are part of the instructional improvement process. According to Costa and Garmston, administrators and supervisors perform evaluation focused on the assessment of teacher performance. Consulting is when experienced and knowledgeable teachers work as mentors, consultants, or peer coaches. Mentoring is when a novice teacher is supported by an experienced teacher in an effort to improve teaching due to performance issues.

Cognitive coaching is one of the more structured models used to support teachers engaged in studying teaching and student learning through the use of coaching. A group of California educators met in the 1970s with the goal of developing strategies that would help support administrators with the evaluation of teachers using humanistic principals. In 1985 the interest in cognitive coaching led to the eventual formation of the Institute for Intelligent Behavior. In 1994, Costa and Garmston published the first edition of *Cognitive Coaching*: *A Foundation for Renaissance Schools*.

Costa and Garmston (2002) defined a cognitive coach as a person trained in using the tools, beliefs, maps, and values of mediation in an effort to support teachers in self-directed learning while improving instructional practices. A cognitive coach helps people develop expertise in reflecting, problem solving, planning, and decision making. At a deeper level this form of coaching serves as the center for professional communities that encourage interdependence, honor autonomy, and produce high achievement.

Review of Research on the Use of Content Specialists

Neufeld and Roper (2003) defined instructional coaching as ongoing, sustained support for principals and teachers to improve school organization and classroom instruction. Neufeld and Roper (2003) listed one of the primary roles of coaching to be the need for engaging teachers in collaborative practices while leading them to teach in ways that engage students and allow them to address questions and problems in meaningful ways.

Several studies have been conducted specifically on Cognitive Coaching in an effort to document its effectiveness in creating self-directed learners. Edward and Green (1999) found that teachers who were trained in Cognitive Coaching, when compared with a control group, spent more hours involved in professional development both during the school day and after regular school hours. These researchers found that "trained" teachers used more new instructional strategies than their "untrained" counterparts.

Green (2004) conducted one of the largest research surveys on coaching so far. Green found that (a) the amount of joint planning is dependent on the personalities of the coaches; (b) teachers are positive about the support provided to them through coaching, especially when they have the opportunity to plan with the coaches; (c) when coaches make frequent informal contacts

with teachers, they are viewed as more supportive; (d) teachers see inconsistencies between theory and practice among coaches; (e) coaches modeling lessons in the classroom helped teachers to rethink and modify their instructional practice; and (f) the factors hindering the effectiveness of the coaching model were a lack of time, teacher resistance, and scheduling conflict.

A study by Krpan (1997) looked at Cognitive Coaching used as an opportunity for professional growth with teachers with 2 to 4 years of experience compared to a control group. Results indicated that through the use of coaching, teachers had more opportunities for growth in teaching practices during a 7-month time period.

A study by McCombs (1995) found senior high school teachers who, as part of a Cognitive Coaching program, had been coached for one school year produced instruction that included more higher-level thinking, as measured on the Encouragement of Higher Order Thinking Skills scale survey. McLymont and da Costa (1998) found teachers who were Cognitive Coaching-trained provided a classroom atmosphere of trust and supported more independent decision making for students.

Research on Cognitive Coaching has supported its impact on teacher growth. Edwards et al. (1989) spent 3 years researching teachers using Cognitive Coaching and found an increased satisfaction with teaching as a profession, and with their current positions in comparison to a control group. A later study by Edwards and Newton (1994) supported the research findings of the 1989 study. They also found teachers who participated in Cognitive Coaching to be more satisfied with their professions as compared to the control group who did not have any Cognitive Coaching.

Interestingly, another study by Garmston and Hyerle (1988), similar to the ones above, looked at college professors who participated in 42 hours of Cognitive Coaching training. An increase in self-confidence, improved ability for self-perception, and a greater enthusiasm for teaching was also found.

Sharan and Hertz-Lazarowitz (1980) studied a professional development model where faculty members used consultant-assisted self-help teams of three to four teachers as a means of providing extensive training in new teaching strategies and staff support. The teams participated in cooperative planning of teaching processes, content knowledge, mutual observation of teaching, and feedback. In the second year follow-up, Sharon and Hertz-Lazarowitz noted that 65% of the teachers were regularly using the new teaching strategies.

A study conducted on Reflective Coaching, by Rock (2002), described the underlying support for job-embedded professional development found in this form of coaching. They stated that Reflective Coaching was made up of four components. Conditions for learning, instructional planning, teacher's role, and instructional delivery guided all decisions regarding the professional development strategies used within the school. The implementation of this model took place in seven elementary schools in the Chicago Public Schools. Based on the use of the Iowa Tests of Basic Skills reading component, students whose teachers implemented this model increased their test scores in a range from 7% to 70%.

Although a variety of success stories emerged, there is little empirical data to support some of the major claims about the effects of coaching. Most success stories remain anecdotal in nature. Many believe this is true because peer coaching is a relatively new form of professional development. Sparks and Bruder (1987) stated that despite the fact that 70% of teachers claimed

that peer coaching improved student achievement, they offered little supportive data to back up their claims.

Many of the research studies on the effectiveness of coaching present coaching as a promising means of improving instructional quality, while some studies show that coaching had little or no effect on instructional improvement (Gutierrez, Crosland, & Berlin, 2001; Veenman, Denessen, Gerrits, & Kenter, 2001). Many in the field agree that improving teacher quality and supporting instructional change require ongoing demonstrations and modeling of strategies and skills, supported by on-site coaching support, with specific feedback (Guskey, 2000; Joyce & Showers, 1995; Joyce, Showers, & Bennett, 1987; Sparks & Loucks-Horsely, 1989). These researchers argued for the need for some type of ongoing specific follow-up as a critical component of supporting teachers in their practice (Guskey, 2000; Garet et al., 2001). They also argued that this follow-up is necessary when integrating new knowledge and skills into classroom practice and in helping to sustain the practice over time with depth of understanding.

In a study by Edwards and Newton (1994), the researchers found teachers who participated in coaching were more satisfied with the teaching profession when compared to teachers without coaching. Edwards et al. (1989) conducted a 1-year study using coaching and reported the participants, like those in the previous study, had an increased satisfaction with the teaching profession and with their specific positions when compared to teachers who had no coaching.

The National Staff Development Council (2001) developed standards for effective staff development practices, and they recommended coaching as a way of meeting several of those standards (NSDC). The standards are (a) effective leadership to support continuous instructional improvement, (b) the organization of educators into learning communities that have clear goals

consistent with school and district goals, (c) the application of research into school and classroom strategies and decision making, and (d) the support for teacher collaboration (http://www.nagb.org/about/plaw.html).

Due to the fact that coaching has not been implemented broadly across the U.S., there is limited empirical data linking it to student achievement (Neufeld & Roper, 2003). There have been, however, some descriptions of studies from school districts currently using the coaching model that lend support to the claim that coaching leads to improved instruction, and these data suggest that coaching has led to increased student achievement (Neufeld & Roper, 2003).

One current model of coaching used for professional development is one in which teachers and coaches work side-by-side in conjunction with others to improve teaching practices (http://www.bpe.org/publications.aspx; Guiney, 2001; Neufeld & Roper, 2003a). This coaching model revolves around the use of collaboration, reflection, modeling of new practices with given support and direction, support and follow-through, dialogue, and collaboration (http://www.bpe.org/publications.aspx). This coaching model assumes change within the classroom occurs when it is contextualized within the larger reform effort of the school and is ongoing (Guiney, 2001; Neufeld & Roper, 2003a).

Although coaching models for staff development have shown positive results, it is important to note the challenges implementation of these models face. Principal belief in the coaching model, program funding, teacher acceptance, and training are a few of the challenges (Neufeld & Roper, 2003b; Russo, 2004; Stein, Schwan, Smith, & Silver, 1999). Despite these challenges, several researchers agreed that the positive results seen so far outweigh the challenges listed (Neufeld & Roper, 2003a; Richard, 2003). Some schools who have

implemented a model of coaching have found it important to report the challenges they faced during implementation in an effort to help others.

One common challenge cited in several studies was in relation to the role of the principal, who was often viewed as the key to the implementation of the coaching model at the school site (Neufeld & Roper, 2003b). At times, principals have resisted this model of staff development, which may lead to problems during implementation. Principals often set the tone that the rest of the staff follow, so when a school has an administrator who does not believe in what staff developers are doing, it is often difficult to get the staff to implement the program (Neufeld & Roper, 2003b). A problem facing principals and school districts is the difficulty of finding qualified coaches to hire (Neufeld & Roper, 2003a, 2003b).

Another challenge found was the need for coaches to be provided with professional development, especially if it is ongoing and contextual (Russo, 2004; Stein et al., 1999). Another challenge facing coaches was the school culture in which they work. Often the coaches' role is entirely new and unique, leaving teachers unaccustomed to the dialogue that is required (Russo, 2004). The funding needed to provide salaries, teacher release time, and other costs associated with this professional development model pose significant challenges to districts, often forcing them to seek outside funding (Russo, 2004).

When a teacher makes the transition from teacher to coach in the same building a new set of challenges may arise. Some teachers feel threatened by "one of their own" observing and providing feedback on their instructional practices (Neufeld, & Roper, 2003b; Symonds, 2003). Unless a cultural change occurs in the building upon establishing the new coaching position, this outcome is nearly impossible to avoid. A similar reaction can be found between the content

coach and administrator. The new relationship finds a transition from teacher to one of a colleague providing input and critiques.

Two San Diego middle schools faced a number of difficulties in implementing the coaching model. The first obstacle faced by these schools was a union contract that stood in the way of assigning coaches to lower performing schools (Neufeld & Roper, 2003b). The union contract allowed the coaches to choose the school they wished to be assigned to instead of the district placing them where they were most needed. Most coaches did not wish to work in the lower performing schools. The lack of training and understanding of the content in which they are coaching others, firsthand experience with teaching, and a working knowledge of their role and responsibilities, were found to be challenges at these two schools (Neufeld & Roper, 2003b).

Coaching has been reported to be promising but underdeveloped in school improvement efforts by Richard (2003). Richard's report centered on the need for coaching to be organized around the reform efforts of the district or school in which it is being implemented. The literature on coaching demonstrates a need for more research.

School Systems Using Content Specialists and Their Results

Several states (Virginia, Massachusetts, Arizona, Kentucky, Texas, Pennsylvania, New York, and California) have adopted reforms and have worked to implement mathematics content specialist positions within their school districts (Guiney, 2001; Neufeld & Roper, 2002a; Poglinco et al., 2003; Russo, 2004). In the state of Virginia, the Virginia Mathematics and Science Coalition (VMSC) established a task force to write a report and prepare a case advocating the needs for and benefits of mathematics specialists. The VMSC felt compelled to

advocate for mathematics specialists after the positive evidence obtained from their own pilot projects was collected (Virginia Mathematics and Science Coalition Task Force, 2005).

The idea of a content teacher specialist was not something new to the state of Virginia. They use such specialists evolved from another model of teaching designed more than 10 years earlier. In this effort, 3 years of outside funding allowed participating K-8 mathematics and science teachers to increase their content knowledge and content pedagogy during intensive summer institutes (Virginia Mathematics and Science Coalition Task Force, 2005). The newly trained leaders then returned to their home schools and led efforts to improve teaching and learning in their content areas.

After the 3 years of funding had ended, Critchfield and Pitt (1997) reported the effectiveness of the lead teacher programs in the nine representative schools. According to Critchfield and Pitt (1997), lead teachers served as resources for teachers, as well as curriculum and staff development leaders. The authors claimed that the increase in test scores was attributed to the implementation of the lead teachers, and that without funding and statewide preparation for these specialists they would have ceased to exist. The report concluded that maintaining higher levels of student learning across the state required implementing instructional programs geared towards helping teachers understand the complexity of mathematics, and gain a deeper knowledge of mathematical subject matter.

Teacher content specialists have been used in Hanover, Virginia, where Exxon Mobil provided funding for such an implementation (Rowan, 2005). Hanover placed 15 teachers in math teacher leader positions. Budget constraints forced these leaders to remain in the classroom during the day so staff development was provided outside the regular work day. These teacher leaders taught with reflective teaching practices.

The Madison District in Phoenix, Arizona, used National Science Foundation grant money to release 13 teachers half a day to take on a mathematics coaching role (Rowan, 2005). These leaders were called Mathematics Teacher Leaders (MTL) and were selected because of their excellence in teaching, interest in mathematics instruction, and demonstration of leadership qualities. MTL participated in extensive professional development with consultants and Arizona State University faculty. The primary focus was on reflective teaching, which they described as the ability to analyze ones' own lessons in an effort to improve instructional practices. According to Rowan (2005), this form of teaching is based on a deeper understanding of the background knowledge of the students, then planning instruction that affects that knowledge.

The Madison School District chose reflective teaching based upon research into how students learn mathematics (Rowan, 2005). The Madison project was not intended as a research project. The district routinely collected data as a means of evaluating themselves with an estimate of how the specialists affected student achievement after implementation. Despite some teacher resistance to the program, as well as an increasingly diverse student population, the Madison district test scores trended in an upward direction for most grade levels. District administrators concluded that teacher leaders, working closely with building principals, contributed to the positive results in the Madison School District. Despite the fact that the National Science Foundation funding had run out, the Madison District continued the use of mathematics specialists due to their perceived value to instruction and student learning (Rowan, 2005).

According to Cohen and Hill (2000), many in the state of California began to say that teaching and learning should be rooted more in the disciplines and be more demanding, especially in the area of mathematics. For this reason they sought to reform the mathematics

curriculum. Cohen and Hill (2000) used 1994 data and surveys of California elementary school teachers to examine the effects of the state reform efforts on mathematics teaching and learning. In 1985 the state of California issued a new mathematics framework designed around rigorous instruction, engaging work for students, and the need for students to have a deeper understanding of mathematical knowledge (Cohen & Hill, 2000). More emphasis was placed on mathematical reasoning and explanation rather than just memorizing simple facts and operations.

This new and more complex form of teaching was constructed in response to students' ideas and understanding. According to Cohen and Hill (2000), this reform is one of the longest running reform efforts in the United States. In the initial analysis of the reform effort, Cohen and Hill (2000) found teachers were provided with greater opportunities to learn the new mathematics content and how to teach it. Cohen's and Hill's study of the reform supported the idea that professional education can play a key role in efforts to improve public education. The evidence from their research showed that teachers' learning influenced student learning. The authors concluded that use of teacher specialists was one way to improve teachers' learning (Cohen & Hill, 2000).

Neufeld (2002) reported on the pilot phase of the implementation of what Boston Public Schools called their Collaborative Coaching and Learning (CCL) model. Boston Public Schools operated under the hypothesis that improved instruction would increase student achievement and the way to do this was to support teachers at their home sites. In their eyes, coaching was a school-based approach to staff development. Like others, the Boston Public Schools reported that mathematics took a second place to literacy and the task facing a math coach was both difficult and much needed. Despite some challenges with school leaders within the schools studied, the Boston Public Schools reported that test data supported the use of a coaching model. Neufeld

stated the CCL model encouraged teachers to learn pedagogy and content in a collegial, collaborative manner with support from an expert in their field.

New York City assigned experienced coaches to schools throughout the city in a model used at the time but now discontinued (Russo, 2004). New York City designed a model where coaches demonstrated sample lessons for teachers and used their planning time to meet and conference with small groups of teachers. The district chose this model to support staff development for writing, reading, and math.

During the 2002-2003 school year, Philadelphia chose to pilot a coaching model. They chose to allow 130 coaching staff and 500 school-based instructional leaders to work part-time circulating through different schools in the district in an effort to improve instruction on "individual student performance data" (Russo, 2004, p.1; Poglinco et al., 2003). After review of the initial teacher and administrator surveys regarding student assessment, site visits, and instructional improvements, the district found initial efforts to be promising.

In 2003 the South Carolina Department of Education developed the Mathematics and Science Coaching Initiative (Dempsey, 2007). They used a model that allowed one coach, one school, one content area. Each participating school was required to commit to a 3-year partnership. The South Carolina Department of Education felt the 3-year commitment would ensure sufficient time for coaching to become an integral part of school. During the 2006-2007 school year, 144 coaches were working with 2,500 elementary and middle school teachers and administrators from 45 different school districts, which in total reached about 58,000 students across the state.

South Carolina stated that the key to improving student learning was to improve teacher learning. The South Carolina Department of Education needed a way to learn that would not add

to those existing stresses. A five-strategy approach was used to create time for coaching: buying time, using common time, freeing time, embedding time, and using existing time more effectively. For buying time, the principal hired substitutes to allow grade-level teams to work with the coach and learn skills necessary to teach. The coach and teachers worked together to study the content, walk through lessons, describe content to be taught, and prepare needed materials. In using common time, administrators adjusted teachers' schedules to provide daily common planning for teachers on each grade level. Freeing time was another attempt to create time by allowing teachers to specialize. Specializing meant allowing each teacher to master and teach one segment of the curriculum. Embedding time meant having the coach available before and after school hours. The coaches led the staff development at their schools, provided impromptu individual coaching sessions, and stayed around for lengthier team meetings. Using existing time more effectively meant working collaboratively with teachers on their teaching practices and on increasing their content knowledge. It was the belief of this educational department that teachers reached more students than a single coach ever could by doing things like interventions instead of coaching.

The South Carolina Department of Education's initiative seemed to have paid off. According to the U. S. Department of Education, South Carolina's 4th graders had the best gains in the nation in National Assessment of Educational Progress in science in 2005. Eighth graders had the third-best gains and South Carolina was one of only five states to show improvement in both 4th and 8th grades.

Best Staff Development Practices

The improvement of teachers' professional expertise and development has become a predominant area for educational reform in the past 10 years, especially in the area of mathematics (OSPI, 2003; Sykes & Darling-Hammond, 1999). Teacher professional expertise can be improved by first developing an understanding of teachers' mathematical knowledge and how that affects students (Hill et al., 2005). Schwab (1978) is credited with coining the term syntactic, which is also called contextual learning. Schwab said syntactic is a means of understanding the ways in which knowledge is created. He also said syntactic knowledge is rarely made explicit for teachers in their teacher preparation programs. He argued this lack of opportunity to build knowledge about mathematics as a discipline left teachers to form their own assumptions about the subject area (Schwab, 1978).

As researchers like Schwab focused on teacher knowledge, other scholars focused on identifying what knowledge was necessary for teaching. In general, the knowledge of subject matter, knowledge of learners, knowledge of learning theory, knowledge of teaching strategies, and knowledge of the social context of schooling have been identified as the elements needed for helping children learn (Mewborn, 2000).

The National Council of Teachers of Mathematics (1989) stated that merely "knowing" mathematics does not ensure that one is able to teach it in ways that best enable students to develop the mathematical power and deep conceptual understanding desired by current reform efforts. Lanier and Little (1986) examined the population of individuals going into the educational profession. They claimed it was important to understand that the issue at hand did not revolve around the populations going into education as some have argued. Through their

analysis of the qualifications of education students, they reported that the profession attracts its fair share of the best and the brightest.

Several researchers have looked at teachers' lack of mathematical knowledge. For example, Ball (1988) found half of the interviewed teachers thought that zero divided by zero was zero, 20% stated they could not remember the rule for division by zero, or did not even answer the question. Baturo and Nason (1996) found that some teachers in their study were not able to produce number facts from memory and were unable to deduce facts when given related facts. Another group of researchers (Ball, 1990; Graeber, Tirosh, & Glover, 1989; Simon, 1993) found teachers were unable to perform procedural mathematics tasks while others were unable to provide explanations for what they had done in solving a problem.

In another study, Hill et al. (2005) looked at 115 elementary schools participating in instructional improvement initiatives. These participating schools chose one of three school reform programs, America's Choice, Success for All, or the Accelerated Schools Project. Twenty-six schools did not participate in any program allowing them to be used as comparison schools. Hill et al. (2005) found teachers' mathematics knowledge positively predicted student scores in mathematics in the first and third grades. An important feature of the analysis used by the researchers was their measurement of mathematical knowledge for teaching. Previous research on this subject tended to focus only on courses taken by teachers. Robbins (1995) reported that coaching allowed teachers to better reflect on their practice, improve their practice, and increase current practices and instructional abilities.

Researchers have studied the effects of professional development on teachers' practices within the classroom across subject areas (Desimone, Porter, Garet, & Yoone, 2002; Neufield & Roper, 2003; OSPI, 2003b). Their research specifically looked at professional development

which (a) is ongoing, (b) uses teacher collaboration, (c) targets specific instructional practices for the classroom, (d) uses active learning, and (e) teaches reflective teaching practices (Cohen & Ball, 1990; Cohen & Hill, 2000; Desimone et al., 2002; McDonnel, 1994; National Research Council, 1999; Spillane & Jennings, 1997). These researchers found that effective professional development specific to a teacher's content area or grade level, focused in research-based practices, ongoing, and embedded in classroom practices with children.

Other research studies related to professional development focused on the enhancement of teacher learning. Research has found teacher learning to be enhanced when (a) it shows commitment to the teaching profession, (b) it provides structured improvement activities that offer teachers a sense of agency, (c) it is a coordinated effort geared toward improving achievement in students, (d) it exhibits a caring attitude that is found to extend to colleagues and students, and (e) it instills a respect for life-long learning (Birman et al., 1998; Gamoran, 2003). School reformers have recognized the significant role teacher's professional development has on improving U.S. schools (OSPI, 2003; Sykes & Darling-Hammond, 1999).

Campbell (1996) and Race, Ho, and Bower (2002) studied the use of mathematics coaches as a component of large-scale professional development programs. Campbell found 40% of the participating teachers had significantly changed their instructional practice by actively engaging students in building conceptual understanding of mathematics. In a similar study, Race et al. (2002) found teacher participants increased the frequency of higher-order thinking, hands-on learning, addressed a variety of learning styles, and used a greater variety of activity-based lessons, discussions, and investigations. The researchers claimed that without the support of the mathematics coaches, teachers would not have been likely to persist in making such significant changes in their instructional practice.

Becker (2001) and McGatha (2008) studied mathematics coaches who were not part of a large-scale professional development program, as seen in the studies above. Teachers in both of these studies experienced positive changes such as (a) emphasis on problem solving over skill-based instruction; (b) focus on more of the "big ideas" of mathematics instead of presenting topics in an isolated and unconnected manner (Becker 2001); (c) allowing students to think independently, which resulted in significant increases in mathematical thinking and communication; and (d) using student work to inform instruction (McGatha 2008). Both studies indicated a potential for positive impact on teachers' instructional practices through the use of coaches.

Campbell (1996) gathered data from a large-scale staff development program that used coaches as one component. When compared to students in the control schools, gains in student achievement were not immediate. Significant results, however, did emerge mid-way through second grade. Once achievement gains were established, students were found to have maintained those gains through second and third grade. Because this was a study that was not designed around the impact of mathematics coaches the connections cited cannot be explicitly made.

Erchick, Brosnan, Forrest, Douglass, Grant, and Hughes (2007) conducted a study for the primary purpose of understanding the effectiveness of the mathematics coaching project as a professional development intervention and its impact on student achievement. Grades 3 and 4 were used to track student achievement for the first year of the study. A pretest was administered in January as the mathematics coaches began their work, then a posttest was administered in May. Despite the short time span, modest gains in student mathematics content knowledge in both grade levels was achieved. An average increase of 9.2% on the mathematics section of the

state achievement was seen as a result of the mathematics coaching project in comparison to the state average of 6.4%.

Campbell (2007) was taking part in a study that was attempting to isolate the explicit impact of a mathematics coach on student achievement. This study focused on the first year of placement of mathematics coaches at five urban and suburban school districts. A characteristic unique to this study was the randomization of the assignment of the mathematics coaches as well as the statistical models used to isolate the impact of the coaches. As of her last report, only one school district had released any student achievement data. With obvious restrictions, Campbell reported that the lower grades reported an impact due to the coaches. Preliminary indication found no significant impact on student achievement in Grades 4 and 5; the analysis showed significant impact on the third-grade subscale of probability and statistics. The researcher hopes to begin isolating and understanding the impact of mathematics coaches as more data are collected. Even though a small amount of empirical evidence is available, critical anecdotal evidence from programs around the United States indicated that coaching can be effective in improving teaching and learning (Neufeld & Roper 2003; Poglinco et al., 2003; Richard 2003).

Research on the effectiveness of mathematics coaches who work directly with students is relatively nonexistent. However, a study by Gerretson, Bosnick, and Schofield (2008) found teachers at the elementary school level were more able to effectively plan lessons and focus on professional development when mathematics coaches were used. Teachers in this study reported student gains in achievement as a result of mathematics coaches.

The State of Georgia Mathematics Curriculum

A combination of educators from various levels of the field, with additional input provided by industry, local government, and business, worked together to develop the Georgia Performance Standards (GPS) for mathematics (http://www.georgiastandards.org/math.aspx). Members worked carefully to align the curricula with the National Council of Teachers of Mathematics Standards, the College Board, Achieve, and the American Statistical Association. They reviewed curricula from other states to remain current with what was occurring across the nation and around the world. After several revisions and extensive input from the public, the State of Georgia adopted the mathematics GPS in 2005. In 2007, the State of Georgia implemented a new Performance Standard in the area of mathematics for Grades 3-5.

The design for the Georgia Mathematics Standards came out of the effort to achieve balance among problem-solving, skills and concepts. Special emphasis was placed on computational skills, challenging concept development and realistic tasks. The curriculum encouraged students in all grades to use the language of mathematics as a means of communicating their ideas, to reason mathematically, to informally and formally evaluate mathematical arguments, and to make connections among the various mathematical topics. The core of the Georgia Mathematical Standards is to prepare students for higher level courses. Georgia Code 20-2-140, "allows school systems to add to or enrich the minimum requirements as deemed necessary or appropriate for its students and communities" (http://public.doe.k12.ga.us/math.aspx).

The Jones County Mathematics Curriculum

Jones County has Academic Knowledge and Skills (AKS) (www.gwinnett.k12.ga.us/aks.nsf?OpenDatabase&O~QuickLinks). The Academic Knowledge and Skills spell out what each student in Grades K-12 is expected to know and do at each particular grade level. Because the AKS fully detail what each student is expected to learn, teachers are able to tailor classroom instruction to better meet the needs of individual students. They have the use of technology, textbooks, and curriculum guides as well as various resources to aid in differentiated instruction.

The AKS were developed by Jones County teachers with some input from the community. Since 1995 the AKS have been reviewed, and altered if necessary, by teachers in each particular grade level or subject area (www.gwinnett.k12.ga.us/aks.nsf?OpenDatabase&O~QuickLinks). When first developed these curriculum standards were designed to correlate with the state-required curriculum and assessments, as well as standards from local, national, and world class levels (www.gwinnett.k12.ga.us/aks.nsf?OpenDatabase&O~QuickLinks).

The Jones County Public School System

Jones County Public Schools, located northeast of metropolitan Atlanta, is the largest school system in the state of Georgia and has continued to grow each year (www.gwinnett.k12.ga.us//gcps-mainwebo/.nsf/pages/Home-aboutUs1~MainPage). During the 2007-2008 school year Jones County Public Schools, GCPS, welcomed 4,000 new students. One out of every five citizens in the county is a GCPS student.

Jones County Public Schools currently has 66 elementary schools, 20 middle schools, and 16 high schools (www.gwinnett.k12.ga.us//gcps-mainwebo/.nsf/pages/Home-aboutUs1~MainPage). The projected enrollment for the 2007-2008 school year was 159,258 students and

growing. The demographics as of May 2007 showed the GCPS to be made up of 26.4% African American, 10.3% Asian American, 20.6% Hispanic, 3.7% other, and 38.8% White. The average SAT score during the 2006-2007 school year was 1524.

In the 2006-2007 school year, GCPS graduated more than 8,000 seniors (www.gwinnett. k12.ga.us// gcps-mainwebo/.nsf/pages/Home-aboutUs1~MainPage). Of those seniors, 88% were planning to attend college/postsecondary school, 1,500 of them were honor graduates, 2,600 took advanced placement classes, and a combined $71 million dollars in scholarships, not including the HOPE scholarship, was awarded to them. In 2010, Jones County Public Schools won the Broad Prize, the largest education award honoring school districts that demonstrate the greatest overall performance and improvement in student achievement while reducing gaps among poor and minority students.

Employment of Mathematics Coaches

The Jones County Public School System currently employs 10 elementary school Mathematics Coaches in nine of the elementary schools. Six of the nine schools are Title 1 schools. Title 1 classification means those schools receive additional funding due to the high number of children receiving free and reduced lunch on a daily basis. This additional funding provides the Title 1 schools with an opportunity others in the district do not have. The remaining three schools not placed under the Title 1 status have leadership teams who have chosen to take funding from other areas as a means of supporting the implementation of mathematics coaches. A complete list of schools was provided by the head of the Jones County Public Schools Mathematics Department.

Summary

The research cited here presents a review of knowledge and information about the best practices found to result in improved student achievement. A possible relationship between the use of mathematics coaches as a means of professional development and student achievement is supported by the review of literature. A review of the literature found in the areas of content knowledge and confidence in their subject knowledge, that teachers are less prepared to teach mathematics than other subjects. Chapter 3 describes the methods used in this research study. It presents the research question, the population sample, sampling methodology, data collection and analysis procedures for the report, a description of the overall study design, and information about the instruments to be used and how the instruments were developed and field tested.

CHAPTER 3

METHODOLOGY

Introduction

The purpose of the study was to examine teacher perceptions of the impact mathematics content coaches have had on instructional practices and on student learning. This chapter describes the problem, the purpose of the study, the research question, population and sample, sampling methodology, data collection procedures, data analysis procedures, and summary of the research design and methodology.

Overview of Problem and Purposes

According to Rowan (2005), after reading and language arts, mathematics is considered by some to be the second most important subject in which students should gain competency. Funding is provided for reading/language arts specialists and staff development, despite the fact that teachers are often considered to be better prepared to teach in these areas than they are in math (Rowan, 2005). On the other hand, budget constraints are often the reason given for the small amount of money allocated for mathematics content specialists and for staff development (Rowan, 2005). If such an importance is placed on mathematics in this country by school systems and those who they serve, it would be easy to argue the need for equal funding,

especially when, according to Rowan (2005), general consensus finds teachers to be less competent in mathematics content knowledge and confidence.

Several studies conducted over the last decade have found the quality of teacher knowledge and skills to be connected to student achievement (Kain, 1998; Wenglinsky, 2002). Students have been found to perform at higher levels when they are taught by a teacher with a deep understanding of mathematics content and methods (Hill et al., 2005). A review of literature has found professional staff development embedded in ongoing and on-site instruction is more likely to improve teachers' instructional practices and may result in improved student achievement (Grodsky & Gamoran, 2003; Neufeld & Roper, 2003). The evidence found in the literature supports the idea that school-based professional development incorporating the coaching model is one reform effort that impacts teachers' instruction within classrooms (Neufeld & Roper, 2003). This study examined teacher perceptions of the impact mathematics content coaches have had on instructional practices and on student learning.

The problem faced by the schools studied in this report is the need to improve student achievement in the area of mathematics so school systems can remain in compliance with No Child Left Behind and to show adequate yearly progress. Little funding is available to provide specialized staff development, specifically for the area of mathematics, unless the school is a Title I school. Most schools in the district do not use current allocated funding for the implementation of mathematics coaches.

Research Design and Methodology

This study used a survey designed by the Alabama State Department of Education (http://www.alabamapepe.com/specialist/MathSurveyfaculty.doc) and follow-up interviews with

teachers to collect data from participants. Participants in this study were Grades 3, 4, and 5 teachers from five elementary schools in a large county school system in the Southeastern United States who have been involved with the use of mathematics content specialists. Teachers responded to a 41-item Likert-type survey about their perceptions of the impact mathematics content coaches have had on instructional practices and on student learning. A select group of teachers were then involved in follow-up telephone interviews (see Appendix A for copies of instruments used).

This study was conducted in a large county school system in the Southeastern United States, Jones County. An instrument (http://www.alabamapepe.com/specialist/MathSurveyfaculty.doc) was used to collect perceptions of teachers.

Research Question

The primary research question was, What is the perceived impact mathematics content coaches have had on improving instructional practices of Grades 3, 4, and 5 teachers, and what is the perceived impact on student learning? A secondary research question was, What is the validity and reliability of the ALSDE survey and its underlying factor structure?

Assumptions of the Research

The purpose of the study was to examine teacher perceptions of the impact mathematics content coaches have had on instructional practices and on student learning. After the researcher discovered that the ALSDE survey had not been tested for validity and reliability, the secondary purpose of this research was identified: to discover the factor structure and internal reliability of the Alabama State Department of Education survey. It was hoped that the survey would help to

provide evidence about the implementation of mathematics coaches and their effect, if any, on improving instructional practices and on student learning. The following assumptions were made about the research conducted:

1. The use of mathematics content specialists has been implemented at each of the five researched schools for the purpose of improving teacher instruction.
2. Mathematics content specialists are providing staff with ongoing, sustained, site-based support in the area of mathematics.

Population of the Study

The population of the study included Grades 3, 4, and 5 teachers from five schools in a large county school system in the Southeastern United States currently using Mathematics Content Specialists in their schools. The information for their selection was provided by the Head of the Jones County Mathematics Department.

Sampling Methodology

This study included 45 teachers from Grades 3, 4, and 5 from each of the five researched elementary schools. Once provided with a list of qualified schools, the Jones County Public School System required the researcher to obtain consent from the principal of each eligible school prior to sending out surveys. A total of five principals allowed the researcher to administer surveys to their staff.

Data Collection

The instrument was administered to the Grades 3, 4, and 5 teachers at each of the five participating schools, and the data were also used to examine the factor structure and the internal reliability and validity of the Alabama State Department of Education survey. The teacher data were collected from the teacher perception survey. The researcher analyzed, using accepted quantitative and qualitative analysis procedures, data collected in order to determine results. The survey data were used to develop questions for follow-up interviews. A subset of teachers was asked to participate in follow-up telephone interviews. The purposeful sample of teachers for the follow-up interviews was selected based on their willingness to participate.

Participant names did not appear on any research instruments. No identifying information was made in the data analysis. All written materials and consent forms were stored in a locked file. Responses only appeared in statistical data summaries, and all materials were destroyed after an appropriate time period following completion of the research project.

Limitations of the Research

The research conducted may have limitations beyond the control of the researcher. Because the implementation of mathematics content specialists is a local school decision, job descriptions and expectations for math coaches may differ from school to school. These limitations may have an impact on the teachers' perceptions of their experiences with the mathematics content specialists.

A major limitation of the study is the small sample size. In a study by Costello and Osborne (2005) the researchers looked at how sample size can affect the likelihood of errors of inference regarding factor structure. An analysis of variance was performed in an effort to

examine the number of examples producing correct factor structure as a function of sample size. This analysis found 70% of the larger samples tended to produce solutions that were accurate. In contrast only 10% of the samples with a 2:1 ratio or smaller, as seen in this study, produced correct solutions.

Analysis of the data from the small sample within this study produced little variability within the survey. Although the researcher was aware the sample size was small, it was thought that reporting the results of the factor analysis may be beneficial because the survey is used by at least one state department of education.

Research Instrument

A teacher perception survey was used, with permission, of the Alabama Department of Education (http://www.alabamapepe.com/specialist/MathSurveyfaculty.doc). This instrument is used by the Alabama Department of Education as a component of their appraisal of professional practices. This instrument was subjected to an exploratory factor analysis and the factor structure determined.

The Alabama survey uses criteria from the former Alabama Professional Education Personnel Evaluation Program (PEPE), which concentrates on competencies and knowledge/skills which effective educators are known to possess, on performance standards, and on results. The Alabama Department of Education developed the teacher perception survey in an effort to collect information about perceptions of an individual's performance with regard to Alabama's approved standards for teacher or administrator performance, in this case mathematics coaches, to be used as part of their yearly professional evaluation.

The teacher perception survey was used by this researcher to obtain teachers' perceptions of the impact mathematics coaches have had on improving instructional practices and on student learning. Because the survey is based on research on teacher performance and performance coaching it has face validity. The researcher expected it to reflect the components of effective mathematics coaches; however, an exploratory factor analysis was conducted to discover the factor structure of the measure and examine the internal reliability and validity of the survey. Because the number of respondents was smaller than expected, the results are of limited value.

Validity and Reliability of the Data Collection Instrument

According to the ALSDE (personal communication, September 11, 2008), the validity of the survey stems from specific procedures used in its development:

1. The survey instrument was directly generated from the Alabama Teacher Competencies which were developed in concert with teachers, administrators, and teacher educators, and approved by the Alabama State Board of Education, ALSDE, as the standards for teacher performance in Alabama.
2. Every item on the survey was generated from the performance indicators and definition items that defined teacher competencies.
3. Items in the surveys administered to different samples of respondents were appropriate to their experience and language levels. Respondents were asked to respond only to items pertaining to processes, procedures, activities, events for which they would have had only first-hand experience/information.
4. The survey was reviewed by teachers, administrators, and teacher educators serving on Alabama's teacher evaluation task forces.

5. The survey was field tested statewide, and the results were analyzed to identify any seeming problems and/or biases. In some cases, a survey item was dropped or wording was changed as a result of the analysis.

With a perceptual survey, reliability of responses cannot be fully determined because there is no one right answer because it measures perceptions. However, the procedures described above contributed to the reliability, as well as validity, and emphasis was placed on procedures which contributed to accuracy of results such as the following:

(a) standardized, systematic survey administration procedures,

(b) training of those who administered and scored surveys,

(c) an electronic scoring routine that lessened administrator time commitment and reduced computational errors,

(d) a procedure was developed for eliminating outlier responses which could have affected scores (personal communication, September 11, 2008).

Summary

Several researchers have found deficits in the area of mathematics instruction (Cohen & Hill, 2000; Grodsky & Gamoran, 2003; Neufeld, 2002; Neufeld & Roper, 2003; Robertson, 2005). In an effort to ensure success of their students and teachers, several districts have implemented the use of mathematics coaches and have reported positive results (Cohen & Hill, 2000; Neufeld, 2002; Robertson, 2005; Rowan, 2005, Virginia Mathematics and Science Coalition Task Force 2005).

The Alabama State Department of Education survey (http://www.alabamapepe.com/specialist/MathSurveyfaculty.doc) was used to collect teacher perceptions on the impact

mathematic content coaches have had on instructional practices and on student learning. Additional follow-up interviews were conducted with a purposefully selected group of teachers.

The primary research question was, What is the perceived impact mathematics content coaches have had on improving instructional practices of Grades 3, 4, and 5 teachers and what is the perceived impact on student learning? After the researcher discovered that the ALSDE survey had not been tested for validity and reliability, the secondary purpose of this research was to discover the factor structure and internal reliability and validity of the Alabama State Department of Education survey. The secondary research question was, What is the reliability and validity of the ALSDE survey and its underlying factor structure?

Once provided with a list of eligible schools, a total of five elementary schools agreed to participate in the study. All Grades 3, 4, and 5 teachers from the participating schools were administered the Alabama State Department of Education survey (http://www.alabamapepe.com/specialist/MathSurveyfaculty.doc). Follow-up interviews were conducted with a select group of teachers.

CHAPTER 4

RESULTS OF THE STUDY

Introduction

The purpose of the study was to examine teacher perceptions of the impact mathematics content coaches have had on instructional practices and on student learning. The survey allowed the researcher to study teacher perceptions of the impact mathematics content coaches have had on instructional practices and on student learning. Chapters 1-3 of this dissertation provided background on mathematics content specialists, a review of significant literature related to the use of mathematics content specialists, and a description of the research methods. This chapter provides a description of the data collected, how the data were analyzed, and presents the findings from the study.

Several studies conducted over the last decade have found the quality of teacher knowledge and skills to be connected to student achievement (Kain, 1998; Wenglinsky, 2002). Students have been found to perform at higher levels when they are taught by a teacher with a deep understanding of mathematics content and methods (Hill et al., 2005). A survey and follow-up interviews were used to collect data about teacher perceptions on the implementation of mathematic content coaches. The survey data were then analyzed to determine factor structure, reliability, and validity of the survey items.

Study Participants

Surveys were distributed to a total of 151 teachers from the five participating schools. Out of the initial 151 surveys distributed, 22, or 14.6%, were returned. To increase participation the researcher contacted the five participating schools and asked permission to redistribute surveys to eligible staff. Out of the 30 additional surveys distributed, 23, or 76.6%, were returned.

Thus, from 151 surveys distributed to the five participating schools, 45, or 29.8% were returned. Nineteen teachers agreed to participate in the follow-up interview; however, on contrast, 15 of the 19 participants agreed to be interviewed.

Survey Results

The survey consisted of two parts. The first part of the survey was composed of 41 questions that allowed teachers to choose from a 5-point Likert-type scale with the response choices of *rarely*, *sometimes*, *usually*, *almost always*, and *don't know*. The second part of the survey consisted of three open-ended questions asking for more specific information about how much time each respondent spends with the mathematics content coach, how their instruction has been improved, as well as any suggested improvements to the coaching process. Upon completion of the surveys the researcher conducted follow-up interviews. The teacher interviews consisted of seven questions related to the research question as well as additional follow-up questions (see Appendix C, for a copy of the interview protocol).

Research Question 1

What is the perceived impact mathematics content coaches have had on improving instructional practices of Grades 3, 4, and 5 teachers and what is the perceived impact on student learning?

Survey Part I: ALSDE Survey Results

The following frequency table summarized 45 participants' responses to each of 41 survey questions. The number in each cell is the frequency of the responses. The percentage in the parenthesis is the row percentage of each type of responses.

The frequency table indicated that the majority of people almost always agree with the survey statement. For all 41 questions, the response type of "almost always" has the highest frequency, and the response type "usually" is the second choice other than "almost always". Only few people choose "rarely" or "sometimes". In summary, the participants are very satisfied with mathematics coaches' performance.

Table 1

Frequency Table of Participants' Responses to Each of 41 Survey Questions

	Response					
Question	Rarely	Sometimes	Usually	Almost always	Don't know	Missing
Q1	2 (4.4%)	5 (11.1%)	15 (33.3%)	23 (51.1%)	0	0
Q2	1 (2.2%)	7 (15.6%)	15 (33.3%)	22 (48.9%)	0	0
Q3	0	4 (8.9%)	7 (15.6%)	34 (75.6%)	0	0
Q4	4 (8.9%)	7 (15.6%)	14 (31.1%)	19 (42.2%)	1 (2.2%)	0
Q5	0	5 (11.1%)	13 (28.9%)	27 (60%)	0	0
Q6	0	2 (4.4%)	13 (28.9%)	25 (55.6%)	5 (11.1%)	0
Q7	1 (2.2%)	5 (11.1%)	12 (26.7%)	27 (60%)	0	0
Q8	1 (2.2%)	4 (8.9%)	12(26.7%)	27 (60%)	0	1 (2.2%)
Q9	0	3 (6.7%)	3 (6.7%)	38 (84%)	0	1 (2.2%)
Q10	2 (4.4%)	1 (2.2%)	9 (20%)	31 (68.9%)	0	2 (4.4%)
Q11	4 (8.9%)	4 (8.9%)	8 (17.8%)	28 (62.2%)	1 (2.2%)	0

	Response					
Question	Rarely	Sometimes	Usually	Almost always	Don't know	Missing
Q12	0	3 (6.7%)	5 (11.1%)	37 (82.2%)	0	0
Q13	2 (4.4%)	3 (6.7%)	4 (8.9%)	35 (77.8%)	1 (2.2%)	0
Q14	1 (2.2%)	4 (8.9%)	8 (17.8%)	32 (71.1%)	0	0
Q15	1 (2.2%)	6 (13.3%)	12 (26.7%)	26 (57.8%)	0	0
Q16	1 (2.2%)	5 (11.1%)	10 (22.2%)	29 (64.4%)	0	0
Q17	0	3 (6.7%)	10 (22.2%)	31 (68.9%)	1 (2.2%)	0
Q18	6 (13.3%)	5 (11.1%)	11 (24.4%)	22 (48.9%)	1 (2.2%)	0
Q19	0	3 (6.7%)	5 (11.1%)	35 (77.8%)	2 (4.4%)	0
Q20	3 (6.7%)	4 (8.9%)	12 (26.7%)	23 (51.1%)	3 (6.7%)	0
Q21	1 (2.2%)	5 (11.1%)	5 (11.1%)	34 (75.6%)	0	0
Q22	1 (2.2%)	2 (4.4%)	7 (15.6%)	35 (77.8%)	0	0
Q23	0	3 (6.7%)	8 (17.8%)	33 (73.3%)	1 (2.2%)	0
Q24	0	3 (6.7%)	13 (28.9%)	28 (62.2%)	1 (2.2%)	0
Q25	2 (4.4%)	8 (17.8%)	17 (37.8%)	17 (37.8%)	1 (2.2%)	0
Q26	0	1 (2.2%)	7 (15.6%)	37 (82.2%)	0	0
Q27	2 (4.4%)	3 (6.7%)	10 (22.2%)	29 (64.4%)	1 (2.2%)	0
Q28	1 (2.2%)	3 (6.7%)	14 (31.1%)	24 (53.3%)	1 (2.2%)	2 (4.4%)
Q29	2 (4.4%)	4 (8.9%)	15 (31.3%)	23 (51.1%)	0	1 (2.2%)
Q30	1 (2.2%)	11 (24.4%)	10 (22.2%)	22 (48.9%)	1 (2.2%)	0
Q31	3 (6.7%)	12 (26.7%)	9 (20%)	21 (46.7%)	0	0
Q32	3 (6.7%)	9 (20%)	10 (22.2%)	20 (44.4%)	2 (4.4%)	0
Q33	2 (4.4%)	3 (6.7%)	10 (22.2%)	30 (66.7%)	0	0
Q34	1 (2.2%)	3 (6.7%)	5 (11.1%)	36 (80%)	0	0
Q35	2 (4.4%)	8 (17.8%)	15 (31.3%)	20 (44.4%)	0	0
Q36	5 (11.1%)	8 (17.8%)	14 (31.1%)	16 (35.6%)	2 (4.4%)	0
Q37	1 (2.2%)	9 (20%)	10 (22.2%)	25 (55.6%)	0	0
Q38	1 (2.2%)	5 (11.1%)	9 (20%)	28 (62.2%)	0	2 (4.4%)
Q39	4 (8.9%)	7 (15.6%)	12 (26.7%)	18 (40%)	4 (8.9%)	0
Q40	1 (2.2%)	2 (4.4%)	9 (20%)	32 (71.1%)	1 (2.2%)	0
Q41	3 (6.7%)	3 (6.7%)	5 (11.1%)	34 (75.6%)	0	0

Table 2 lists the important variables (item of questionnaires) in each factor. It suggests Factor 1 (performance) may be a comprehensive measurement of the performance of the content coach. Statistically, Factors 2 (collaboration), 3 (environment), and 4 (attitude) measure different aspects of the performance of the content coach.

Table 2

List of the Important Variables in Each Factor

Factor	Important variables (item of questionnaires)
1	Q9, Q13, Q14, Q15, Q16, Q17, Q18, Q19, Q21,Q22, Q25, Q28,Q32, Q35, Q38, Q40
2	Q1, Q4, Q7, Q10, Q12, Q20, Q26, Q27, Q29, Q30
3	Q2, Q3, Q5, Q6, Q8, Q33, Q34, Q37
4	Q11, Q23, Q24, Q39

Discussion of ALSDE Survey Results Part I

Responses to survey items can be grouped into four main themes: performance, collaboration, environment, and attitude. The first theme contained performance-related questions. The 16 questions found within this theme were used to provide a comprehensive measurement of the performance of instructional specialists. Questions asked for opinions related to each content specialist's ability to communicate information effectively, develop student assessments, role taken in improving instruction and student outcomes, as well as a variety of other performance-related behaviors. Responses to the 5-point Likert-type scale for each of the 16 questions found within the performance theme were as follows: *rarely* = 23 (4%), *sometimes* = 74 (11%), *usually* = 144 (20%), *almost always* = 445 (62%), and *don't know* = 10 (2%). These questions were skipped a total of 5 times, 1%.

The second theme, collaboration, measured the effectiveness of collaboration and communication between the instructional specialists and the teachers in training. The 10 questions found within this theme asked for opinions related to each content specialist's ability to evaluate programs and instruction, assist teachers and administrators in understanding instructional programs, remain positive and maintain composure, as well as a variety of other behaviors related to collaboration. Responses to the 5-point Likert-type scale for each of the 10

questions found within the collaboration theme were as follows: *rarely* = 16 (4%), *sometimes* = 44 (10%), *usually* = 109 (24), *almost always* = 271 (61%), and *don't know* = 6 (1%). These questions were skipped a total of 3 times, <1%.

The 8 questions found within the third theme, environment, measure the goodness of the teaching and learning environment created by the instructional specialists. Questions found within this theme asked for opinions related to each content specialist's ability to accept input from teachers related to suggested programs, assist in overcoming barriers to teaching and learning, use information from student performance to improve instruction, create a school environment conducive to increasing student achievement, as well as a variety of other behaviors related to the school environment. Responses to the 5-point Likert-type scale for each of the 8 questions found within the Environment theme were as follows: *rarely* = 6 (1%), *sometimes* = 37 (10%), *usually* = 85 (24%), *almost always* = 226 (63%), and *don't know* = 5 (2%). These questions were skipped a total of 1 time, <1%.

The 4 questions found within the fourth theme, attitude, reflected that of the instructional specialist's innovation. Questions found within this theme asked for opinions related to each content specialist's ability to celebrate instructional and academic improvement, promote and support innovations, use gained information to make changes, interpret, and clarify pertinent program-related law. Responses to the 5-point Likert-type scale for each of the 4 questions found within the attitude theme were as follows: *rarely* = 16 (4%), *sometimes* = 44 (10%), *usually* = 109 (24%), *almost always* = 271 (61%), and *don't know* = 6 (1%). None of these questions were skipped, 0%.

There was little difference found among the responses to each of the four themes. Within all four themes the response type of *almost always* has the highest frequency of occurrence at

62%, with *always* being the second most chosen response at 23%. This demonstrates participants are very satisfied with the mathematics coaches' performance, collaboration, environment, and attitude. Few respondents chose *usually* (23%), *sometimes* (10%), and *rarely* (5%) as their response choice.

Discussion of ALSDE Survey Results Part II

Several research studies related to professional development focused on the enhancement of teacher learning. Research has found teacher learning to be enhanced when (a) it shows commitment to the teaching profession, (b) it provides structured improvement activities that offer teachers a sense of agency, (c) it is a coordinated effort geared toward improving achievement in students, (d) it exhibits a caring attitude that is found to extend to colleagues and students, and (e) it instills a respect for life-long learning (Birman et al., 1998; Gamoran, 2003). School reformers have recognized the significant role teacher's professional development has on improving U.S. schools (OSPI, 2003; Sykes & Darling-Hammond, 1999). Each of the items listed above are found in the four themes discussed. When these items are present many researchers also reported levels of teacher satisfaction as found in the survey responses listed above.

Survey Part II: Open-ended Question Results

The second part of the survey was composed of three open-ended questions designed to obtain specific information about respondents' experiences with the mathematics content coach.

Survey Questions

The first open-ended question asked, "What specifically, has the instructional specialist done to improve your teaching of math?"

When respondents were asked to discuss how the mathematics content coach has helped to improve their instruction, as in question 42, two main themes became evident: lesson modeling, which includes observation and feedback, and lesson development. Four respondents, 8.8%, chose not to answer this question.

Observing a lesson modeled by the mathematics content coach was the response given more than any other when respondents were asked what specifically has helped improve their mathematics instruction. One teacher stated, "Having the opportunity to observe an expert provides me with additional tools to be the best I can be in a manner our usual staff development doesn't provide" (Teacher 3). Another teacher said, "Watching a modeled lesson by our mathematics coach helps me better understand how to teach my students difficult concepts that I may not have done as great a job with otherwise" (Teacher 10). This reflects what Mizell (2006) discovered in his research. Mizell stated that coaches are a dynamic, positive, and concrete way to embed adult learning in the routine of the regular school day. Yet another stated, "Teachers are always looking for new and better ways to teach the same thing and when you have somebody with the knowledge of our mathematics coach available to model new or difficult skills, it is a big help" (Teacher 15.) A majority of the teachers did not elaborate beyond just writing modeling lessons as well as observing lessons and providing feedback.

Observation and feedback. When respondents described how modeled lessons improved their instructional practices, a majority of the teachers also discussed how the use of observation

and feedback often followed the modeled lessons. One teacher wrote about, "being able to watch a lesson or have somebody watch me then have a conversation about it with a person who is always available gives me a greater confidence in what I am doing" (Teacher 20). Another stated, "Having an open dialog with the expertise of our coach allows me an honest view of how best to reach my students" (Teacher 9). Another challenge facing coaches is the school culture in which they work, according to Russo (2004). Often the coaches' role is entirely new and unique, leaving teachers unaccustomed to the dialogue that is required. With such a challenge facing mathematics coaches, the fact that many of the respondents were comfortable with being observed and dialoging about the observation was a positive result.

Lesson development. Respondents described how beneficial it was to have that "go to" person when they either did not feel confident with a particular skill, or needed some guidance on how best to implement required curriculum. One teacher said,

> As a new teacher in an upper grade the stress of test scores and student achievement began to take a toll. Having the ability to sit down with somebody who is an expert in the field, helped to provide me with direction and a curriculum map that was best suited for the success of my students. (Teacher 13)

Another teacher stated, "The start of the year can often be overwhelming. By having somebody sit down and work with me to develop a good guided math program helped take away some anxiety about my math instruction" (Teacher 19).

The second open-ended question asked, "On a weekly basis how much time do you spend with the instructional specialist and how is that time spent?"

Time spent with the mathematics content coaches can be categorized into two groups. Group one saw the mathematics content coach on a weekly basis ranging from 30 minutes to 4

hours per week. Group two saw the mathematics content coach only one or two times every 9 weeks. Seven respondents chose not to answer the question at all.

Question 43 sought to determine how often teachers had the ability to work with their mathematics coaches. Darling-Hammond and McLaughlin (1995) reported that for professional development to be effective, it needs to be sustained, ongoing, intensive, supported by coaching and collective problem solving around specific forms of practice. Seven respondents, 15.5%, chose not to respond to this question. Thirty-five of the respondents, 77.7%, came in contact, in one form or another, with their mathematics coaches on a weekly basis. Each of these respondents met with their coach once a week from 30 minutes to 4 hours. Three respondents, 6.8%, did not have the opportunity to meet with their coach on a weekly basis. Their responses varied from 1 entire week a semester, only during math specials every 8 days, as well as once or twice a semester.

The third open-ended question was, "Do you feel any improvements could be made regarding the use of the instructional specialists in your building and if so what would those improvements be?"

This question asked respondents to make improvement suggestions. The researcher was quite surprised by the lack of respondents who took the opportunity to respond and make suggestions for improvement. Seventeen respondents, 37.7%, skipped this question while six others just wrote, "none" or "she is perfect." Gorman (2003) indicated that aspects of community, such as distributed decision making, collaboration, and shared values, contribute to teacher's commitment and effectiveness when working with a content coach. For this reason the researcher was surprised to find the respondents did not take the opportunity to have their voice heard and be part of the decision-making process. In this community setting it was their feedback

that helps mold the mathematics content coaching program. Another possibility for the lack of responses may relate to the sense of community within the school. Perhaps no response was given in an effort to preserve the sense of community found within each school.

The overwhelming theme suggested by the respondents revolved around spending more time in the classroom. One teacher stated, "I only wish I had a great deal more time to spend with the coach" (Teacher 14). Another suggested, "In addition to more time I would like for administration to do a better job of creating a long-term schedule for the coaches so we could best use the time we have" (Teacher 7). Another teacher stated,

> My greatest suggestion would be to have more time available for the coaches to work with us. From what I can see she is pulled in so many directions to do a variety of things in addition to her coaching duties. (Teacher 11)

Yet another teacher stated, "In addition to spending more time with us in our classrooms I would really enjoying using their expertise to help me in planning my lessons" (Teacher 27). One teacher talked about the need for two mathematics content specialists in each building. She said, "There is such a difference between material presented on an upper and lower grades. I would like to have one coach designated for the lower grades and one designated for the upper grades" (Teacher 36).

One challenge facing coaches was the school culture in which they work. Often the coaches' role is entirely new and unique, leaving teachers unaccustomed to the dialog that is required (Russo, 2004). This challenge can lead to a misunderstanding in regard to the purpose and role of the content coach. This was evident in some of the responses for question 44, which asked, "If respondents felt any improvements could be made regarding the use of the instructional specialists in your building and if so what would those improvements be?"

When asked what improvements could be made, a few respondents said the mathematics content coaches' time would be better spent working with lower level students. One teacher stated, "We are desperate for help with students below grade level. This would be a better use of time than teaching the teachers" (Teacher 39). Another teacher said, "I wish the math coach would just teach a special class and reinforce what we teach in the classroom" (Teacher 32). Yet another teacher stated, "I believe the math coaches should be the ones to help with kids who struggle" (Teacher 29). A final teacher stated, "I would like to see the coaches working with my low achieving students to build their confidence and background knowledge" (Teacher 23). Each of these demonstrated a lack of understanding of the coach's role.

Discussion of Open-ended Question Results

Joyce and Showers (2002) stated that teachers who are provided with continued assistance by their peer experts are more likely to achieve a higher level of implementation of their training. Showers found teachers working with a content specialist coach used instructional objectives and specific teaching models in more appropriate ways than their un-coached counterparts (Showers, 1982, 1984).

Responses that fell under the theme of lesson modeling, which included observation and feedback, reflected what Mizell (2006) discovered in his research. Mizell stated that coaches are a dynamic, positive, and concrete way to embed adult learning into the routine of the regular school day. Green (2004) stated that coaches modeling lessons in the classroom does help teachers to rethink and modify their instructional practice.

Responses found within the theme of lesson development reflected what research has shown. Research on staff development practice has found the traditional models of professional

development most used by schools are inadequate for supporting the improvement of classroom practice (Cohen, McLaughlin, & Talbert, 1993; Lieberman, 1994; Saunders et al., 1992). According to Cohen et al. (1993), the typical staff development is centered on a sit and get format with no continued dialog and conversation. Several researchers believe, just as the respondents above, that teachers are in need of some type of ongoing specific follow-up as a critical component for supporting teachers in their practice (Guskey, 2000; Garet et al., 2001). They agreed this follow-up is necessary when integrating new knowledge and skills into classroom practice and in helping to sustain the practice over time with depth of understanding.

Darling-Hammond and McLaughlin (1995) reported that for professional development to be effective, it needs to be sustained, ongoing, intensive, supported by coaching and collective problem solving around specific forms of practice as seen in the responses to the second open-ended question. In Boston (Boston Plan for Excellence, 2001; Neufeld & Roper, 2003a; Russo, 2004) they replaced their original coaching model of a 1-day-a-week, one-teacher-at-a-time rotation to a revolving cycle designed with school leaders, coaches, and teachers. In Philadelphia the school district used surveys from teachers and administrators to mold instructional improvements for their coaching model (Neufeld & Roper, 2003a, Russo 2003). Green (2004) listed the factors hindering the effectiveness of the coaching model as a lack of time, teacher resistance, and scheduling conflicts. One current model of coaching used for professional development is one in which teachers and coaches work side-by-side in conjunction with others to improve teaching practices (http://www.bpe.org/publications.aspx; Guiney, 2001; Neufeld & Roper, 2003a). This coaching model revolves around the use of collaboration, reflection, modeling of new practices with given support and direction, support and follow-through,

dialogue, and collaboration (http://www.bpe.org/publications.aspx). All of which was seen in the participant responses to the third open-ended question.

Survey Part III: Teacher Interview Results

Teacher interviews were selected based on their willingness to participate. Nineteen teachers agreed to participate in the follow-up interviews; however, 15 interviews were conducted. The teacher interviews (see Appendix C for interview questions) consisted of seven questions related to participants' understanding of the content coach's role at the school, how time is spent with the coach, and administration's explanation of the coach's role in the school.

The following results are from the interviewee responses. Often respondents gave the same answer to a particular question. For reporting purposes like responses to a particular question were only reported once. Because the use of a content specialist is such a departure from the standard staff development practices. the researcher first sought to determine the interviewees' understanding of the coaches' role and purpose in regard to staff development practices.

The respondents reported the importance of observation and feedback as an essential component of their content coach's role. Their responses and understanding of their content coach's role in regard to staff development correlated with what research has found to be the key components of that role. One respondent stated, "My coach genuinely cares about my growth as a teacher and improving student achievement." Another respondent said, "Our coach has had an extremely positive influence on student learning." Yet another respondent said, "My coach really makes me feel comfortable enough to come with any question I have regardless of how simple it may be." Respondents listed things such as a coordinated effort geared toward improving student

achievement, improved instructional strategies and lessons, and a caring attitude that extends to colleagues and students, as seen in the research by Gamoran (2003) and Birman et al. (1998).

Several respondents commented on how their content coach has taught them to be reflective thinkers through observation and discussion. During the interview a respondent stated, "The coach has taught me how to reflect on my teaching of a specific content area and make necessary improvements or changes through the use of observation and continued discussions." Several others stated, "Even the littlest questions I have are answered and she will make sure that you fully understand something you had difficulty with." Additional respondents said, "The time spent with my coach after an observation and discussion is priceless. I truly appreciate their insight into how I can better teach my students."

As previously noted, one limitation of the research study was the fact that the Jones County Public School System does not fund the use of mathematics content coaches; therefore, there are no set guidelines for the implementation of the position. In an attempt to compare how each of the studied schools implemented the use of their content coach, in relation to the districts reviewed in the literature, the researcher asked the interviewees about the time spent with their content coach.

Although all interviewees talked about the benefit of individualized time with the content coach, 8 of the 15 respondents said more of their time with the coach was spent working with grade levels or department groups leading discussions and demonstrations similar to what was implemented in New York City.

One of the discussion questions asked the interviewees if they felt the mathematics content coaches at each of their schools have had a positive influence on their mathematics instruction. The overwhelming response to this question was yes. One respondent stated, "Any

kind of assistance I can get is always positive. New ideas and a better understanding of what I am doing and how to best do it is a good thing." Another teacher stated, "Having somebody to model lessons, observe lessons, and spend time discussing both with me has strengthened the belief that I am doing the right thing with my students. I am thankful for that." These responses mirror the research conducted by Mizell (2006). Mizell (2006) stated that coaches are a dynamic, positive, and concrete way to embed adult learning in the routine of the regular school day. The result of a positive and dynamic individual who is there for your benefit is a positive experience for teachers.

A few respondents talked about how their mathematics content specialist works hard to make it a positive experience. One respondent stated, "At first I didn't know what to expect as I was being observed and later in our discussions. My coach knew that and worked very hard to make me comfortable and confident." Another said, "When we were first introduced to this new idea I didn't know what to make of it. Time has shown me what a benefit it has been to my instruction."

Another question asked respondents the same thing about student learning. A study conducted on Reflective Coaching, by Rock (2002), described the underlying support for job-embedded professional development found in this form of coaching. Based on the use of the Iowa Tests of Basic Skills reading component, students whose teachers implemented this model increased their test scores in a range from 7% to 70%. Responses seemed to mirror what Rock found. One teacher stated, "Since we began working with our coach test scores in math have shown improvement." Another teacher stated, "I have seen a positive result with my students. Some of the lessons my coach has given me really engaged my class and made learning fun for

them." Another respondent said, "I definitely think my students have grown thanks to the coach at my school. When I do I better job they do a better job."

While discussing interviewees' opinions on the effects of student learning a few of the respondents started out positively relating their experience with the coach to student learning but then moved in another direction. These respondents discussed how they felt the staff development provided by their coach has positively influenced student outcomes but that they felt those individuals could be better utilized in other ways. One interviewee stated, "The coach has been a nice asset but she would be better served teaching those students instead of the teachers." Yet another stated, "It seems like each year we see more and more students who aren't able to keep up and need help. With class sizes continuing to increase we need as many people as possible working with these students, not trying to teach us."

The last question revolved around the role of the principal. Interviewees were asked what role their principal has played in making them aware of the coach's role and the tone set for their position in the school. The researcher had some difficulty getting the interviewees to elaborate on their principal's role. Most all respondents stated their principal clearly explained the role of the content coach and worked to create a climate that encouraged collaboration with the coach. However, after continued discussion with many of the interviewees it was clear to the researcher that several of those interviewed felt their principal clearly explained the role of the coach but in reality they truly did not have a concrete understanding of this role, as intended in the literature.

Discussion of Interview Results

Rosenthal (1989) described teaching as an isolated profession where peers do not often have the opportunity to collaborate on instruction and teachers teach in isolation from their peers. The coaching model, in contrast, provides ongoing, site-based, sustained staff development.

After extensive research, Buly and Valencia (2002) found that through classroom-based professional development, teachers were able to be observers and decision makers because their knowledge was immediately situated in the complex practices of the classroom environment. Each answer given by respondents mirrors what Buly and Valencia (2002) stated in their research.

The cities of Boston, Massachusetts; Philadelphia, Pennsylvania; Louisville, Kentucky; San Diego, California; and Corpus Christi, Texas, are school districts that have implemented a variety of different coaching models as a part of their reform efforts (Neufeld & Roper, 2003a). Each system chose to implement the use of the content coach in different ways. In Boston the model initially used was one-day-a-week, one-teacher-at-a-time (Boston Plan for Excellence, 2001). In New York City the content coaches worked with small groups of teachers during their planning as well as providing classroom demonstrations for teachers to observe (Russo, 2004). In Philadelphia the content coach worked part-time at several schools (Russo, 2004). Each district took a different approach to how they would implement the content coach in an effort to improve instructional practices and students' learning just as each of the studied schools did. Each district was pleased with the outcome of their efforts.

Eight respondents said their coaches spent more time working with grade levels or department groups leading discussions and demonstrations. Seven interviewees' experiences were similar to what the Boston School System implemented in regard to the individualized time

spent with individual teachers. These individuals had the opportunity to spend a great deal of individualized time with the coach. All interviewees spent time with the coach as a whole school faculty, within their grade level, or department group, as well as individually.

The intended goal of coaching is for reflection and personal growth. In education, coaching is a way to move teachers in the direction of new instructional strategies and knowledge about teaching/learning (Thomas, 1995; Whitmore, 1992). A few of the interviewees began discussing how they felt the coach in their building could best be utilized. Each of these interviewees began talking about how students have become needier and time would be better utilized teaching those students who struggle the most. Collectively they believed teaching the teachers would not be as beneficial as directly teaching those students with the greatest need.

Neufeld and Roper (2003b) listed the principal as the key to the implementation of the coaching model within the school and stated how the principal can pose a challenge to this implementation. According to research, principal belief in the coaching model, program funding, teacher acceptance, and training are a just a few of the challenges that often face schools implementing this form of staff development (Neufeld & Roper, 2003b; Russo, 2004; Stein et al., 1999). In this study, I found individuals who thought they understood the coaching model but clearly demonstrated a lack of understanding. This was reflected in responses to question 43 and in the interviews conducted, where respondents were asked what improvements they would recommend. It is another example of how a lack of understanding may affect the relationship between the coaches and the teachers with whom they work. At least three of the respondents who described their desire for the coach to work with needy students also described their feelings of frustration that went along with that belief. One interviewee said,

> I feel like the challenges we face keep growing, yet we are always being watched and checked on for producing perfection. I want all my students to be successful but I can't do it alone. Why don't we use the coaches that way?

In another discussion a respondent stated, "We are under so much pressure and are always the first to be blamed for lack of success. Maybe if we had help working with our students who need it most we won't feel as stressed." Russo (2004) wrote about how school culture was a challenge that faces the success of coaches in a school. This challenge also leads to a misunderstanding in regard to the purpose and role of the content coach.

Research Question 2

What is the validity and reliability of the ALSDE survey and its underlying factor structure?

Data Analysis

Survey data were tabulated, subjected to descriptive statistical analysis. An exploratory factor analysis was applied to the 41-question survey. Prior to performing the exploratory factor analysis a pairwise correlation between the 41 variables was calculated to discover the factor structure and examine the internal reliability of the Alabama State Department of Education survey.

The scree plot of eigenvalues suggests four underlying important factors. The first factor (performance) was generated from 16 survey items, and is essentially a comprehensive measurement of the performance of instructional specialist. The second factor (collaboration), which was generated from 10 survey items, measures the effectiveness of collaboration and communication between the instructional specialists and the teachers in training. The third factor

(environment), which was generated from 8 survey items, puts more emphasis on the measure of the goodness of teaching and learning environment created by the instructional specialists. The fourth factor (attitude), which was generated from 4 survey items, is related to the measure of attitude of the instructional specialists on innovation. Cronbach's α coefficients indicated very strong internal consistency for all the four factors: Cronbach's $\alpha = 0.963$ for Factor 1 (performance), Cronbach's $\alpha = 0.923$ for Factor 2 (collaboration), Cronbach's $\alpha = 0.929$ for Factor 3 (environment), and Cronbach's $\alpha = 0.842$ for Factor 4 (attitude). Table 3 displays the factor loadings, factor components and descriptive statistics for these four factors.

Table 3

Factors, Survey Items, Factor Loadings, Descriptive Statistics, and Reliabilities for Variable Scales (N = 45)

Factors	Factor description and survey items loading on the factor	Factor loadings	Range	Mean	SD
Factor 1					
PERFORMANCE	Comprehensive measurement of the performance of instructional specialist				
	*The instructional specialist actively leads us in developing and implementing appropriate policies and procedures that promote proficient learning for all students.	0.783	1.000-4.000	3.489	0.787
	*The instructional specialist takes an active role in improving curriculum and instruction	0.769	2.000-4.000	3.636	0.613
	*The instructional specialist contributes positively to improvement of instruction	0.759	2.000-4.000	3.795	0.553
	*The instructional specialist helps us establish routines and procedures that contribute to learning and teaching of various content	0.750	1.000-4.000	3.119	0.993
	*The instructional specialist conducts planning, modeling, and feedback sessions (i.e., coaching cycles) with teachers	0.741	1.000-4.000	3.178	0.886
	*The instructional specialist communicates the importance of focusing on the needs of students	0.715	1.000-4.000	3.689	0.668
	*The instructional specialist communicates information clearly and succinctly	0.708	1.000-4.000	3.400	0.809
	*The instructional specialist assists in developing appropriate student assessments	0.691	2.000-4.000	3.744	0.581
	*The instructional specialist keeps abreast of teaching/learning research and best practices	0.678	2.000-4.000	3.795	0.553
	*The instructional specialist promotes the use of technology in the programs	0.666	1.000-4.000	3.452	0.739
	*The instructional specialist models research-based instructional procedures and helps teachers implement these procedures	0.664	1.000-4.000	3.556	0.893
	*The instructional specialist sets high standards for teacher and student performance	0.605	1.000-4.000	3.578	0.753

(*table continues*)

Factors	Factor description and survey items loading on the factor	Factor loadings	Range	Mean	SD
	*The instructional specialist develops program plans with teachers and administrators	0.584	1.000-4.000	3.488	0.798
	*The instructional specialist performs duties in a professional manner	0.550	1.000-4.000	3.600	0.780
	*The instructional specialist actively promotes and facilitates a school-wide commitment to the improvement of instruction and learning	0.549	1.000-4.000	3.114	0.868
	*The instructional specialist works to make the school a place where students learn content well	0.543	1.000-4.000	3.114	1.083
	Cronbach's α = 0.963				
Factor 2 COLLABORATION	Measure of the effectiveness of collaboration and communication between the instructional specialists and the teachers in training				
	The instructional specialist helps us to identify and solve problems	0.737	1.000-4.000	3.444	0.785
	The instructional specialist makes faculty a part of the decision making process	0.717	1.000-4.000	3.310	0.924
	The instructional specialist communicates regularly with me	0.710	1.000-4.000	3.311	0.848
	The instructional specialist leads us in evaluating programs and instruction	0.693	1.000-4.000	3.091	0.984
	The instructional specialist regularly monitors the program, instruction, and student progress	0.686	1.000-4.000	3.500	0.821
	The instructional specialist maintains open, two-way communication with school faculty	0.633	2.000-4.000	3.756	0.570
	The instructional specialist works closely with teachers and administrators, helping them to understand the school's instructional programs and their roles in them	0.612	1.000-4.000	3.605	0.760
	The instructional specialist seeks to provide me with relevant professional growth opportunities	0.589	1.000-4.000	3.205	0.904
	The instructional specialist creates opportunities for faculty, staff, parents, and others to share ideas, suggestions, etc	0.522	1.000-4.000	3.341	0.834
	The instructional specialist is a positive person who maintains his/her composure	0.509	2.000-4.000	3.800	0.457
	Cronbach's α = 0.923				

(*table continues*)

Factors	Factor description and survey items loading on the factor	Factor loadings	Range	Mean	SD
Factor 3 ENVIRONMENT	Measure of the goodness of teaching and learning environment created by the instructional specialists				
	The instructional specialist works with us to ensure that program standards, instruction, and measures of learning are aligned	0.710	1.000-4.000	3.689	0.701
	The instructional specialist helps to create a school environment conducive to increasing achievement	0.688	1.000-4.000	3.511	0.815
	The instructional specialist assists teachers in instructional planning	0.679	1.000-4.000	3.311	0.874
	I am given the opportunity to provide input to activities and programs led by this instructional specialist	0.634	1.000-4.000	3.289	0.815
	The instructional specialist helps us overcome barriers to teaching and learning.	0.561	1.000-4.000	3.605	0.760
	The instructional specialist uses information about student performance to help us improve programs and instruction	0.539	1.000-4.000	3.114	0.868
	The instructional specialist is knowledgeable of laws and policies that affect the school and the instructional program	0.516	1.000-4.000	3.341	0.834
	The instructional specialists finds new ways to do things better	0.502	1.000-4.000	3.114	1.083
	Cronbach's $\alpha = 0.929$				
Factor 4 ATTITUDE	Measure of attitude of the instructional specialists on innovation				
	The instructional specialist promotes and supports innovations	0.905	2.000-4.000	3.682	0.601
	The instructional specialist uses information gained from a variety of sources to lead us in making changes in programs and our instruction	0.801	2.000-4.000	3.568	0.625
	The instructional specialist believes in celebrating instructional and academic improvement	0.739	1.000-4.000	3.364	0.990
	The instructional specialist interprets and clarifies pertinent program-related law and policies for teachers	0.560	1.000-4.000	3.073	1.010
	Cronbach's $\alpha = 0.842$				

Pearson correlations were calculated to assess criteria-related validity between the four factors. Highly significant correlations were found (p-value < 0.0001). The results are presented in Table 4. For example, Factor 1 (performance) and Factor 2 (collaboration) at 0.543, Factor 1 (performance) and Factor 3 (environment) at 0.285, Factor 1 (performance) and Factor 4 (attitude) at 0.309, Factor 2 (collaboration) and Factor 3 (environment) at 0.234, Factor 2 (collaboration) and Factor 4 (attitude) at 0.339, Factor 3 (environment) and Factor 4 (attitude) at 0.240.

Table 4

Pearson Correlation among Four Factors

	PERFORMANCE	COLLABORATION	ENVIRONMENT	ATTITUDE
PERFORMANCE	1			
COLLABORATION	0.543*	1		
ENVIRONMENT	0.285*	0.234*	1	
ATTITUDE	0.309*	0.339*	0.240*	1

Note: *p-value < 0.0001.

Survey Results Part III: Analysis for Teacher Survey Questionnaire

The secondary purpose of the study was to discover the factor structure and examine the internal reliability of the Alabama State Department of Education survey. The primary purpose of the researcher was to look at teachers' perceptions of the impact mathematics coaches have had on improving instructional practice and on student learning.

To obtain a comprehensive understanding of the responses to this survey questionnaire, the researcher applied an exploratory factor analysis on the 41 questions using the a Likert-type

scale. Exploratory factor analysis is a statistical method used to reveal the unobservable latent structure underlying the observed variables such as items of questionnaires.

Before doing the exploratory factor analysis, the researcher calculated the pairwise correlation between the 41 variables. Table 5 lists part of the correlation matrix, which illustrates that there are fairly strong associations between some variables. Thus, the exploratory factor analysis may be useful here to detect the latent factors.

Table 5

Pairwise Correlation Matrix

Correlations	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Q1	1.00000										
Q2	0.46684	1.00000									
Q3	0.28721	0.31802	1.00000								
Q4	0.47217	0.31447	0.50347	1.00000							
Q5	0.25174	0.12016	0.50158	0.58832	1.0000						
Q6	0.21955	0.19647	0.17924	0.45250	0.34067	1.00000					
Q7	0.60067	0.37335	0.52989	0.65185	0.46664	0.36366	1.0000				
Q8	0.65337	0.27426	0.35493	0.33836	0.23484	0.04459	0.54100	1.00000			
Q9	0.33946	0.13348	0.62126	0.45680	0.51556	0.51952	0.63469	0.46139	1.00000		
Q10	0.65288	0.54112	0.59439	0.63706	0.49461	0.38112	0.62946	0.57720	0.58498	1.00000	
Q11	0.20142	0.04163	0.47953	0.30201	0.50739	0.56079	0.44442	0.31130	0.51669	0.36352	1

As the first step of exploratory factor analysis, eigenvalues were calculated for the correlation matrix, which are also known as the factor numbers and corresponding eigenvalues. The results are summarized in Table 6. The eigenvalues were sorted from the largest to the smallest. The column difference means the difference between a certain eigenvalue and its next one. The column proportion means the proportion of a certain eigenvalue in the total summation of all eigenvalues. The column cumulative means the cumulative proportion. As seen, there are 35 non-zero eigenvalues.

Table 6

Eigenvalues of the Correlation Matrix

Eigenvalues of the Correlation Matrix: Total = 41 Average = 1				
	Eigenvalue	Difference	Proportion	Cumulative
1	19.7879966	17.1400151	0.4826	0.4826
2	2.6479815	0.3194060	0.0646	0.5472
3	2.3285755	0.1562864	0.0568	0.6040
4	2.1722890	0.4429168	0.0530	0.6570

Four factors were extracted based on the scree plot.(Figure 1). Notice that a secondary change-point occurred at the fourth factor, implying a four-factor solution. The results presented in the following figure are based on retaining the first four factors.

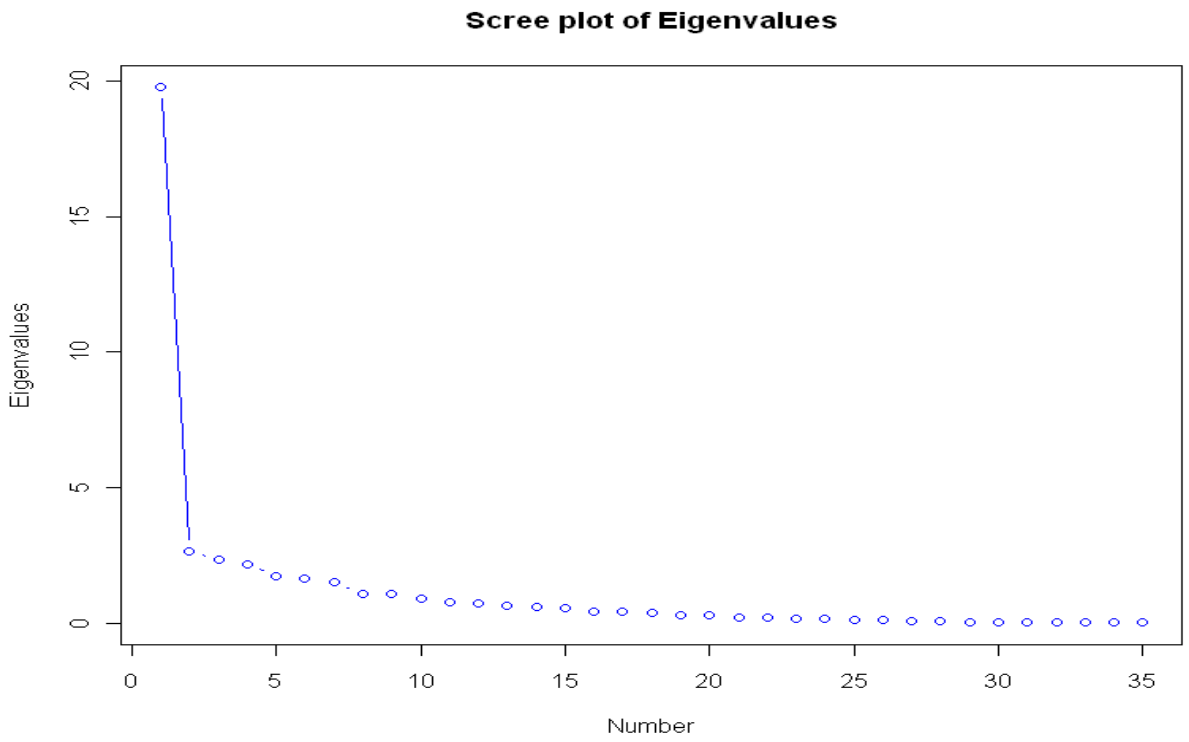

Figure 1. Scree plot of eigenvalues.

The data were subjected to Varimax rotation (see final Varimax rotation table Appendix G).

Table 7

Variance Explained by Each Factor

Factor1 PERFORMANCE	Factor2 COLLABORATION	Factor3 ENVIRONMENT	Factor4 ATTITUDE
10.175060	7.032541	5.502507	4.226735

Summary

This chapter described results from the surveys, the 15 interviews that were conducted, and the factor analysis presented. The frequency table indicated that the majority of people almost always agree with the survey statement. For all 41 questions, the response type of "almost always" has the highest frequency, and the response type "usually" is the second choice other than "almost always". Only few people choose "rarely" or "sometimes". In summary, the participants are very satisfied with mathematics coaches' performance.

Responses to survey items can be grouped into four main themes. These were: Performance, Collaboration, Environment, and Attitude. There was little difference found among the responses to each of the four themes. Within all four themes the response type of "almost always" has the highest frequency of occurrence 62%, with "almost always" being the second most chosen response, 23%. This demonstrates participants are very satisfied with the mathematics coaches' performance, collaboration, environment, and attitude. Few respondents chose "usually" 23%, "sometimes" 10%, and "rarely" 5%, as their response choice.

Overwhelmingly the respondents talked about the value of having an expert in the mathematical field available for observations, feedback, lesson development, and just being there to support their needs. Respondents felt the content coaches genuinely cared about them and had their best interests at heart. Bryk and Schneider (2002) reported that staff development centered on a trust between adults is a necessary component of school reform and directly related to academic achievement. Respondents described how they were comfortable approaching their content coaches with any question or concern no matter how small they felt it was. As found in the open-ended questions, respondents talked about their desire to spend more time with the content coaches. Many of them noted the full schedule their content coaches wrestled with on a regular basis. A few respondents described their desire to have coaches time spent teaching needy students instead of teachers. Each respondent had one coach available to service the entire school.

Survey data were subjected to an exploratory factor analysis. The major findings of the survey were as follows: the scree plot of the eigenvalues of the pairwise correlation matrix between 41 survey question variables suggests that there were four important latent factors underlying the 41 survey questions. Factor 1 (performance) is essentially a comprehensive measurement of the performance of instructional specialists, factor 2 (collaboration) measures the effectiveness of collaboration and communication between the instructional specialists and the teachers in training, factor 3 (environment) puts more emphasis on the measure of the goodness of teaching and learning environment created by the instructional specialists, factor 4 (attitide) is related to the measure of attitude of the instructional specialists on innovation . Cornbach's α coefficients indicated very strong internal consistency for all four factors.

CHAPTER 5

SUMMARY AND DISCUSSION

Introduction

This chapter provides a summary of the findings, discussion of results, and recommendations for research on mathematics content coaches. The intention of this study was to examine teacher perceptions of the impact mathematics content coaches have had on instructional practices and on student learning. Darling-Hammond and McLaughlin (1995) reported that for professional development to be effective, it needs to be sustained, ongoing, intensive, and supported by coaching and collective problem solving around specific forms of practice. The research continues to show how teacher professional development can influence and change a teacher's practices within the classroom (Desimone et al., 2002; Neufeld & Roper, 2003).

This study looked at how the implementation of a mathematics content coach may affect a teacher's instructional practices as well as student learning. The researcher used a Professional Education Personnel Evaluation Survey developed and used by the Alabama State Department of Education (http://www.alabamapepe.com/specialist/MathSurveyfaculty.doc) to conduct research for this study. The primary research question was, What is the perceived impact mathematics content coaches have had on improving instructional practices of Grades 3, 4, and 5 teachers and what is the perceived impact on student learning? A secondary research question was, What is the validity and reliability of the ALSDE survey and its underlying factor structure?

The researcher studied five elementary schools with varied demographics and sizes to gather data about the impact mathematics content coaches have had on instructional practices and on student learning. There were 151 teachers asked to participate in the study. Of the 151 surveys distributed, 45, or 29.8%, were collected. A select group of teachers was selected to participate in follow-up interviews. Fifteen teachers participated in a follow-up interview.

The theoretical framework for this dissertation stems from research on how staff development practice has shown the traditional models of professional development most used by schools are inadequate for supporting the improvement of classroom practice (Cohen et al., 1993; Lieberman, 1994; Saunders et al., 1992). Traditional staff development practices often teach new methodology and curricula through a limited number of days of in-service workshops that are most often focused on topics unrelated to issues facing teachers on a daily basis (Fuhrman, 1993). Teachers are then often left alone in their classrooms to interpret this information and to put it into practice. Research has shown that the results of this form of staff development were unchanged instructional practices by teachers and unchanged academic success for students (Cuban, 1990; Darling-Hammond & McLaughlin, 1995; McLaughlin & Zarrow, 2001; Neufeld & Roper, 2003; Powell et al., 1995; Saunders et al., 1992; Tharp & Gallimore, 1988; Tyack & Tobin, 1994).

A vast amount of evidence reinforces the importance of professional development as one reform effort found within a school that can positively impact a teacher's instruction within the classroom (Neufeld & Roper, 2003). Staff development can influence, impact, and change practices within the classroom (Desimone et al., 2002). Research has shown the types of staff development that most impact instructional practices, which are (a) focused on specific, higher-order teaching strategies, (b) reflective, (c) high quality, (d) coherent in nature, (e) collaborative,

and (f) focused on a shared vision and values (Birman et al., 1998; Morrissey, 2000; Tighe, Wang, & Foley, 2002).

Summary of Teacher Survey Results and Teacher Interview Results

The primary research question was, What is the perceived impact mathematics content coaches have had on improving instructional practices of Grades 3, 4, and 5 teachers and what is the perceived impact on student learning? A secondary research question was, What is the validity and reliability of the ALSDE survey and its underlying factor structure? This study utilized an exploratory factor analysis on the 41 questions using a Likert-type scale. This statistical method was used to reveal the unobservable latent structure underlying the observed variables.

The first part of the survey was composed of 41 questions that allowed teachers to choose from a 5-point Likert-type scale with the response choices of *rarely*, *sometimes*, *usually*, *almost always*, and *don't know*. The frequency table indicated that the majority of people almost always agree with the survey statement. Responses to survey items can be grouped into four main themes. These were: Performance, Collaboration, Environment, and Attitude. There was little difference found among the responses to each of the four themes. There was little difference found among the responses to each of the four themes. Within all four themes the response type of "almost always" has the highest frequency of occurrence 62%, with "almost always" being the second most chosen response, 23%. This demonstrates participants are very satisfied with the mathematics coaches' performance, collaboration, environment, and attitude. Few respondents chose "usually" 23%, "sometimes" 10%, and "rarely" 5%, as their response choice.

The second part of the survey consisted of three open-ended questions seeking to obtain more specific information about how much time each respondent spends with the mathematics content coach, how their instruction has been improved, as well as any suggested improvements. When reviewing responses to the first open-ended question, two main themes became evident: lesson modeling, which included observation and feedback, and lesson development.

Twenty out of 45, or 44.4%, of respondents who answered the first question mentioned modeling lessons. Fourteen, or 31.1%, of respondents described how the mathematics content coach assisted with lesson development as well as strategies for best instructional practices. Eight, or 17.7%, chose to skip the question all together. There were a few other more versatile responses such as assistance with assessment, resource for manipulatives, and a little bit of everything.

The second question looked at the amount of time respondents spent with the mathematics content specialists. Respondents reported a range from 30 minutes to 4 hours a week. Three respondents do not have the opportunity to meet with their mathematics coach on a weekly basis.

The last question allowed respondents the opportunity to offer any improvement suggestions. The researcher was surprised to find 17 respondents, 37.7%, chose not to answer this question, while 6 others just wrote “none,” or “she is perfect.” For those who did answer the question the overwhelming theme was a need for additional time as the leading suggestion for improvement.

Summary of Procedures

The procedures utilized in this study included the use of a 41-question survey developed and used by the State of Alabama Department of Education (http://www.alabamapepe.com/ specialist/ MathSurveyfaculty.doc). This instrument is used by the Alabama Department of Education as a component of their appraisal of professional practices. The teacher perception survey was used by this researcher to determine teachers' perceptions of the impact mathematics coaches have had on improving instructional practices and on student learning. Forty-five of the 151 eligible teachers voluntarily responded to the survey, representing a 29.8% participation rate. In a Monte Carlo study of exploratory factor analysis, Preacher (2002) demonstrated that even when a study has a low sample size, the underlying factor structure can still be adequately recovered.

To obtain a comprehensive understanding of the survey questionnaire, the researcher applied an exploratory factor analysis on the 41 questions using a Likert-type scale. The exploratory factor analysis was used to reveal the unobservable latent structure underlying the observed variables. The researcher first began the analysis by calculating the pairwise calculations between the 41 variables. When completed, the next step was to calculate the eigenvalues of the correlation matrix. The eigenvalues were then sorted from largest to smallest. Next the researcher determined how many factors were to be extracted based on the scree plot. A varimax rotation, which is an orthogonal rotation of the factor axes to maximize the variance of the square loadings of a factor, was adopted. This rotation helps to make the results more understandable. Correlations with a critical p-value of $< .05$ were found to be an important component in the corresponding factors.

The perception survey administered had three open-ended questions for respondents to respond to. The researcher reviewed responses and discussed how those responses related to the literature. The first question had a total of 8 respondents, 17.7%, who chose not to answer this question. A total of 4 respondents, .09%, chose not to answer the second question. Seven respondents, 15.5%, chose not to answer the last question, while 2 simply wrote "none" or "she is perfect."

The researcher conducted follow-up interviews with a total of 15, 33.3%, of the respondents. The respondents were chosen based on their willingness to participate.

Discussion of the Findings

The first part of the study consisted of a 41 item Likert-type scale. A frequency table indicated that the majority of people almost always agree with the survey statement. Responses to survey items can be grouped into four main themes. These were: Performance, Collaboration, Environment, and Attitude. For all 41 questions, the response type of "almost always" has the highest frequency, and the response type "usually" is the second choice other than "almost always". Only few people choose "rarely" or "sometimes". In summary, the participants are very satisfied with mathematics coaches' performance.

The second part of the survey was composed of three open-ended questions designed to obtain specific information about respondents' experiences with the mathematics content coach. When reviewing responses to the first open-ended question two main themes became evident: lesson modeling, which included observation and feedback, and lesson development. The second question sought to obtain insight into how often teachers have the ability to work with their mathematics coach. Most respondents met with their coach once a week from 30 minutes to 4

hours. A few respondents did not have the opportunity to meet with their coach on a weekly basis. Other responses varied from 1 entire week a semester, only during math specials every 8 days, as well as once or twice a semester. The final question asked respondents to make any improvement suggestions. The overwhelming theme suggested by the respondents revolved around spending more time in the classroom.

Fifteen interviews were conducted by the researcher. The interview questions were designed to provide the researcher with detailed information based on the research question for this study. The interviewees reported the importance of observation and feedback as an essential component of their content coach's role. Several interviewees commented on how their content coach has taught them to be reflective thinkers through observation and discussion. A few respondents demonstrated their lack of a true understanding of the purpose of a coach.

In an attempt to compare how each of the studied schools implemented the use of their content specialist in relation to the districts from the literature, the researcher asked the interviewees about the time spent with their content specialist. All interviewees spent time with the coach as a whole school faculty, within their grade level or department group, as well as individually. Neufeld and Roper (2003b) listed the principal as the key to the implementation of the coaching model within the school and stated how the principal can pose a challenge to this implementation. Each respondent stated their administrator clearly explained the role of the content coach and worked to create a climate that encouraged collaboration with the coach.

Statistical analysis was conducted on the 41 survey questions, which used a Likert-type scale. Specifically, the exploratory factor analysis was used to reveal the unobservable latent structure underlying the observed items of questionnaires. The scree plot of the eigenvalues of the pairwise correlation matrix between 41 survey question variables suggests that there were

four important latent factors underlying the 41 survey questions. The list of the important survey questions in each factor were summarized in Table 6.

The dominant factor, or Factor 1 (performance), is essentially a comprehensive measurement of the performance of instructional specialists. Statistically, the other three factors (collaboration, environment, attitude) measure different aspects of the performance of instructional specialists. The practical explanation of what aspects of the instructional specialists' performance these three factors are measuring is not obvious. However, after careful investigation of the survey questions, which are strongly associated with these three factors, one can summarize the practical meanings of them as follows. Factor 2 (collaboration) measures the effectiveness of collaboration and communication between the instructional specialists and the teachers in training. Factor 3 (environment) puts more emphasis on the measure of the goodness of teaching and learning environment created by the instructional specialists. Factor 4 (attitude) is related to the measure of attitude of the instructional specialists on innovation.

Limitations

This research study consisted of limitations that may have affected the outcome of results. Since the implementation of mathematics content coaches is a local school decision, job descriptions and expectations for math coaches will differ from school to school. These limitations could have an impact on the teachers' perceptions of their experiences with the mathematics content coaches.

Another limitation affecting the validity of the research is the limited amount of participants who were willing to take part in the study. Because participation was voluntary, there was little the researcher could do to increase the number willing to participate. The lack of

participants completing the survey also led to a lack of available participants for the follow-up interviews. The researcher had intended on choosing interview participants based on the results of the surveys but when only 19 respondents were willing to participate in the follow-up interview the researcher was forced to interview any respondent willing to participate.

One of the major concerns for the exploratory factor analysis in this paper is the small sample size. This issue has been investigated by quite a few researchers. For example, through a Monte Carlo study of exploratory factor analysis, Preacher (2002) demonstrated that even when the sample sizes are low in the study, the underlying factor structure can still be adequately recovered if communalities are high, model error is low, and few factors are retained. More recently, de Winter, Dodou, and Wieringa (2009) made similar conclusions through comprehensive simulation studies. Therefore, the exploratory factor analysis may still be valid in our study with small sample size. Nevertheless, the researcher realizes that more reliable analytical results can be obtained from the exploratory factor analysis given that the researcher has a larger sample size.

In a study by Costello and Osborne (2005) the researchers looked at how sample size can affect the likelihood of errors of inference regarding factor structure. An analysis of variance was performed in an effort to examine the number of examples producing correct factor structure as a function of sample size. This analysis found 70% of the larger samples tended to produce solutions that were accurate. In contrast only 10% of the samples with a 2:1 ratio or smaller, as seen in this study, produced correct solutions.

The small sample size found within this study produced little variability within the survey. Although the researcher was aware the sample size was small, it was thought that

reporting the results of the factor analysis may be beneficial because the survey is used by at least one state department of education.

Practical Implications

Researchers have found professional development to be an effective tool in helping teachers make the much needed changes to their current practices, especially when it was site based and ongoing (Fanke et al., 2005). These researchers found that site-based staff development with mathematics content specialists, or any subject specialists, to be critical for improving student learning and instruction, perhaps because it is job embedded. In turn, researchers have found students perform at higher levels when they are taught by a teacher with a deep understanding of mathematics content and methods (Hill et al., 2005).

Future Research

One recurring assumption of the coaching model is that by improving teacher instructional practices student achievement will be positively impacted. At this point in time there is little quantitative evidence found within the research that coaching impacts student achievement. Many districts have implemented the coaching model within their professional development models because of the qualitative case studies that have been conducted (Neufeld & Roper, 2003a).

The coaching model has not been broadly implemented and as a result there is no empirical data linking it directly to the improvement of student achievement (Neufeld & Roper, 2003). Much of the current research emphasizes the need for additional studies to examine the relationship between the use of the coaching model and student achievement. The difficulty

resulting from the lack of research supporting this model of reform is the gamble districts take when implementing it. Many schools districts rely heavily on the data available to support their reform choices. With little quantitative evidence in the research demonstrating a link between the coaching model and improved student achievement resulting from improved instructional practices, many districts choose not to implement the coaching model. If districts are staying away from this model due to a lack of evidence, how are we going to increase the research available on this topic?

The cities of Boston, Massachusetts; San Diego, California; Philadelphia, Pennsylvania; and New York, New York, had districts that chose to implement this reform model and continued using the coaching model because it was deemed to be successful. In the end, it is solid quantitative data that is needed to help raise awareness of the success found within these districts as a result of the coaching model (Boston Plan for Excellence, 2001; Neufeld & Roper, 2003; Russo, 2004). Districts will continue to find challenges when implementing the coaching model. Money, time, and isolationist practices are just some of the road blocks standing in the way of adding to the data needed to further this model. The implementation found in the above schools perhaps provides evidence that this reform model is ready for large-scale research and analysis.

Conclusion

This chapter outlined a summary of the study procedures and discussion of the findings, while looking at the practical implications of the research. The limitations of the research were reviewed along with recommendations for further research. Although the results cannot be

generalized to other research, the limited data found within this study will help to inform future studies conducted.

While limited in statistical significance, this study does add to the existing body of research devoted to the implementation of the coaching model in an effort to improve teacher instructional practices and student learning. Further research should also be conducted on how the implementation of the coaching model directly effects student achievement.

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APPENDIX A

CONSENT TO PARTICIPATE IN RESEARCH FOR TEACHERS

CONSENT TO PARTICIPATE IN RESEARCH FOR TEACHERS

Dear participant,

My name is Leyah Nicometi and I work at Craig Elementary in the Brookwood cluster as a kindergarten teacher. Currently, I am also working on my Ed.D at The University of Alabama. It is my hope that you will be willing to assist me with my research project. Below is a brief description of the project. I am conducting a survey of teacher perceptions of the impact of math coahes. Each survey will be given an identification code to ensure all results remain confidential. I understand how busy you are, but if you will be willing to participate I would greatly appreciate it. **All I need for you to do is to complete the enclosed survey, place it in the provided envelope, and then return it to me by currier. It should only take about 20 minutes to complete. The following consent form should be signed and returned with the survey.** If you have any questions or concerns, please feel free at any time to contact me any time. Thank you again for your time and assistance with my graduate studies.

Would you be willing to participate in a brief follow-up phone interview regarding your experiences with the instructional specialist? _____ yes _____no

My dissertation Supervisor is Dr. Daisy Arredondo-Rucinski, Professor in Educational Leadership and Policy Studies, at The University of Alabama. You may contact her at darredo@bamaed.ua.edu.

Sincerely, _____ Leyah K. Nicometi _____Date

TITLE:	Teacher perceptions on the use of Mathematics Coaches for Improvement of Instructional Practices
INVESTIGATOR:	Leyah K. Nicometi 2375 Cobble Creek Lane Grayson, Ga 30017 678-469-4456
ADVISOR:	Dr. Daisy E. Arredondo-Rucinski, Ph.D. Professor Educational Leadership, Policy, and Technology Studies College of Education 205-348-7826
SOURCE OF SUPPORT:	This study is being conducted as a partial fulfillment of the requirements for the doctoral degree in Educational Administration at University of Alabama.
PURPOSE:	You are being asked to participate in a research project that seeks to investigate the perceived impact mathematics coaches have on improving instructional practices and on student learning.

RISKS AND BENEFITS:	There are no risks or benefits to the participants.
COMPENSATION:	Participation in the project will require no monetary cost to you. You will not be compensated for your participation. An envelope has been provided for the return of your response.
CONFEDENTIALITY:	Your name will not appear on any research instruments. No identifying information will be made in the data analysis. All written materials and consent forms will be stored in a locked file. Your responses will appear only in statistical data summaries. All materials will be destroyed after the completion of the research project.
RIGHT TO WITHDRAW:	You are under no obligation to participate in this study. You are free to withdraw your consent to participate at any time.
SUMMARY OF RESULTS:	A summary of the results of this research project will be supplied to you upon request.
VOLUNTARY CONSENT:	I have read the above statements and understand what is being asked of me. I also understand that my participation in this research project is voluntary and that I am able to withdraw my consent at any time, for any reason. On these terms, I certify that I am willing to participate in this research project. I understand that should I have any concerns about my participation in this study, I may call the investigator at 678-469-4456 or email her at Leyah_Nicometi@gwinnett.k12.ga.us. If I have any concerns that my rights are being violated, I may contact Ms. Tanta Myles at the University of Alabama Institutional Review Board for the Protection of Human Subjects at (205) 348-5152.

_____ _____

Participant's Signature **Date**

_____ _____

Investigator's Signature **Date**

APPENDIX B

TEACHER SURVEY

Teacher Survey

Dear Participant,

The purpose of this study is to examine the perceived impact mathematics coaches have had on improving instructional practices and student learning. Five Jones County elementary schools who have implemented the use of mathematics coaches have been selected to complete the perception survey. Individual survey results will be assigned a number for tracking purposes only. Participant confidentiality will be maintained. Results will remain anonymous and only known to the researcher.

Because you are a faculty or staff member in a school served by the instructional specialist/coach, you have been selected to complete this survey. This information is used to assist in assessing the effectiveness of the instructional specialist/coach. It will take approximately 15-20 minutes to complete. Your responses are important and will remain confidential. Therefore, do not place your name on this survey. When you have finished, please return the survey in the enclosed envelope to the contact person named on the cover of this survey. If you have any questions, you may call the contact person.

Please respond to all statements by circling one number or letter to the right of the statement. Respond from your own knowledge about this instructional specialist using the following rating scale with the corresponding response choices:

1 - rarely
2 - sometimes
3 - usually
4 - almost always
x - don't know

Statement	Rarely	Sometime	Usually	Almost Always	Don't Know
1. The instructional specialist communicates regularly with me.	1	2	3	4	x
2. I am given the opportunity to provide input to activities and programs led by this instructional specialist.	1	2	3	4	x
3. The instructional specialist helps us overcome barriers to teaching and learning.	1	2	3	4	x
4. The instructional specialist leads us in evaluating programs and instruction.	1	2	3	4	x
5. The instructional specialist uses information about student performance to help us improve programs and instruction.	1	2	3	4	x
6. The instructional specialist is knowledgeable of laws and policies that affect the school and the instructional program.	1	2	3	4	x

7. The instructional specialist helps us to identify and solve problems.	1	2	3	4	x
8. The instructional specialist finds new ways to do things better.	1	2	3	4	x
9. The instructional specialist contributes positively to improvement of instruction.	1	2	3	4	x
10. The instructional specialist works closely with teachers and administrators, helping them to understand the school's instructional programs and their roles in them.	1	2	3	4	x
11. The instructional specialist believes in celebrating instructional and academic improvement.	1	2	3	4	x
12. The instructional specialist maintains open, two-way communication with school faculty**.**	1	2	3	4	x
13. The instructional specialist sets high standards for teacher and student performance.	1	2	3	4	x
14. The instructional specialist communicates information clearly and succinctly.	1	2	3	4	x
15. The instructional specialist actively leads us in developing and implementing appropriate policies and procedures that promote proficient learning for all students.	1	2	3	4	x
16. The instructional specialist takes an active role in improving curriculum and instruction.	1	2	3	4	x
17. The instructional specialist works to make the school a place where students learn content well.	1	2	3	4	x
18. The instructional specialist assists in developing appropriate student assessments.	1	2	3	4	x
19. The instructional specialist performs duties in a professional manner.	1	2	3	4	x
20. The instructional specialist makes faculty a part of the decision making process.	1	2	3	4	x
21. The instructional specialist communicates the importance of focusing on the needs of students.	1	2	3	4	x

22. The instructional specialist actively promotes and facilitates a school-wide commitment to the improvement of instruction and learning.	1	2	3	4	x
23. The instructional specialist promotes and supports innovations.	1	2	3	4	x
24. The instructional specialist uses information gained from a variety of sources to lead us in making changes in programs and our instruction.	1	2	3	4	x
25. The instructional specialist promotes the use of technology in the programs.	1	2	3	4	x
26. The instructional specialist is a positive person who maintains his/her composure.	1	2	3	4	x
27. The instructional specialist regularly monitors the program, instruction, and student progress.	1	2	3	4	x
28. The instructional specialist helps us establish routines and procedures that contribute to learning and teaching of various content.	1	2	3	4	x
29. The instructional specialist creates opportunities for faculty, staff, parents, and others to share ideas, suggestions, etc.	1	2	3	4	x
30. The instructional specialist seeks to provide me with relevant professional growth opportunities.	1	2	3	4	x
31. The instructional specialist assists me in understanding how to integrate technology into my instruction.	1	2	3	4	x
32. The instructional specialist conducts planning, modeling, and feedback sessions (i.e., coaching cycles) with teachers.	1	2	3	4	x
33. The instructional specialist helps to create a school environment conducive to increasing achievement.	1	2	3	4	x
34. The instructional specialist works with us to ensure that program standards, instruction, and measures of learning are aligned.	1	2	3	4	x
35. The instructional specialist develops program plans with teachers and administrators.	1	2	3	4	x
36. The instructional specialist provides feedback to teachers about their instruction.	1	2	3	4	x
37. The instructional specialist assists teachers in instructional planning.	1	2	3	4	x

38. The instructional specialist models research-based instructional procedures and helps teachers implement these procedures.	1	2	3	4	x
39 The instructional specialist interprets and clarifies pertinent program-related law and policies for teachers.	1	2	3	4	x
40. The instructional specialist keeps abreast of teaching/learning research and best practices.	1	2	3	4	x
41. The instructional specialist is a mentor to teachers.	1	2	3	4	x

42. What specifically, has the instructional specialist done to improve your teaching of math? **Please use the back of this form to provide an answer.**

43. On a weekly basis how much time do you spend with the instructional specialists and how is that time spent? (eg. Observing model lessons, lesson feedback discussions, staff in-services)

44. Do you feel any improvements could be made regarding the use of the instructional specialists in your building and if so what would those improvements be? **Please use the back of this form to provide an answer.**

Thank you for your time and help. Your participation is greatly appreciated.
Please return this questionnaire by currier in the provided envelope to **Leyah K Nicometi, Craig Elementary**. Comments or questions can be sent directly to **Leyah_Nicometi@gwinnett.k12.ga.us**.

APPENDIX C

INTERVIEW QUESTIONS

Interview Questions

1. What do you believe the purpose of a content specialist or subject specific coach is?

2. During the 2008-2009 school year please estimate the amount professional development hours spent with the mathematics coach/coaches at your school in the following settings

   _____whole school faculty _____grade level or department group ____individualized assistance

3. How do you feel the mathematics coach/coaches spend the majority of their time?

4. What do you feel is the primary focus of the mathematics coach/coaches at your school?

5. Do you feel the mathematics coach/coaches at your school have had a positive influence on your mathematics instruction?

6. Do you feel the mathematics coach/coaches have had a positive, or any, influence on student learning?

7. Has your administrative team clearly explained the role of the mathematics coach/coaches to you?

APPENDIX D

CORRELATION MATRIX FOR VARIABLES

The Whole Correlation Matrix for 41 Variables

Correlations												
		Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**
Q1	Q1	1.00000	0.46684	0.28721	0.47217	0.25174	0.21955	0.60067	0.65337	0.33946	0.65288	0.20142
Q2	Q2	0.46684	1.00000	0.31802	0.31447	0.12016	0.19647	0.37335	0.27426	0.13348	0.54112	0.04163
Q3	Q3	0.28721	0.31802	1.00000	0.50347	0.50158	0.17924	0.52989	0.35493	0.62126	0.59439	0.47953
Q4	Q4	0.47217	0.31447	0.50347	1.00000	0.58832	0.45250	0.65185	0.33836	0.45680	0.63706	0.30201
Q5	Q5	0.25174	0.12016	0.50158	0.58832	1.00000	0.34067	0.46664	0.23484	0.51556	0.49461	0.50739
Q6	Q6	0.21955	0.19647	0.17924	0.45250	0.34067	1.00000	0.36366	0.04459	0.51952	0.38112	0.56079
Q7	Q7	0.60067	0.37335	0.52989	0.65185	0.46664	0.36366	1.00000	0.54100	0.63469	0.62946	0.44442
Q8	Q8	0.65337	0.27426	0.35493	0.33836	0.23484	0.04459	0.54100	1.00000	0.46139	0.57720	0.31130
Q9	Q9	0.33946	0.13348	0.62126	0.45680	0.51556	0.51952	0.63469	0.46139	1.00000	0.58498	0.51669
Q10	Q10	0.65288	0.54112	0.59439	0.63706	0.49461	0.38112	0.62946	0.57720	0.58498	1.00000	0.36352
Q11	Q11	0.20142	0.04163	0.47953	0.30201	0.50739	0.56079	0.44442	0.31130	0.51669	0.36352	1.00000
Q12	Q12	0.53034	0.29931	0.50689	0.60436	0.43954	0.54601	0.49537	0.41404	0.68678	0.63195	0.39443
Q13	Q13	0.41121	0.16169	0.62909	0.53420	0.64493	0.32103	0.58217	0.48929	0.76677	0.62035	0.53340
Q14	Q14	0.21738	0.06494	0.39317	0.27300	0.49110	0.40120	0.43387	0.34752	0.82785	0.43254	0.37574
Q15	Q15	0.49590	0.16197	0.63019	0.36284	0.52533	0.23087	0.62664	0.60555	0.72799	0.49530	0.40340
Q16	Q16	0.26821	0.17514	0.70246	0.49340	0.60594	0.32330	0.47638	0.53315	0.79284	0.61664	0.50813
Q17	Q17	0.55748	0.34399	0.61515	0.44177	0.54254	0.23607	0.47932	0.60820	0.58708	0.63384	0.48870
Q18	Q18	0.34262	0.21384	0.49231	0.45102	0.72583	0.45219	0.50535	0.38972	0.67033	0.57183	0.34072
Q19	Q19	0.45396	0.30312	0.63480	0.47212	0.63507	0.31759	0.57476	0.53909	0.75552	0.72313	0.54842
Q20	Q20	0.58071	0.18048	0.43245	0.56758	0.36186	0.36729	0.59213	0.47768	0.58144	0.63542	0.27772
Q21	Q21	0.33565	0.20980	0.73798	0.53675	0.56523	0.36908	0.50535	0.47415	0.79808	0.62155	0.46515
Q22	Q22	0.45446	0.45508	0.64107	0.41753	0.41597	0.35085	0.36750	0.54911	0.70120	0.77139	0.35170
Q23	Q23	0.16012	0.04690	0.20186	0.19104	0.21909	0.63765	0.29241	0.22504	0.41404	0.35687	0.73911
Q24	Q24	0.17091	0.03688	0.19230	0.10027	0.22773	0.49184	0.23851	0.26025	0.28140	0.32202	0.65230
Q25	Q25	0.26782	0.14427	0.18494	0.02950	0.28621	0.21034	0.18294	0.40592	0.44373	0.28161	0.19588
Q26	Q26	0.36218	0.36197	0.28898	0.36911	0.39776	0.52110	0.35141	0.17184	0.51044	0.52460	0.31871
Q27	Q27	0.44825	0.27862	0.46016	0.48644	0.34823	0.52171	0.59780	0.53514	0.72947	0.61337	0.33164
Q28	Q28	0.40082	0.23050	0.55648	0.42851	0.51719	0.45345	0.60269	0.57840	0.83415	0.53284	0.38775
Q29	Q29	0.47485	0.36996	0.43635	0.63899	0.62292	0.26661	0.54470	0.53562	0.47442	0.65030	0.38456
Q30	Q30	0.42777	0.27302	0.32923	0.50589	0.50106	0.51665	0.65429	0.36705	0.61801	0.45336	0.44039

Correlations												
		Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**
Q31	Q31	0.57863	0.26686	0.33107	0.37228	0.51960	0.32224	0.44494	0.52660	0.40923	0.39803	0.31657
Q32	Q32	0.28060	0.07632	0.37451	0.24392	0.34963	0.24194	0.40657	0.54080	0.59387	0.40644	0.35729
Q33	Q33	0.53073	0.37298	0.57501	0.42527	0.64127	0.12775	0.50337	0.59360	0.46855	0.70151	0.46457
Q34	Q34	0.37654	0.34849	0.62088	0.41356	0.66459	0.21524	0.37476	0.43995	0.57127	0.70948	0.42568
Q35	Q35	0.39164	0.22800	0.46265	0.44612	0.54660	0.37092	0.40608	0.45984	0.52049	0.47641	0.31685
Q36	Q36	0.35672	0.26122	0.41445	0.14764	0.36943	0.01244	0.33991	0.29735	0.32106	0.15666	0.23332
Q37	Q37	0.34528	0.53765	0.50320	0.40460	0.46520	0.28482	0.25204	0.33701	0.43606	0.65286	0.22149
Q38	Q38	0.39654	0.23858	0.50242	0.43619	0.61094	0.31615	0.48381	0.48184	0.66834	0.62174	0.35367
Q39	Q39	0.32486	0.42377	0.13680	0.32459	0.31271	0.56678	0.18206	0.21572	0.19429	0.39116	0.43321
Q40	Q40	0.02458	0.24213	0.24393	0.15887	0.46650	0.29142	0.10958	0.16940	0.47352	0.29909	0.14948
Q41	Q41	0.50177	0.30708	0.61300	0.32388	0.33086	0.34709	0.41332	0.55552	0.75053	0.52460	0.39786

Correlations												
		Q12	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**	**Q18**	**Q19**	**Q20**	**Q21**	**Q22**
Q1	Q1	0.53034	0.41121	0.21738	0.49590	0.26821	0.55748	0.34262	0.45396	0.58071	0.33565	0.45446
Q2	Q2	0.29931	0.16169	0.06494	0.16197	0.17514	0.34399	0.21384	0.30312	0.18048	0.20980	0.45508
Q3	Q3	0.50689	0.62909	0.39317	0.63019	0.70246	0.61515	0.49231	0.63480	0.43245	0.73798	0.64107
Q4	Q4	0.60436	0.53420	0.27300	0.36284	0.49340	0.44177	0.45102	0.47212	0.56758	0.53675	0.41753
Q5	Q5	0.43954	0.64493	0.49110	0.52533	0.60594	0.54254	0.72583	0.63507	0.36186	0.56523	0.41597
Q6	Q6	0.54601	0.32103	0.40120	0.23087	0.32330	0.23607	0.45219	0.31759	0.36729	0.36908	0.35085
Q7	Q7	0.49537	0.58217	0.43387	0.62664	0.47638	0.47932	0.50535	0.57476	0.59213	0.50535	0.36750
Q8	Q8	0.41404	0.48929	0.34752	0.60555	0.53315	0.60820	0.38972	0.53909	0.47768	0.47415	0.54911
Q9	Q9	0.68678	0.76677	0.82785	0.72799	0.79284	0.58708	0.67033	0.75552	0.58144	0.79808	0.70120
Q10	Q10	0.63195	0.62035	0.43254	0.49530	0.61664	0.63384	0.57183	0.72313	0.63542	0.62155	0.77139
Q11	Q11	0.39443	0.53340	0.37574	0.40340	0.50813	0.48870	0.34072	0.54842	0.27772	0.46515	0.35170
Q12	Q12	1.00000	0.72831	0.48437	0.48034	0.53143	0.47582	0.43768	0.73669	0.54761	0.67596	0.64256
Q13	Q13	0.72831	1.00000	0.54450	0.69542	0.75997	0.68046	0.64969	0.82185	0.49170	0.80121	0.59568
Q14	Q14	0.48437	0.54450	1.00000	0.62352	0.69464	0.44494	0.55997	0.60750	0.33381	0.55388	0.62767
Q15	Q15	0.48034	0.69542	0.62352	1.00000	0.75578	0.65002	0.70931	0.61460	0.55701	0.72865	0.58324
Q16	Q16	0.53143	0.75997	0.69464	0.75578	1.00000	0.72644	0.72698	0.67165	0.52642	0.80046	0.71048
Q17	Q17	0.47582	0.68046	0.44494	0.65002	0.72644	1.00000	0.60829	0.67810	0.54226	0.69575	0.69341

Correlations												
		Q12	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**	**Q18**	**Q19**	**Q20**	**Q21**	**Q22**
Q18	Q18	0.43768	0.64969	0.55997	0.70931	0.72698	0.60829	1.00000	0.57419	0.58559	0.69576	0.55354
Q19	Q19	0.73669	0.82185	0.60750	0.61460	0.67165	0.67810	0.57419	1.00000	0.47135	0.76791	0.78790
Q20	Q20	0.54761	0.49170	0.33381	0.55701	0.52642	0.54226	0.58559	0.47135	1.00000	0.58358	0.49045
Q21	Q21	0.67596	0.80121	0.55388	0.72865	0.80046	0.69575	0.69576	0.76791	0.58358	1.00000	0.75488
Q22	Q22	0.64256	0.59568	0.62767	0.58324	0.71048	0.69341	0.55354	0.78790	0.49045	0.75488	1.00000
Q23	Q23	0.27229	0.34592	0.40657	0.26000	0.30830	0.31066	0.20174	0.40451	0.15166	0.29618	0.40336
Q24	Q24	0.21413	0.28083	0.26596	0.24769	0.25765	0.28787	0.19318	0.38803	0.15583	0.27537	0.32648
Q25	Q25	0.31735	0.36513	0.39093	0.57151	0.47523	0.41152	0.46288	0.44250	0.24812	0.45174	0.43950
Q26	Q26	0.63568	0.37158	0.45599	0.26789	0.31241	0.41772	0.44596	0.55340	0.43537	0.44861	0.50837
Q27	Q27	0.67531	0.48532	0.58308	0.50932	0.57545	0.54675	0.51032	0.60874	0.59298	0.67191	0.65006
Q28	Q28	0.57653	0.61409	0.70571	0.75834	0.75510	0.63683	0.75916	0.58754	0.61238	0.79038	0.67561
Q29	Q29	0.52021	0.56685	0.41279	0.40528	0.53938	0.54218	0.46471	0.61365	0.48006	0.54583	0.56372
Q30	Q30	0.51258	0.47305	0.52372	0.46142	0.50284	0.56317	0.50808	0.45835	0.54523	0.48307	0.41736
Q31	Q31	0.47596	0.52521	0.37582	0.53859	0.39556	0.55904	0.60049	0.46417	0.36696	0.52394	0.41899
Q32	Q32	0.40360	0.48513	0.51415	0.64405	0.66849	0.51913	0.50047	0.46361	0.44277	0.55712	0.51877
Q33	Q33	0.48437	0.61594	0.41732	0.56497	0.57107	0.71047	0.46643	0.79691	0.37625	0.55388	0.70307
Q34	Q34	0.58816	0.81241	0.46749	0.60922	0.66816	0.68224	0.60312	0.85492	0.34332	0.75635	0.76020
Q35	Q35	0.48598	0.59487	0.42382	0.54316	0.63929	0.64217	0.79823	0.52573	0.48671	0.62495	0.51953
Q36	Q36	0.15685	0.36598	0.28879	0.56517	0.36835	0.54307	0.38916	0.35725	0.17504	0.34948	0.30334
Q37	Q37	0.34663	0.42913	0.43612	0.44352	0.56951	0.63364	0.61311	0.46752	0.46820	0.54221	0.73350
Q38	Q38	0.49263	0.65124	0.70038	0.74140	0.72852	0.67010	0.70004	0.62637	0.57988	0.74459	0.72014
Q39	Q39	0.29123	0.28889	0.31899	0.23442	0.34612	0.39239	0.30411	0.22393	0.07184	0.20301	0.37581
Q40	Q40	0.22225	0.39847	0.53479	0.36517	0.42020	0.28953	0.53933	0.46211	0.08191	0.34589	0.53057
Q41	Q41	0.63568	0.56252	0.65066	0.68523	0.64268	0.73314	0.52930	0.72215	0.51099	0.75599	0.84426

Correlations												
		Q23	**Q24**	**Q25**	**Q26**	**Q27**	**Q28**	**Q29**	**Q30**	**Q31**	**Q32**	**Q33**
Q1	Q1	0.16012	0.17091	0.26782	0.36218	0.44825	0.40082	0.47485	0.42777	0.57863	0.28060	0.53073
Q2	Q2	0.04690	0.03688	0.14427	0.36197	0.27862	0.23050	0.36996	0.27302	0.26686	0.07632	0.37298
Q3	Q3	0.20186	0.19230	0.18494	0.28898	0.46016	0.55648	0.43635	0.32923	0.33107	0.37451	0.57501
Q4	Q4	0.19104	0.10027	0.02950	0.36911	0.48644	0.42851	0.63899	0.50589	0.37228	0.24392	0.42527

Correlations												
		Q23	**Q24**	**Q25**	**Q26**	**Q27**	**Q28**	**Q29**	**Q30**	**Q31**	**Q32**	**Q33**
Q5	Q5	0.21909	0.22773	0.28621	0.39776	0.34823	0.51719	0.62292	0.50106	0.51960	0.34963	0.64127
Q6	Q6	0.63765	0.49184	0.21034	0.52110	0.52171	0.45345	0.26661	0.51665	0.32224	0.24194	0.12775
Q7	Q7	0.29241	0.23851	0.18294	0.35141	0.59780	0.60269	0.54470	0.65429	0.44494	0.40657	0.50337
Q8	Q8	0.22504	0.26025	0.40592	0.17184	0.53514	0.57840	0.53562	0.36705	0.52660	0.54080	0.59360
Q9	Q9	0.41404	0.28140	0.44373	0.51044	0.72947	0.83415	0.47442	0.61801	0.40923	0.59387	0.46855
Q10	Q10	0.35687	0.32202	0.28161	0.52460	0.61337	0.53284	0.65030	0.45336	0.39803	0.40644	0.70151
Q11	Q11	0.73911	0.65230	0.19588	0.31871	0.33164	0.38775	0.38456	0.44039	0.31657	0.35729	0.46457
Q12	Q12	0.27229	0.21413	0.31735	0.63568	0.67531	0.57653	0.52021	0.51258	0.47596	0.40360	0.48437
Q13	Q13	0.34592	0.28083	0.36513	0.37158	0.48532	0.61409	0.56685	0.47305	0.52521	0.48513	0.61594
Q14	Q14	0.40657	0.26596	0.39093	0.45599	0.58308	0.70571	0.41279	0.52372	0.37582	0.51415	0.41732
Q15	Q15	0.26000	0.24769	0.57151	0.26789	0.50932	0.75834	0.40528	0.46142	0.53859	0.64405	0.56497
Q16	Q16	0.30830	0.25765	0.47523	0.31241	0.57545	0.75510	0.53938	0.50284	0.39556	0.66849	0.57107
Q17	Q17	0.31066	0.28787	0.41152	0.41772	0.54675	0.63683	0.54218	0.56317	0.55904	0.51913	0.71047
Q18	Q18	0.20174	0.19318	0.46288	0.44596	0.51032	0.75916	0.46471	0.50808	0.60049	0.50047	0.46643
Q19	Q19	0.40451	0.38803	0.44250	0.55340	0.60874	0.58754	0.61365	0.45835	0.46417	0.46361	0.79691
Q20	Q20	0.15166	0.15583	0.24812	0.43537	0.59298	0.61238	0.48006	0.54523	0.36696	0.44277	0.37625
Q21	Q21	0.29618	0.27537	0.45174	0.44861	0.67191	0.79038	0.54583	0.48307	0.52394	0.55712	0.55388
Q22	Q22	0.40336	0.32648	0.43950	0.50837	0.65006	0.67561	0.56372	0.41736	0.41899	0.51877	0.70307
Q23	Q23	1.00000	0.80043	0.06331	0.22776	0.29936	0.31049	0.27072	0.24957	0.12587	0.22366	0.34959
Q24	Q24	0.80043	1.00000	0.01011	0.16314	0.29285	0.25690	0.20490	0.34493	0.14476	0.17094	0.42728
Q25	Q25	0.06331	0.01011	1.00000	0.30170	0.39891	0.43926	0.22885	0.22082	0.44279	0.66617	0.29880
Q26	Q26	0.22776	0.16314	0.30170	1.00000	0.63187	0.42082	0.39750	0.45429	0.40986	0.34476	0.32621
Q27	Q27	0.29936	0.29285	0.39891	0.63187	1.00000	0.78110	0.59158	0.58752	0.49760	0.53250	0.42750
Q28	Q28	0.31049	0.25690	0.43926	0.42082	0.78110	1.00000	0.54244	0.67136	0.57464	0.65438	0.44719
Q29	Q29	0.27072	0.20490	0.22885	0.39750	0.59158	0.54244	1.00000	0.40008	0.60565	0.21824	0.60776
Q30	Q30	0.24957	0.34493	0.22082	0.45429	0.58752	0.67136	0.40008	1.00000	0.47233	0.54441	0.43078
Q31	Q31	0.12587	0.14476	0.44279	0.40986	0.49760	0.57464	0.60565	0.47233	1.00000	0.35606	0.42233
Q32	Q32	0.22366	0.17094	0.66617	0.34476	0.53250	0.65438	0.21824	0.54441	0.35606	1.00000	0.39349
Q33	Q33	0.34959	0.42728	0.29880	0.32621	0.42750	0.44719	0.60776	0.43078	0.42233	0.39349	1.00000
Q34	Q34	0.34235	0.33726	0.44687	0.42981	0.44838	0.48190	0.66287	0.25604	0.52067	0.35480	0.78342
Q35	Q35	0.11653	0.18852	0.37235	0.47080	0.53662	0.61937	0.33388	0.52496	0.67710	0.56402	0.42382
Q36	Q36	0.07009	0.05992	0.32730	0.18968	0.17036	0.33296	0.10345	0.31336	0.35803	0.39460	0.48378

Correlations												
		Q23	**Q24**	**Q25**	**Q26**	**Q27**	**Q28**	**Q29**	**Q30**	**Q31**	**Q32**	**Q33**
Q37	Q37	0.24756	0.13204	0.30193	0.50990	0.33306	0.50006	0.50702	0.37129	0.44626	0.39505	0.53793
Q38	Q38	0.36818	0.26790	0.41891	0.38681	0.52802	0.77955	0.58961	0.56311	0.56963	0.60724	0.58312
Q39	Q39	0.58332	0.40527	0.19556	0.22317	0.18742	0.23270	0.32131	0.30465	0.38737	0.19289	0.31899
Q40	Q40	0.23735	0.11642	0.42604	0.15577	0.12693	0.36748	0.33037	0.18482	0.29441	0.17321	0.40795
Q41	Q41	0.32929	0.25896	0.50690	0.53750	0.67807	0.74328	0.39750	0.49569	0.53416	0.55976	0.52088

Correlations									
		Q34	**Q35**	**Q36**	**Q37**	**Q38**	**Q39**	**Q40**	**Q41**
Q1	Q1	0.37654	0.39164	0.35672	0.34528	0.39654	0.32486	0.02458	0.50177
Q2	Q2	0.34849	0.22800	0.26122	0.53765	0.23858	0.42377	0.24213	0.30708
Q3	Q3	0.62088	0.46265	0.41445	0.50320	0.50242	0.13680	0.24393	0.61300
Q4	Q4	0.41356	0.44612	0.14764	0.40460	0.43619	0.32459	0.15887	0.32388
Q5	Q5	0.66459	0.54660	0.36943	0.46520	0.61094	0.31271	0.46650	0.33086
Q6	Q6	0.21524	0.37092	0.01244	0.28482	0.31615	0.56678	0.29142	0.34709
Q7	Q7	0.37476	0.40608	0.33991	0.25204	0.48381	0.18206	0.10958	0.41332
Q8	Q8	0.43995	0.45984	0.29735	0.33701	0.48184	0.21572	0.16940	0.55552
Q9	Q9	0.57127	0.52049	0.32106	0.43606	0.66834	0.19429	0.47352	0.75053
Q10	Q10	0.70948	0.47641	0.15666	0.65286	0.62174	0.39116	0.29909	0.52460
Q11	Q11	0.42568	0.31685	0.23332	0.22149	0.35367	0.43321	0.14948	0.39786
Q12	Q12	0.58816	0.48598	0.15685	0.34663	0.49263	0.29123	0.22225	0.63568
Q13	Q13	0.81241	0.59487	0.36598	0.42913	0.65124	0.28889	0.39847	0.56252
Q14	Q14	0.46749	0.42382	0.28879	0.43612	0.70038	0.31899	0.53479	0.65066
Q15	Q15	0.60922	0.54316	0.56517	0.44352	0.74140	0.23442	0.36517	0.68523
Q16	Q16	0.66816	0.63929	0.36835	0.56951	0.72852	0.34612	0.42020	0.64268
Q17	Q17	0.68224	0.64217	0.54307	0.63364	0.67010	0.39239	0.28953	0.73314
Q18	Q18	0.60312	0.79823	0.38916	0.61311	0.70004	0.30411	0.53933	0.52930
Q19	Q19	0.85492	0.52573	0.35725	0.46752	0.62637	0.22393	0.46211	0.72215
Q20	Q20	0.34332	0.48671	0.17504	0.46820	0.57988	0.07184	0.08191	0.51099
Q21	Q21	0.75635	0.62495	0.34948	0.54221	0.74459	0.20301	0.34589	0.75599
Q22	Q22	0.76020	0.51953	0.30334	0.73350	0.72014	0.37581	0.53057	0.84426
Q23	Q23	0.34235	0.11653	0.07009	0.24756	0.36818	0.58332	0.23735	0.32929

Correlations									
		Q34	**Q35**	**Q36**	**Q37**	**Q38**	**Q39**	**Q40**	**Q41**
Q24	Q24	0.33726	0.18852	0.05992	0.13204	0.26790	0.40527	0.11642	0.25896
Q25	Q25	0.44687	0.37235	0.32730	0.30193	0.41891	0.19556	0.42604	0.50690
Q26	Q26	0.42981	0.47080	0.18968	0.50990	0.38681	0.22317	0.15577	0.53750
Q27	Q27	0.44838	0.53662	0.17036	0.33306	0.52802	0.18742	0.12693	0.67807
Q28	Q28	0.48190	0.61937	0.33296	0.50006	0.77955	0.23270	0.36748	0.74328
Q29	Q29	0.66287	0.33388	0.10345	0.50702	0.58961	0.32131	0.33037	0.39750
Q30	Q30	0.25604	0.52496	0.31336	0.37129	0.56311	0.30465	0.18482	0.49569
Q31	Q31	0.52067	0.67710	0.35803	0.44626	0.56963	0.38737	0.29441	0.53416
Q32	Q32	0.35480	0.56402	0.39460	0.39505	0.60724	0.19289	0.17321	0.55976
Q33	Q33	0.78342	0.42382	0.48378	0.53793	0.58312	0.31899	0.40795	0.52088
Q34	Q34	1.00000	0.48651	0.36460	0.62212	0.68560	0.36289	0.53160	0.57054
Q35	Q35	0.48651	1.00000	0.45005	0.51061	0.52244	0.34641	0.27794	0.58771
Q36	Q36	0.36460	0.45005	1.00000	0.39926	0.37924	0.28658	0.28359	0.46764
Q37	Q37	0.62212	0.51061	0.39926	1.00000	0.71763	0.48828	0.57143	0.55525
Q38	Q38	0.68560	0.52244	0.37924	0.71763	1.00000	0.44187	0.43325	0.64798
Q39	Q39	0.36289	0.34641	0.28658	0.48828	0.44187	1.00000	0.30588	0.25543
Q40	Q40	0.53160	0.27794	0.28359	0.57143	0.43325	0.30588	1.00000	0.38178
Q41	Q41	0.57054	0.58771	0.46764	0.55525	0.64798	0.25543	0.38178	1.00000

APPENDIX E

THE FACTOR STRUCTURE MATRIX BEFORE ROTATION

The Factor Structure Matrix Before Rotation

Factor Pattern					
		Factor1	**Factor2**	**Factor3**	**Factor4**
Q1	Q1	0.65391	-0.12244	0.51676	-0.03493
Q2	Q2	0.43179	0.31381	0.46892	0.46183
Q3	Q3	0.79574	0.14740	0.13374	-0.29327
Q4	Q4	0.74591	-0.25819	0.49763	0.11300
Q5	Q5	0.86454	0.04719	0.26063	0.09248
Q6	Q6	0.63340	-0.48025	0.02248	0.53549
Q7	Q7	0.82679	-0.32597	0.18465	-0.06680
Q8	Q8	0.76155	0.10098	0.02204	-0.42683
Q9	Q9	0.89945	-0.10214	-0.36117	-0.01072
Q10	Q10	0.85927	0.04440	0.35897	-0.12804
Q11	Q11	0.80742	-0.05489	0.12946	-0.22195
Q12	Q12	0.84479	-0.17651	0.27211	-0.00689
Q13	Q13	0.88818	0.14745	0.06521	-0.13355
Q14	Q14	0.76026	0.00414	-0.48189	0.08653
Q15	Q15	0.94002	0.04997	-0.19112	-0.02287
Q16	Q16	0.91395	0.11499	-0.21280	-0.07891
Q17	Q17	0.86646	0.17945	0.01574	-0.13230
Q18	Q18	0.87410	-0.17087	-0.12472	0.22180
Q19	Q19	0.91654	0.21167	0.08259	-0.25534
Q20	Q20	0.68338	-0.39356	0.04513	-0.13909
Q21	Q21	0.90641	-0.01548	-0.10595	-0.15761
Q22	Q22	0.92169	0.25754	-0.12156	-0.07996
Q23	Q23	0.91028	0.18362	-0.25037	-0.00108
Q24	Q24	0.85934	0.00856	-0.03825	-0.32139
Q25	Q25	0.73310	0.11416	-0.25870	0.30752
Q26	Q26	0.67570	-0.34258	0.19537	0.20513
Q27	Q27	0.84104	-0.41663	-0.15448	-0.10362
Q28	Q28	0.88568	-0.23205	-0.35721	0.01055
Q29	Q29	0.86391	0.10238	0.29397	-0.12730
Q30	Q30	0.76079	-0.47350	-0.10513	0.25991
Q31	Q31	0.73799	-0.24525	0.24021	0.16949
Q32	Q32	0.76887	-0.23115	-0.41571	0.01868

Factor Pattern					
		Factor1	**Factor2**	**Factor3**	**Factor4**
Q33	Q33	0.78025	0.43523	0.22636	-0.30182
Q34	Q34	0.81885	0.44443	0.17927	-0.11826
Q35	Q35	0.73511	-0.35750	0.00531	0.09359
Q36	Q36	0.44547	0.47891	-0.10765	0.26577
Q37	Q37	0.70393	0.36472	0.03989	0.35850
Q38	Q38	0.89009	0.09660	-0.18399	0.07844
Q39	Q39	0.43644	0.27923	0.27731	0.68807
Q40	Q40	0.51348	0.57573	-0.34356	0.41431
Q41	Q41	0.94711	0.02931	-0.23303	-0.07939

APPENDIX F

ORTHOGONAL TRANSFORMATION MATRIX USED IN VARIMAX ROTATION

Orthogonal Transformation Matrix Used In Varimax Rotation

Orthogonal Transformation Matrix				
	1	**2**	**3**	**4**
1	0.61209	0.56414	0.47504	0.28536
2	0.38474	-0.17050	-0.66433	0.61772
3	0.29985	-0.80556	0.49576	0.12407
4	-0.62242	0.06131	0.29534	0.72222

APPENDIX G

THE FACTOR STRUCTURE MATRIX AFTER THE VARIMAX ROTATION

The Factor Structure Matrix After The VARIMAX Rotation

Rotated Factor Pattern					
		Factor1	**Factor2**	**Factor3**	**Factor4**
Q1	Q1	0.52983	-0.02865	0.63785	0.14985
Q2	Q2	0.23818	-0.15934	0.36552	0.70878
Q3	Q3	0.76641	0.29805	0.25978	0.12291
Q4	Q4	0.43611	0.07088	0.80594	0.19672
Q5	Q5	0.56792	0.27539	0.53586	0.37498
Q6	Q6	-0.12364	0.45393	0.78923	0.27362
Q7	Q7	0.47760	0.36916	0.68113	0.00924
Q8	Q8	0.77727	0.36847	0.17955	-0.02583
Q9	Q9	0.40963	0.81512	0.31291	0.14102
Q10	Q10	0.73036	0.18015	0.51884	0.22469
Q11	Q11	0.65007	0.34696	0.41865	0.05227
Q12	Q12	0.53506	0.28705	0.65144	0.16082
Q13	Q13	0.70305	0.41519	0.31685	0.25617
Q14	Q14	0.26858	0.82168	0.14506	0.22221
Q15	Q15	0.55153	0.67433	0.31185	0.25889
Q16	Q16	0.58896	0.66257	0.22897	0.24844
Q17	Q17	0.68647	0.43741	0.26112	0.26451
Q18	Q18	0.29384	0.63631	0.53242	0.28860
Q19	Q19	0.82615	0.39878	0.26031	0.21813
Q20	Q20	0.36698	0.40774	0.56738	-0.14295
Q21	Q21	0.61518	0.58966	0.34179	0.12212
Q22	Q22	0.67656	0.56907	0.18287	0.34927
Q23	Q23	0.55342	0.68384	0.18599	0.34134
Q24	Q24	0.71786	0.49443	0.28865	0.01365
Q25	Q25	0.22367	0.62135	0.23498	0.46972
Q26	Q26	0.21268	0.29479	0.70601	0.15359
Q27	Q27	0.37267	0.66359	0.56912	-0.11136
Q28	Q28	0.33916	0.82761	0.40092	0.07270
Q29	Q29	0.73556	0.22529	0.45052	0.25430
Q30	Q30	0.09020	0.61055	0.70061	0.09929
Q31	Q31	0.32389	0.27503	0.68264	0.21131
Q32	Q32	0.24541	0.80918	0.31823	0.03854

Rotated Factor Pattern					
		Factor1	Factor2	Factor3	Factor4
Q33	Q33	0.90077	0.16511	0.10459	0.30160
Q34	Q34	0.79956	0.23450	0.14769	0.44503
Q35	Q35	0.25575	0.47712	0.61698	0.05719
Q36	Q36	0.25922	0.27266	-0.08142	0.60154
Q37	Q37	0.36001	0.32478	0.21775	0.69003
Q38	Q38	0.47799	0.63868	0.29060	0.34749
Q39	Q39	0.02945	0.01741	0.36252	0.82838
Q40	Q40	0.17492	0.49367	-0.18651	0.75877
Q41	Q41	0.57054	0.71216	0.29147	0.20212