EARLY CHILDHOOD MATH COACHING:
RELATIONSHIPS AND STRATEGIES

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Abstract

Falling scores in American student achievement in mathematics has prompted renewed interest in elementary math instruction. By their own admission, elementary school teachers, however, are not always comfortable teaching math. On-site math coaches/specialists can help teachers implement best practices and new standards. Since teachers’ sense of efficacy has been shown to affect their instructional practices and, in turn, their students’ math achievement, coaches’ support of such efficacy is essential. This qualitative case study explored the relationships between elementary math coaches and early childhood educators. The goal was to identify the strategies most effective in developing and supporting teachers’ sense of efficacy. Three pairs of teachers and coaches/specialists were interviewed using open-ended questions. The interviews took place in three independent schools in a large urban setting in the northeastern United States. The results of this study underlined the importance of modeling and co-teaching as effective ways of supporting teachers’ sense of efficacy. Further, these results added to the existing research on the importance of non-evaluative, supportive and collaborative relationships between coaches and teachers. One implication for practice is to insure that coaches’ job descriptions allow for these relational elements. Additional implications for best practices and further research are discussed.

Keywords: math coaching, early childhood teachers, teachers’ sense of efficacy
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Early Childhood Math Coaching: Relationships and Strategies

Chapter 1

Statement of the Problem

The topic. Many early childhood educators dislike teaching math (Wilkins, 2010). In addition, many teachers have been found “to be better prepared to teach reading and language arts than mathematics” (Findley, 2006, p. 95). Teachers’ sense of confidence and competence in teaching math not only affects their teaching styles but also the perceptions their students have of their own abilities (Scarpello, 2010). Teachers’ self-confidence has even been shown to affect their students’ achievement (Bandura, 1997; Tschannen-Moran & Woolfolk Hoy, 2001). Herron (2010) found that when teachers were given “greater understanding” of the material to be covered, those teachers could “change their instruction even with limited professional development” (p. 370). Support may offer teachers an opportunity to reflect and change their teaching strategies (Bonner, 2006). The purpose – and central question – of this study is to explore aspects of the relationships between math coaches and early childhood math educators that best support the development of teachers’ perceptions of self-confidence and competence, their sense of efficacy, in independent schools.

Research problem. In 2011, American fourth grade math students scored lower in math and science achievement than their international counterparts in eight countries (TIMSS, 2011). As Thornton, Crim, and Hawkins (2009) wrote, “As the world continues to advance and new technologies emerge and evolve, a solid foundation in mathematical understanding becomes increasingly necessary” (p. 150). In order to develop a strong foundation in mathematics in our younger students, special attention must be paid even to the earliest childhood instruction, particularly in light of the recent rise in enrollment in early childhood programs (Thornton et al., 2009).
Many early childhood educators have not had the benefit of training in the area of teaching math to young children (Thornton et al., 2009). Despite teachings as far back as Dewey (1938/1997) and as recently as Tomlinson and Imbeau (2010) advocating a more student-centered approach, innumerable teachers continue to implement a teacher-directed approach with teachers leading classroom discussions “as though mathematics contained only right and wrong answers” (Olson & Barrett, 2004, p. 63). Teachers can be helped, however, to grow in confidence and ability to make instructional changes; Tschannen-Moran and McMaster (2009) found that when teacher training “supported mastery experiences through follow-up coaching”, the training had “the strongest effect on self-efficacy beliefs for reading instruction as well as for implementation of the new strategy” (p. 228). In other words, when coaching was provided as a support after professional development experiences, teachers experienced the greatest gains in self-efficacy beliefs. In fact, in a different study, Hoy (2000) found that when certain kinds of support were no longer available to first year teachers, “efficacy fell” (p. 17).

Researchers found that when teachers feel more confident about their teaching abilities, they may be inclined to teach with less criticism toward their students and with more encouragement to persist through challenging problems (Gibson & Dembo, 1984). Support in the form of on-site coaching has been found to improve teachers’ levels of self-confidence (Tschannen-Moran and McMaster, 2009; Neuberger, 2012), which has been linked to improved student achievement (Bandura, 1997). The coaching that influences this kind of self-confidence was the focus of this study.

“Perceptions of self-efficacy” is a concept studied for decades by Bandura (1977a; 1997) and Zimmerman and Schunk (2003). It incorporates a person’s “beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments” (Bandura,
1997, p. 3). Bandura (1997) contended that it is these beliefs in one’s own abilities that represent the crucial factor of human agency. Without such self-confidence and conviction about one’s own abilities to be successful, Bandura (1997) proposed, people “will not attempt to make things happen” (p. 3). Often, in the face of low perceptions of self-efficacy, many teachers are not able to keep students on task (Gibson & Dembo, 1984). Certain kinds of coaching relationships, Joyce and Showers (1992) found, could help teachers address their frustrations and struggles.

**Justification for the research problem.** Recently, researchers have tackled the issue of coaching from a number of perspectives, including but not limited to peer coaching, content coaching, teacher mentoring, and professional development. Bruce and Ross (2008) explored the role of peer coaches, describing ways that colleagues have successfully helped one another create differentiated (multi-tiered) lesson plans for their diverse classrooms (Miller, 1994; Latz, Speirs Neumeister, Adams, and Pierce, 2009). Some researchers have focused on a different form of coaching, “teacher mentoring…[which] is clearly hierarchical with the coaches in a position of power” (Anstey & Clarke, 2010, p. 6), that has been shown to have varying degrees of success (Olson & Barrett, 2004; Ward, 2005). Others have examined the effectiveness of professional development projects that enabled changes among elementary school teachers on-site (Turner, Warzon, & Christensen, 2011). Yet another group of researchers has approached the issue of teacher mentoring as an issue of raising the levels of teachers’ efficacy beliefs by improving teachers’ knowledge of mathematics (Swackhamer, Koellner, Basile, & Kimbrough, 2009). This case study explored the relationships between on-site math coaches and early childhood teachers, the coaches’ strategies, and the influence of those relationships and strategies on teachers’ sense of efficacy.
One of the reasons for exploring teachers’ sense of efficacy pertains to the role that such efficacy beliefs can play in students’ achievement. Though it was beyond the scope of this present study, it is worth noting that researchers have demonstrated that teachers’ levels of efficacy beliefs affect student outcomes (Guo, Piasta, Justice, & Kaderavek, 2010) and that the extent to which teachers feel confident and competent in presenting the material affects their students’ “achievement, motivation, and self-efficacy beliefs” (Tschannen-Moran & Woolfolk Hoy, 2001, p. 783).

**Deficiencies in the evidence.** Little research has been done on the effect of ongoing professional math coaching on teachers and students at the early childhood level. Though there have been studies on coaching aimed at improving teacher efficacy – their instructional effectiveness – and, by extension, student achievement in language arts and language acquisition (Shidler, 2009; Rudd, Lambert, Satterwhite, & Smith, 2009), few if any researchers have focused on math in early childhood education. There has been an increasing amount of research on instructional coaching at the elementary level (Swackhamer et al., 2009) but studies involving early childhood teachers are lacking. This research explored the relationships and the ways math coaches and early childhood educators collaborated to increase teachers’ efficacy beliefs.

The reason for the focus on early childhood instruction is that teachers need to understand the topics and strategies that appeal to students’ curiosity in the early childhood classroom (Thornton et al., 2009). The hope is that, with coaches helping teachers design age-appropriate engaging math activities and learning opportunities, young children may gain confidence from their successes and derive new pleasure from their discoveries. The goal is for students to view math activities as exciting, challenging, enjoyable opportunities through which they can explore and construct meaning for themselves. As Thornton et al. (2009) wrote,
For young children, mathematics is a natural part of daily life, as they explore and investigate the world around them. To build on this exploration, and to begin establishing a mathematical foundation, early childhood educators must not only be knowledgeable about mathematical concepts themselves, they must also understand the appropriate concepts to teach at each grade level and be aware of the most developmentally appropriate ways in which to teach mathematical concepts to young children. (p. 151)

**Relating the discussion to audiences.** Early childhood teachers often bemoan the lack of guidance as to how they might improve as educators in the area of math instruction. With new research that explores innovative, engaging approaches to instructional coaching in early childhood, math coaches might help teachers grow in efficacy beliefs. The teachers might then go on to provide young students with greater opportunities to build the foundation of solid and wonder-filled math knowledge and experience. Documenting the role of instructional coaching in helping students build their math knowledge base can uncover the kinds of activities that engage learners more comprehensively. This case study examined two aspects of early childhood education in urban independent schools: the many elements of on-site math coaching relationships and the influence of coaching on teachers’ sense of efficacy.

**Significance of the Research Problem**

The issue of math coaching is of particular national significance during this time when middle and high school student achievement in math has been declining relative to their international counterparts (U. S. Department of Education, 2009). In order to develop mathematically literate students who can compete globally and benefit our own economy, solid foundations of math knowledge and competence need to be laid in the early years of their mathematics education (Thornton et al., 2009). One of the problems however, is that, in many
cases, “elementary school teachers tend to be better prepared to teach reading and language arts than mathematics” (Findley, 2006, p. 95).

There is a need to investigate the utility of math coaching for early childhood educators (Guo, Justice, Sawyer, & Tompkins, 2011). Though many researchers have examined various kinds of peer coaching (Miller, 1994; Showers & Joyce, 1996; Bruce & Ross, 2008; Elder & Padover, 2011), and some have explored a model of instructional coaching in the elementary grades (Olson & Barrett, 2004; McGatha, 2008; Chval, Arbaugh, Lannin, van Garderen, Cummings, Estapa, & Huey, 2010), there appears to be very little, if any, research done on math coaching in the early childhood setting.

At the teacher and classroom level, certain kinds of math coaching have been shown to have “a positive impact on teacher efficacy and on teacher implantation of standards-based teaching” (Bruce & Ross, 2008, p. 363). Teachers’ perceptions of self-efficacy have, in turn, been shown to affect the classroom environment, students’ perceptions of self-efficacy, and achievement outcomes (Bandura, 1997). Exploring the best approaches to math coaching of early childhood educators may help both teachers and students alike.

**Positionality Statement**

As Machi and McEvoy (2009) stated, awareness of one’s personal opinions and biases, and the effort to control for those biases, can help a researcher “become open minded, skeptical, and considerate of research data” (p. 19). It is therefore important to identify, acknowledge and explore one’s motivations, biases, assumptions and presuppositions at the outset. The goal is to ensure, to the greatest extent possible, a degree of objectivity and impartiality that can allow personal issues to inform, but minimally interfere with, the research process.
Having worked in independent schools for over twenty years, I was most familiar with the systems and relationships within that culture. I therefore chose to study early childhood math coaches and teachers in independent schools because of the extent of my experience specific to that setting. Furthermore, in independent schools math coaches and specialists are more frequently on-site full-time employees dedicated to curriculum oversight and teacher coaching in one school, whereas in public school districts, math coaches are often responsible for overseeing multiple schools. Lastly, I had the greatest access to coaches in independent schools because of my own involvement in the various networks within the profession of math coaching.

One aspect of my motivation in conducting this research grew out of my own experience as a math student. Most of the teachers who taught me were not enthusiastic about math. They presented the material in the same way that they seemed to want it learned: dryly, without exploration or questioning, and worst of all, without any sense of wonder or discovery. Those rare, inspiring teachers, whom I still remember, made a major difference in my interest level and even in my ability to attend and persevere when the material became more challenging.

My second motivation stemmed from some of my own “turnaround” experiences as a math teacher. When I was teaching at a private elementary school in suburban Connecticut, there was a particular fourth grade student who was deemed to be “incompetent” and “lazy” in math. When he was in my math class as a fifth grader, he broke his leg and was unable to join his classmates for recess and sports. To help him pass the time, I showed him some math games and challenging puzzles. He enjoyed the games tremendously and began to excel in my class. He continued to do extremely well in math throughout secondary school and achieved perfect scores on his math achievement and SAT tests. He has since graduated from a very rigorous college having majored in math and physics. Looking back at the dramatic change in his interests, he
later told his parents that his fifth grade experiences with math were a turning point in his academic career.

A third motivation came from years of conversations with early childhood math teachers. Many confessed to me that they considered themselves to be stronger in language arts than in math. Others admitted feeling unable to tutor anyone beyond the grade they teach, and several felt they might well qualify for a diagnosis of “math phobia”. A number of teachers have asked me for further coaching and training to strengthen their own knowledge of math and to devise innovative and exciting ways to present math to their students.

As I reflected on my years of observing both teachers and students and the impressions I have developed, I realized I had come to certain conclusions about math education and as a result, I carried a number of implicit but not necessarily valid assumptions about best practices in math education. For example, as I observed hundreds of lessons in which students appear distracted and inattentive, I became aware that I must be conscious of my opinions about the styles of teaching that I considered “successful” and therefore “preferable”. In his counsel to graduate students, Butin (2010) wrote,

> Your dissertation is a systematic examination of a particular topic. There is literally no space (or need) for opinions or feelings that are not part of this systemic process…which includes clarity, trustworthiness, and constant attention to not biasing the study (p. 121-122).

Accordingly, I needed to remain appropriately self-conscious as I evaluated the behavior and appearance of teachers and students. I needed to be cognizant of Carlton Parson’s (2008) Cultural-Historical Activity Theory as well; the concentric circles comprising dynamic systems of influence affect all participants and need to be recognized. I needed to attend to the many
layers of factors of students’ and teachers’ appearances, behaviors, and characteristics (Carlton Parsons, 2008).

Beyond my own biases about teaching and learning, there were assumptions and presuppositions about best practices with which I approached this research. For example, I assumed that a collaborative coaching relationship with teachers yielded positive results. Admittedly, the interview data may not have demonstrated this so I definitely needed to be aware of such a supposition. I also assumed that there would be an emerging consensus among the participants that distinct learning and growth resulted from relationships with coaches. Furthermore, it was possible that the teachers would vary in their abilities to be introspective and, as an interviewer, I needed to be sensitive to their feelings throughout the process.

Other factors may also have played a role in my preparation for and consideration of these coaching relationships. For example, I needed to be prepared for the fact that, during the interview process, teachers may not have felt comfortable in discussing the full gamut of feelings that surround coaching relationships. Teachers I interviewed may not have shared my objectives, perspectives and interests. An atmosphere of acceptance and trust needed to be established in order to allow interviewees to feel safe and respected.

In summary, while this case study was modest in scope as I studied three coach/teacher dyads to examine the influence of math coaching relationships, it was important to err on the side of caution in controlling for biases.

Research Question

The research question that flowed from this problem of practice was: How do the relationships between math coaches and early childhood math teachers influence the development of teachers’ self-confidence and sense of competence? Two sub-questions that
followed this preliminary one were: What elements of the relationships between coaches and teachers do coaches identify as most effective in influencing teachers’ self-efficacy? What aspects of these relationships do early childhood math educators identify as influencing the development of their own perceptions of self-efficacy?

**Theoretical Framework**

The purpose of this study was to explore aspects of the relationships between by math coaches and early childhood math educators that best supported the development of those teachers’ sense of efficacy in urban independent schools. Several seminal works on coaching and sense of efficacy provided the theoretical framework with which I constructed this study. Joyce and Showers (1982), Shidler (2009), Ross (1992) and McGatha (2008) explored some of the many forms of coaching, while Bandura (1977) explored the “elusive construct” of efficacy, as Tschannen-Moran and Hoy (2001) more recently described it. Some of the major researchers who have contributed to the discussion on coaching and self-efficacy are the focus of the sections on coaching and self-efficacy that follow.

**Coaching.** It is important to introduce a few of the widely accepted definitions of the terms used in this study. The term “math coaching” refers to a process where “the intent is for a knowledgeable colleague with a deep understanding of mathematics and of how students learn, as well as pedagogical expertise, to serve as an on-site resource and leader for teachers” (Campbell & Malkus, 2011, p. 431). In this study, as in other research, the terms “coach” and “specialist” are used.¹

The term “peer coaching” refers to a process that involves two or more teachers “of similar experience and competence [who] observe each other teach, establish improvement

¹See Campbell and Malkus (2014) and Fennell (2011) for more on this topic.
goals, develop strategies to implement goals, observe one another during the revised teaching, and provide specific feedback” (Bruce & Ross, 2008, p. 350).

“Peer coaching”, as a model of professional development among colleagues, was explored by Joyce and Showers (1980, 1982) in response to the need for teacher support beyond existing training sessions in order to help them implement new teaching strategies. More recently, Shidler (2009) applied a slightly different coaching strategy in her research of math coaches as she implemented a model of collaborative conversation and observation between coach and teacher with the intention of addressing what she called “instructional efficacy” (p. 453) and other specific objectives jointly.

It is imperative to build levels of teacher efficacy as they move toward best practices in the classroom. To do so coaches need to focus on specific content, model techniques and instructional practices, observe teacher practices, and dedicate consultative hours to working with teachers…to better facilitate reflection. (p. 459)

These varied functions of modeling are vital components of the theories of Bandura (1997) and Joyce and Showers (1982). Such theories are central to this project since one dimension of this study specifically explored the role that coaching, including modeling, can play in fostering teachers’ sense of efficacy.

Other theorists have done considerable amounts of research in the two fields of coaching and teachers’ sense of efficacy that apply directly to this topic of study. Shidler and Fedor (2010) focused on the nature of the relationship between a coach and a teacher, while Guo et al. (2011) studied characteristics that “predicted teacher self-efficacy” (p.961). In one of his seminal works, Bandura (1986) delineated the many factors that influenced teachers’ sense of self-efficacy: “performance attainments, vicarious experiences of observing the performances of others, verbal persuasion…and physiological states” (p.399). Whether they provide accurate feedback or not,
maintained Bandura (1986), these four sources of information form the foundation of a person’s understanding of one’s own efficacy. Guo, Piasta, Justice, and Kaderavek (2010) focused on some of these characteristics of teachers’ sense of efficacy as they affected children’s vocabulary acquisition.

**Self-efficacy.** Bandura’s (1986) definition of self-efficacy is quite specific:

> Perceived self-efficacy is defined as people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned…with the judgments of what one can do with whatever skills one possesses. (p. 391)

In other words, teachers who feel more confident about their understanding of the material and more competent in their abilities to convey the information effectively and engagingly are described as having higher levels of self-efficacy beliefs, similar to what Schunk (2008) calls instructional self-efficacy. Tschannen-Moran and McMaster (2009) went one step further in describing teacher self-efficacy as “a teacher’s perceived capability to impart knowledge and to influence student behavior, even that of unmotivated or challenging students” (p. 228).

Bandura (1977b, 1986) wrote extensively on perceptions of self-efficacy and social learning theory. He applied his theories to students (1993) as well as to teachers (1997), emphasizing that teachers’ perceptions play a significant role in determining the kinds of learning environments created and expectations held for their students. “Teachers’ beliefs in their efficacy affect their general orientation toward the educational process as well as their specific instructional activities”, wrote Bandura (1997), citing research that indicated “teachers’ efficacy beliefs can affect students’ self-conceptions, aspirations, and academic learning” (p. 241).

It is important to note that several researchers make distinctions among kinds of efficacy (Ross, 1994; Tschannen-Moran, Woolfolk Hoy and Hoy, 1998). Self-efficacy, as Ross (1994)
described it, “refers to a subject’s expectation that he or she will be able to perform the actions required to bring about desired outcomes (‘whether I can do x’)…[it] is a relatively stable constellation of personal beliefs that emerges from a subject’s interpretation of experience” (p. 381, parentheses included). Teacher efficacy, Ross (1994) continued, is a kind of self-efficacy that pertains to one’s “beliefs about proficiency in performing the actions thought to lead to student learning” (p. 382). Zambo and Zambo (2008) distinguished between individual and collective efficacy: “teachers with a strong sense of individual efficacy believe they can and do make a difference in the lives of their students and that their students can and will achieve”, whereas the collective efficacy refers to “beliefs about his or her colleagues’ effectiveness” (p. 159-160). In an interview with Shaughnessy (2004), Hoy described the importance of semantics when referencing perceptions of self-efficacy. “Teachers’ self-efficacy”, Hoy said, can be easily confused with teachers’ abilities to perform tasks. The phrases “teachers’ sense of efficacy, self-efficacy of teachers, instructional efficacy, teachers’ efficacy beliefs, or teachers’ perceived efficacy”, she said, are more accurate ways of describing Bandura’s concepts of teachers’ beliefs in their own self-confidence and sense of competence. Except in direct quotations, or when specific terminology is used by researchers, the terms “teachers’ sense of efficacy” and “self-efficacy” are therefore used throughout the rest of this study.

**Synthesis of theoretical framework.** The theories of Bandura (1993, 1986, 1997) are particularly relevant to this study because of his focus on the potential of teachers’ sense of efficacy to engage their students and to encourage learning that affects “the types of learning environments they create and the level of academic progress their students achieve” (Bandura, 1993, p. 117). Theories about coaching, whether among peers (Joyce and Showers, 1982) or as a
form of professional development as described by Ross (1992), and Bruce and Ross (2008), all hint at the potentially positive effect that coaching can have on teachers’ sense of efficacy.

Underlying Bandura’s (1997) theories is his awareness that “beliefs of personal efficacy constitute the key factor of human agency”, observing that unless people are certain they have to power to achieve they will not expend the necessary effort (p. 3). This view of human agency is a key component of Bandura’s (1997) work that applies to this dissertation. Bandura (1997) was careful to distinguish self-efficacy from locus of control – “beliefs about whether actions affect outcomes” – and from outcome expectancies – “beliefs about whether one can produce certain actions” (p. 20). Bonner’s (2006) research demonstrated that a coaching relationship can offer a kind of attitudinal change critical to a teacher’s transformation “from aversion to pleasure and self-confidence” (p. 36).

Because “efficacy beliefs are considered to be most pliable early in learning”, according to Tschannen-Moran and Hoy (1998, p. 947), it is worth noting one of the best known aspects of Bandura’s (1997) learning theory: his triadic reciprocal causation in which he posited that it is the totality of all that surrounds, comprises and interacts with a person’s “behavior”, “environmental events”, and “cognitive, affective, and biological events” that affects learning.

In this transactional view of self and society, internal personal factors in the form of cognitive, affective and biological events; behavior; and environmental events all operate as interacting determinants that influence one another bidirectionally. Reciprocity does not mean that the three sets of interacting determinants are of equal strength. Their relative influence will vary for different activities and under different circumstances. (p. 6)

The following diagram depicts this “transactional view”.

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Bandura’s work represented a major departure from the conditioning theorists who argued for the primacy of environmental factors in knowledge acquisition (Bandura, 1978; Schunk, 2008). Tschannen-Moran and Woolfolk Hoy (2007) later studied the kinds of support that most affected experienced and novice teachers’ sense of efficacy. These researchers found that “contextual factors such as the teaching resources and interpersonal support available were found to be much more salient in the self-efficacy beliefs of novice teachers” than among teachers with more years of experience (p. 944).

**Conclusion/Forward**

This chapter has provided a summary of the research problem, a positionality statement and a brief overview of the theoretical framework. The remainder of this dissertation contains four chapters: a literature review, a description of the research methodology, a presentation of the data, and finally a summary and discussion. In Chapter 2, the literature review, I explore a selection of seminal works and more recent research on coaching, coaching and teachers’ sense of efficacy, and coaching and student achievement. The section on coaching and student achievement is included to illustrate the rationale for studying coaching and teachers’ sense of efficacy. A synthesis provides highlights of the investigated research. In Chapter 3, I offer an overview of the research design including a description of qualitative research in general and the
case study approach in particular. Following an explanation of my data collection and analysis methods, I present my plans for strengthening the trustworthiness of the study, recognizing its inherent limitations, and insuring the ethical treatment of all participants. In Chapter 4, I present findings from the interviews and observations, according to the themes that emerged. Chapter 5 contains a discussion of the data and its relevance to educational practice today. Samples of the letters sent to prospective participants and of the open-ended interview questions are contained in the Appendices.

Before proceeding to Chapter 2, it is important to provide some additional clarification of titles. One researcher (McGatha, 2009) made a distinction between math coach and math specialist, indicating that “coaches” work with teachers while “specialists” focus on students. Others (Campbell and Malkus, 2014) use the terms interchangeably. As the research for this study progressed, it became clear that the coaches to be interviewed were titled “specialists” by the independent schools in the metropolitan area. Therefore, for the purposes of this paper, the terms are used synonymously. As Campbell and Malkus (2014) wrote, “The role of the specialist or coach is to support the improvement of mathematics teaching and learning in schools by targeting teachers’ understanding and action” (p. 213-214). Coaching often refers to the work the specialists do while the term specialist refers to the title held. In Chapter 4 and parts of Chapter 5, the term specialist is used out of deference to the terminology used by the participants.
Chapter 2 – Literature Review

The thesis of the first part of this literature review is that math coaching, as one form of professional development, can lead to improvements in teachers’ perceptions of themselves. Professional development itself has taken many forms as it has evolved over the years, including workshops and “large systemic change initiatives with both summer institutes and school year support” (Olson & Barrett, 2004, p.64). Darling-Hammond (1995) described “effective professional development” as engaging “teachers both as learners and as teachers and allow[ing] them to struggle with the uncertainties that accompany each role” (p. 598). Although the initial impact of these forms of training appeared to be quite positive, researchers have since found that ongoing input was needed to consolidate those gains, since the skills and confidence that teachers gained from these professional development workshops were found to dissipate quickly without support of some kind (Showers and Joyce, 1996). In this first section of the literature review, various forms of coaching including peer coaching, mentoring, and on-site math coaching are reviewed.

Research on teachers’ sense of efficacy comprises the second half of this literature review. Bandura (1986) was among the first to research this concept of self-efficacy in depth. Bandura (1977) highlighted four sources of what he called “expectations of personal efficacy…performance accomplishments, vicarious experience, verbal persuasion, and physiological states” (p. 191). Tschannen-Moran and Hoy (2007) focused on two of these components of Bandura’s (1997) construct of self-efficacy, verbal persuasion and mastery experiences, in an effort to learn more about the sources of teachers’ sense of efficacy.
Coaching

In their review of coaching research, Joyce and Showers (1980) determined that several kinds of support were needed to effect improvements or changes in the classroom. In their article entitled, “Improving Inservice Training: The Message of Research”, Joyce and Showers (1980) examined over 200 studies and found essentially five types of training were described in the literature:

1. Presentation of theory or description of skill or strategy,
2. Modeling or demonstration of skills or models of teaching,
3. Practice in simulated and classroom settings,
4. Structured and open-ended feedback (provision of information about performance),
5. Coaching for application (hands-on, in-classroom assistance with the transfer of skills and strategies to the classroom). (p. 380, parentheses included)

Joyce and Showers (1980) found that “The most effective training activities…will be those that combine theory, modeling, practice, feedback, and coaching to application” (p. 384-5). They were among the first to introduce a “peer coaching” model whereby teachers planned together, strategized together, and observed one another in action. After implementing several such programs of peer coaching, Joyce and Showers (1982) surmised that peer coaching could provide teachers with opportunities to experiment with newly learned skills and could, in turn, enable them “to transfer the new model into their active repertoire” (p. 5). They concluded that, “Like athletes, teachers will put newly learned skills to use – if they are coached” (p. 5).

This same pair of researchers (Joyce & Showers, 1982) sought to address the concern that learning new theories alone did not transfer into the classroom in the form of improved instructional practices. They advocated a form of peer coaching:
If we had our way, all school faculties would be divided into coaching teams who regularly observe one another’s teaching and provide helpful information, feedback, and so forth. In short, we recommend the development of a ‘coaching environment’ in which all personnel see themselves as one another’s coaches. (p. 6, italics given)

This new form of professional development became popular in the decades that followed as peers collaborated in designing high school lesson plans (Slater & Simmons, 2001) and in providing instructional support for one another (Latz, Speirs Neumeister, Adams, & Pierce, 2009). Bruce and Ross (2008) studied peer coaching among third and sixth grade math teachers. Specifically, Bruce and Ross (2008) sought to determine whether peer coaching affected not only teachers’ strategies but also their “beliefs about their capacity to have an impact on student learning” (p. 346). Teachers volunteered to become involved in a professional development program that combined “effective mathematics teaching strategies and peer coaching opportunities” (p. 346). The researchers found that simultaneous peer coaching and “pedagogical training in mathematics proved to be a powerful strategy for moving teachers along a continuum of practices toward more effective teaching and learning opportunities” (p. 366). In other words, teachers began to try new approaches as a result of meeting with colleagues in a peer coaching format (Bruce & Ross, 2008). Remarkably, these researchers (Bruce & Ross, 2008) found that the benefits of the peer coaching were reciprocal; not only did the input from their coaching peers influence teachers’ sense of efficacy and encourage creative teaching practices, but the benefits of improved teaching and teacher confidence affected the input from fellow teachers. Later researchers (Elder & Padover, 2011) appeared to concur with Bruce and Ross (2008) when they posited that the gains were mutual: peer coaching helped both the observed teachers and the teachers serving as coaches. When Elder and Padover (2011) studied the results of peer coaching at a secondary school, they found the program had been very successful in helping teachers think
more deeply about their own teaching practices by serving as coaches. There was one problem cited: “The biggest challenge for the coaches was to find the time to coach, as they were teaching full time and had other assignments” (Elder & Padover, 2011, p. 142).

The intention of the design of the peer coaching model described in an article by Showers and Joyce (1996) was that the teacher, acting as the observer, was not to critique the lesson but rather to learn from it. Showers and Joyce (1996) emphasized their specific definition of a coach with italics: “when pairs of teachers observe each other, the one teaching is the ‘coach’ and the one observing is the ‘coached’” (p. 15). According to this model of peer coaching, teachers did not provide one another with “verbal feedback” (p. 15). Instead, the intention was to engage in more “collaborative planning” (p. 15). Rather than one teacher providing another with a critique of a lesson, as might be common in a formal evaluation, the goal was to have “teachers learn from one another while planning instruction, developing support materials, watching one another work with students, and thinking together about the impact of their behavior on their students’ learning” (p. 15).

Overall, the results of studies on peer coaching appear to vary. For several decades, peer coaching, most notably popularized by Joyce and Showers (1980, 1982), was widely implemented as a form of professional support and was shown to benefit classroom teachers’ instruction (Elder & Padover, 2011) and to provide more frequent opportunities for teacher reflection (Bruce & Ross, 2008). Other researchers found a limitation inherent in the peer coaching programs included teachers’ reluctance to become involved. In their review of a program that addressed one school’s need to differentiate instruction, Latz et al. (2009) found that teachers’ agreement with and commitment to the program were essential ingredients for the success of the coaching relationship, but that many teachers refused to participate in the program.
The major challenges of time limitations, mandated curricula, and diverse student needs restricted teachers’ interest in becoming involved in the program.

In their study of a mentoring program similar in design to the peer coaching model, Latz et al. (2009) described a system that provided assistance to teachers attempting to differentiate their instruction in third, fourth and fifth grades, particularly regarding the gifted and talented students in their classrooms. The program involved seven mentoring teachers observing 30 teachers in their classrooms three times over the course of three consecutive spring terms. The intention was to provide the mentored teachers with non-evaluative non-judgmental feedback “in order to effectively reach [them] in a non-threatening way” (Latz et al., 2009, p. 32).

Latz et al. (2009) reported that the teachers and the mentors considered this support program “beneficial within the context of developing differentiation strategies” (Latz et al., 2009, p. 34). However, these same teachers listed several concerns and challenges. Some teachers feared involvement in the mentoring program would require them to deviate from state requirements, possibly resulting in lower scores among their students on the standardized tests (Latz et al., 2009). Other teachers worried that they would not be able to meet the diverse needs of their students. The main complaint was that their busy schedules of classroom instruction, field trips and special events left no time in the workday for additional responsibilities (Latz et al., 2009). In addition, although the experience of mentoring was described as positive by many, only 36% of the teachers reported having greater comfort with differentiation as a result of the mentoring program (Latz et al., 2009).

Hiring math coaches, referred to here as “specialists”, rather than using mentors or peer coaches, was described by Fennell (2011) as a strategic move for schools: “Mathematics specialists at the elementary school level are becoming increasingly important as we
acknowledge the complexities of elementary teaching and learning” (p. 53). Math coaching has become more popular in districts around the country over the past decade, partly because of the long-term ineffectiveness of standalone professional development workshops (Chval et al., 2010), partly because teacher preparation is often lacking (Fennell, 2011), and partly in acknowledgement of the burden that peer coaching places on the teachers (Elder & Padover, 2011). Math coaches can provide a different sort of support than the busy colleagues are able to offer one another; Campbell and Malkus (2011) highlighted the differences by defining a coach as one who is “a highly knowledgeable teacher, who frequently does not have responsibility for the instruction of a classroom of students, [placed] in a school in order to advance instructional and programmatic change across the whole school” (p. 432). The absence of classroom responsibilities seems to be an important feature of the coach’s position.

The benefits of this kind of coaching have been documented in recent years. Cave and Brown (2010) wrote of a “project between a university and a charter school aiming to increase young elementary students’ math achievement while providing pre-service teacher candidates meaningful opportunities and rich teaching experiences” (p. 2). These researchers found that the mentoring program had a positive effect on both instructional practices and student achievement. In her examination of a coaching program that involved a similar ongoing support system, Herron (2010) found that teachers who attended training sessions and then received a very limited amount of support were able to put their newly acquired knowledge and strategies into action. As was mentioned earlier, Herron (2010) stated, “There are many teachers who want to be better math teachers at the pre-K level. This study shows that teachers can change their instruction even with limited professional development” (p. 370).
Other researchers (Bruce & Ross, 2008) have agreed that the combination of training seminars and ongoing instructional support provided more opportunities for growth than workshop experiences alone. In a study by Rudd, Lambert, Satterwhite, and Smith (2009), the two-hour training session was linked to an increase of teachers’ use of more sophisticated math vocabulary by 56%. The added support from coaches yielded an additional increase of 39.5% in the teachers’ use of more sophisticated math vocabulary. Rudd et al. (2009) concluded that “the professional development training in addition to the side-by-side coaching was an effective intervention package” for improving the use of sophisticated math vocabulary (p. 69).

The study conducted by Neuberger (2010) echoes these findings. In his case study of “a teacher and coach collaboration”, Neuberger (2012) sought to determine “whether the coaching intervention had affected the teacher’s classroom practices and, if so, in what way” (p. 290). Neuberger (2012) sat in on a planning meeting, visited a math class, and interviewed both the coach and the teacher involved. Neuberger (2012) concluded that the teacher changed noticeably in terms of pedagogical and content knowledge from her experiences with the coach, giving “ample evidence that coaching can be a powerful professional teaching tool. The teacher apparently was aided significantly in her beliefs and practices, to the likely benefit of her students” (p. 309). Neuberger (2012) added that the school’s “fertile ground” in the form of a “receptive atmosphere of the school, the principal, and teacher’s colleagues, the willingness of the teacher herself, and the skills of the coach” went a long way toward enabling success between the coach and teacher (p. 309).

Chval (2010) found that coaches faced many challenges including the establishment of clear job descriptions. Anderson (2007) wrote, “The Mathematics Specialist as Visionary Strategist”, which provided a similar view of a specialist’s job: “The most important part of the
role is to understand the culture of the school and meeting the teachers where they are, and then moving them forward in their instructional practices and their content understanding” (p. 35).

Anderson’s (2007) mention of the importance of coming alongside teachers and then nudging them forward is a significant theme emerging throughout many of the studies reviewed herein. Smith (2006) expressed similar sentiments when she wrote, “it is critical to promote change from the inside, by understanding where teachers are coming from, what they face on a daily basis, what their interests and apprehensions are, and what resources (or lack of) they have available” (p. 113, parentheses included). In other words, these researchers and practitioners advocate fostering relationships of compassion, trust and respect while offering instructional coaching.

Several other researchers (Anstey & Clarke, 2010; Elder & Padover, 2011; Tieso, 2004) described the central task of a math coach as enabling changes in the classroom that enhance students’ learning and improve teacher practices and that the potential for such change depended, in part, upon “the interpersonal and relational aspects of coaching” (Anstey & Clark, 2010, p. 28-29). Skiffington, Washburn, and Elliott (2011) specified the kind of support offered; the coaches helped teachers develop the practice of being reflective about their students’ progress and about the various changes that might contribute to increased understanding among their students:

Coaching has qualities lacking in other forms of professional development that are essential for teacher learning: it is practice-based, ongoing, individualized, reflective, and intensive and it actively supports the transition of research into practice…It leads to measurable changes in teachers’ practice and improvements in children’s learning. (p. 13)

In addition to examining coaches’ roles in enabling changes in the classroom, researchers explored the role that math coaches can play in helping teachers develop confidence and instructional competence, finding that the coaches’ support can have far-reaching implications (Shidler & Fedor, 2010). Like Skiffington et al. (2011), these researchers (Shidler & Fedor,
2010) found that coaches can encourage teachers in the habits of self-reflection and careful observation of their instructional practices, thereby improving not only the teachers’ confidence but also their tendencies to improve their teaching strategies. “Reflection is one of the skills coaches can encourage in teachers,” wrote Shidler and Fedor (2010); “To be successful, the coach must look at each situation as a part of the whole and encourage teachers to become reflective about his or her practices as well as beliefs” (p. 71).

Being reflective of one’s own practice is especially important because, as Shidler and Fedor (2010) remarked, “When confronted by stressors in the environment, teachers often rely on learned behaviors, such as shushing children or using discipline techniques that are not effective” (p. 73). Zeller (2006) described the challenges he encountered as he sought to encourage teachers to strive for meaning and conceptual understanding as opposed to rote learning of facts and algorithms. Teachers, Zeller (2006) found, were often uncomfortable teaching differently than they had been taught. In her recent article published in the New York Times on July 27, 2014 entitled, “(New Math) – (New Teaching) = Failure, Green (2014) addressed this discomfort and the fact that United States teachers are often weak in math. She cites Magdalene Lampert, who hears her education students say,

‘I’m just not a math person.’…Consequently, the most powerful influence on teachers is the one most beyond our control. The sociologist Dan Lortie calls the phenomenon the apprenticeship of observation. Teachers learn to teach primarily by recalling their memories of having been taught, an average of 13,000 hours of instruction over a typical childhood. (p. 9)

The importance of teachers’ self-confidence and sense of competence becomes an increasingly important issue; researchers have asserted that both teachers’ instructional strategies and their personal beliefs about their own competencies can affect the classroom (Herron, 2010) and the students themselves (Bandura, 1993).
Knight (2011) wrote about finding ways that coaches might best help teachers “embrace learning” (p. 18). He described a “partnership approach” in which the coach works collaboratively with teachers rather than from a position of power. He listed “Seven Partnership Principles” that best enhance coaching success using these specific terms: equality, choice, voice, reflection, dialogue, praxis, and reciprocity (p. 18-21). Knight (2011) further proposed that, using this “partnership approach”, coaches “replace empty power that we get by virtue of our position with authentic power gained through choice” (p. 21).

“Content-focused coaching” was highlighted in a study by Vogt and Rogalla (2009) in which science teachers attended a seminar and then received nine sessions with a trained coach. These researchers found that the seminar followed by the coaching sessions that included lesson planning, post-lesson evaluations, and in-class co-teaching had positive effects on “competencies of teachers” (p. 1059). Furthermore, the multiple interventions resulted in “better learning outcomes” among the students of the teachers involved in the coaching process (p. 1058).

With respect to the effect of math coaching on teachers’ strategies, some researchers (Obara & Sloan, 2009) discovered noticeable positive changes in teachers’ lesson designs and instructional strategies that resulted from collaborating with math coaches. Obara and Sloan (2009) documented the implementation of a new curriculum at one school and found that the elements of trust and continuity in the relationships that developed between the faculty and the math coach were instrumental in enabling the teachers to make adjustments in their instructional practices in accordance with the new expectations. The same researchers cautioned that, despite significant preparation, training, and expertise, the job of a math coach is not without significant challenges. They (Obara & Sloan, 2009) recommended that districts provide support for coaches.
One researcher sought to discern the characteristics of effective coaching relationships, particularly with respect to the “coaching discourse” (Heineke, 2013). She studied the “one-on-one coaching interactions” of four pairs of coaches and teachers and determined that the nature of the relationship established between the coach and teacher was key:

Without a doubt, the teacher/coach relationship was discussed more ardently by coaches and teachers than any other factor related to successful coaching…positive relationships were perceived in my research as being the most critical element of coaching. The participants stressed that a foundation for coaching must be laid by coaches who display a respectful/listening attitude toward teachers, who build credibility with teachers, are available and visible among teachers, and maintain trust/confidentiality with teachers. Coaches and teachers agreed that without these relationship factors in place, it was unlikely that productive coaching would occur. (p. 427)

Sheffield (2006) agreed with Heineke about the importance of trust when she described the challenges a coach faces when working with teachers. In her detailing the “broad goals [she sought to keep] in mind throughout the year when working with hesitant teachers”, Sheffield (2006) placed “develop their trust” and “develop friendly working relationships” at the top of the list (p. 46). Woleck (2010), in her book on coaching, listed “a broad collection of essential elements of coaching” and placed “a trusting teacher-coach relationship” as the first ingredient. Even Slater and Simmons (2001), in their exploration of peer coaching relationships, reminded their readers that peer coaching had to include “trust among the participants” (p.68) and expressed an emphatic agreement with Showers and Joyce (1996, as cited in Slater and Simmons, 2001) that the coaching relationship must “not be confused with, or used for, evaluation of teachers” (p. 68).

While much of the research described successful coaching relationships, not all studies of coaching demonstrated purely positive results. In Shidler’s (2009) study of coaches who were
involved with the Florida Head Start literacy programs, there were mixed results. On the positive side, Shidler (2009) found that “a significant correlation was seen in year one in the time coaches spent in the classroom and alphabet letter recognition” (p. 459). Improvements in student achievement were less significant in the second two years however, leading Shidler (2009) to note that simply increasing the number of hours that coaches spent in the classroom did not always result in significant advances by the students. The authors concluded that their research suggested that improvement in student achievement was not necessarily a function of the amount of time coaches spent in the classroom but more a function of “the type and quality of interaction” (p. 459, italics added).

Like Obara and Sloan (2009), other researchers determined that math coaching is not always an easy task; Olson and Barrett (2004) found that teachers’ traditional attitudes about math instruction sometimes adversely affected their openness to new approaches in the classroom offered by coaches. These researchers (Olson & Barrett, 2004) encountered a great deal of difficulty in getting teachers to consider using more open-ended questions with the students in order to stimulate their own teachers’ curiosity. They (Olson & Barrett, 2004) concluded their report with a resounding call for more research on the kinds of coaching strategies that might encourage teachers to be more open to implementing innovative teaching practices shown to enhance student discussion and achievement.

**Coaching and Teachers’ Sense of Efficacy**

“Teachers’ self-efficacy is a little idea with a big impact,” wrote Tschannen-Moran and Hoy (2007). Bandura (1997) highlights the importance of studying teachers’ self-efficacy in the early childhood education context:
A teacher’s sense of efficacy is likely to be especially influential on young children because their beliefs about their capabilities are still relatively unstable, peer structures are relatively informal, and young children make little use of social comparison information in evaluating their capabilities. (p. 242)

In their article examining “professional development activities”, Landry, Swank, Anthony, and Assel (2011) seemed to indicate that the early years of education are vital ones (p. 971). Citing recent research, Landry et al. (2011) wrote that the research on young children’s academic experiences that has focused on the acquisition of reading, writing and language skills has shown that “teachers trained in instructional strategies that expose children to experiences with emergent literacy skills are more likely to have students who show cognitive gains that carry into kindergarten” (p. 972).

Researchers take great care to provide a concise and consistent definition of teachers’ self-efficacy and all that it entails (Wolters & Daugherty, 2007). Gibson and Dembo (1984), for instance, connected self-beliefs with teacher output: “Self-efficacy beliefs would indicate teachers’ evaluation of their abilities to bring about positive student change” (p. 570). As mentioned above, Zambo and Zambo (2008) studied the role that professional development can play in teachers’ practices; “A strong sense of efficacy influences teachers’ expectations, attributions, and goals” (p. 165).

Tschannen-Moran and Woolfolk Hoy (2001) sought to capture the “elusive construct” of teacher efficacy and the various instruments used to measure it. They determined that the Ohio State teacher efficacy scale was “reasonably valid and reliable” (p. 801), especially with its inclusion of the “three dimensions of efficacy… instructional strategies, student engagement and classroom management [that] represent the richness of teachers’ work lives and the requirements of good teaching” (p. 801). Bandura (1997) provided this definition: “Perceived self-efficacy
refers to beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments” (p. 3). Bandura (1993) described the importance of teachers’ self-perceptions as they pertain to the classroom and the students: “Teachers’ beliefs in their personal efficacy to motivate and promote learning affect the types of learning environments they create and the level of academic progress their students achieve” (p. 117).

Bandura (1997) emphasized the importance of the relationship among teachers’ practices, their sense of competence, and their students’ learning potential:

Students learn much more from teachers imbued with a sense of efficacy than from those beset with self-doubts. Teachers with a high sense of efficacy tend to view difficult students as reachable and teachable and regard their learning problems as surmountable by ingenuity and extra effort. Teachers of low perceived efficacy are inclined to invoke low student ability as an explanation for why their students cannot be taught. (p. 242)

Such a positive sense of self-efficacy can come from teacher training, Swackhamer et al. (2009) determined, as they evaluated the relationship between the content knowledge of science teachers and their levels of efficacy. The more courses teachers took in their field, the greater their sense of “outcome efficacy”, defined as “teachers’ belief that the education system can work for all students, regardless of outside influences such as socio-economic status and parental influence” (p. 66).

Gibson and Dembo (1984) pursued this notion of the importance of teacher efficacy and the dimensions of such efficacy that might “relate to Bandura’s theory of self-efficacy” (p. 573). They posited that their research suggested “that teacher efficacy may influence certain patterns of classroom behavior known to yield achievement gains” (p. 579). Gibson and Dembo (1984) called for more research on the relationship between teachers’ self-efficacy and teacher efficacy. More recently, Bates, Latham, and Kim (2011) studied teachers in training and described the
importance of how they feel about their own abilities: “Preservice teachers who felt good about their mathematics abilities were more likely to also feel good about their ability to teach mathematics than preservice teachers who did not feel good about their mathematics abilities” (p. 329).

Brown (2005) affirmed the important role that others play in how teachers perceive themselves: “Efficacy beliefs are developed not only by personal and vicarious experiences, but also evaluations and feedback from significant others” (p. 241). Tschannen-Moran and Woolfolk Hoy (2001) suggested that math coaching can play a positive role in improving early childhood educators’ perceptions about themselves as competent teachers and about their students’ potential for success. Furthermore, in an early study on teacher self-efficacy, Tschannen-Moran, Woolfolk Hoy, and Hoy (1998) noted the negative impact that change can have on teachers’ personal efficacy. Tschannen-Moran and Johnson (2011) later confirmed that teachers’ self-efficacy can decrease when faced with implementing changes in a curriculum; they found, however, that “Both self-efficacy for literary instruction and implementation of the new instructional strategy were enhanced when follow-up coaching was offered to teachers” (p. 753).

Though relatively few researchers focused specifically on early childhood school teachers’ perceptions, Herron (2010) described the greater degrees of confidence with which prekindergarten teachers designed their lessons, asked open-ended questions, and created opportunities for small group instruction in a prekindergarten classroom after working even briefly with the math coach. In addition, Guo et al. (2011) examined some of the components of preschool teachers’ self-efficacy. They noted that such self-efficacy has been found to be a “significant predictor of classroom quality and children’s gains in literacy” (p. 961). In their study, Guo et al. (2011) determined that there was a significant correlation among the variables
of teachers’ self-efficacy, teachers’ sense of collaboration and their decision-making influence. Specifically, they (Guo et al., 2011) found that “teachers’ sense of collaboration is essential in fostering teachers’ self-efficacy” (p. 966). In their suggestions for further research, these authors recommended further exploration into “the support that could help build strong efficacy beliefs among teachers” (p. 967).

**Coaching, Teachers’ Sense of Efficacy, and Student Achievement**

Though it is beyond the scope of this work to provide a thorough understanding of the role that teachers’ self-efficacy beliefs plays in student achievement, it is important to note briefly some studies pertaining to the relationships between the two phenomena. Scarpello (2010) argued that students are sensitive to the perceptions and feelings of their teachers and maintained that the students’ academic performance can reflect the confidence with which the teachers present the lessons. For Skiffington et al. (2011), teacher growth and improved student achievement went hand-in-hand. In a project designed to enhance young children’s language and literacy skills, coaches and teachers worked together, reviewing taped classroom videos, planning lessons, and exploring the most appropriate ways to guide students in their learning. Skiffington et al. (2011) described one teacher who was excited not only to learn new strategies to help her students learn but also to watch her students’ skills improve as well (p. 12). “Coaching,” Skiffington et al. (2011) wrote, “leads to measurable changes in teachers’ practice and improvements in children’s learning” (p. 13).

Over two decades ago, Ross (1992) studied coaching, teacher efficacy, teachers’ efficacy beliefs, and student achievement and determined that “student achievement [was] higher in the classrooms of teachers who interacted more extensively with their coaches” as compared with the classrooms of teachers who did not work with coaches (p. 60). Additionally, “student
achievement [was] higher in the classrooms of teachers with high teacher efficacy beliefs” which confirmed that “personal teaching efficacy” was a significant factor in promoting achievement (p. 60). While the research did indicate a possible trend in the direction of an interaction, the sample size of the study was too small to provide definitive results. One unexpected finding of the Ross (1992) study was that student achievement was lower in the classrooms of teachers who made less frequent use of the available coaches but who sought more regular interaction with the administration. Ross (1992) speculated that, among other things, it was possible that teachers sought the “reassurance from an authority figure” instead of seeking the constructive feedback offered by the coaches (p. 62).

Bruce, Esmonde, Ross, Dookie, and Beatty (2010) embarked on a similar study that explored the effects of a program involving collaborative work between math coaches and classroom teachers in two Canadian school districts. The researchers (Bruce et al., 2010) sought to determine “the effects of sustained classroom-embedded teacher professional learning on teacher efficacy and related student achievement” (p. 1598). In contrast to the findings of Ross (1992), Bruce et al. (2010) found that when teachers had “high teacher efficacy” and felt confident of their own abilities to enable positive learning among their students, their high level of confidence actually hampered their openness to constructive feedback (p. 1599). Bruce et al. (2010) defined “teacher efficacy” in terms very similar to Bandura’s (1997): “teacher efficacy is the teacher’s self-assessment of his or her ability to support student learning. Teachers with high teacher efficacy believe that they can positively impact student achievement despite a possible range of perceived challenging circumstances” (p. 1599). Bruce et al. described many teachers’ inflated self-assessments as interfering with their openness to suggestion. These researchers pointed out that, without other mediating factors affecting teachers’ practices, teachers’ self-
efficacy was not sufficient by itself to have a significant effect on student achievement. In fact, Bruce et al. (2010) found that the teachers with comparatively lower efficacy showed greater gains in terms of their efficacy beliefs and in their student achievement levels, perhaps in part, they speculated, due to the teachers’ openness to new ideas and growth opportunities. Bruce et al. (2010) concluded that teachers’ efficacy is more of a mediator than a cause of improved student achievement; teacher efficacy “operates indirectly by influencing teachers’ goal setting and persistence” (p. 1598).

Campbell and Malkus (2011) provided a convincing argument that the work of math coaches affected the performance of third, fourth and fifth grade math students. These researchers recognized that many school district leaders hired math coaches in recognition of the limits of professional development workshops and peer coaching models to improve teachers’ classroom practices. In their quantitative analysis over three years, Campbell and Malkus (2011) found that, even when controlling for interfering variables, third, fourth, and fifth grade students in schools with math coaches scored significantly better than those in schools without coaches. Interestingly, the advances were not realized until the second and third year of the coaches’ involvement. Campbell and Malkus (2011) proposed that “a coach’s positive effect on student achievement develops over time as a knowledgeable coach and the instructional and administrative staffs in the assigned school learn and work together” (p. 451).

**Synthesis of Literature**

This literature review explored math coaching as it has evolved as one form of professional development and support. The role that coaching has played in improvements in teachers’ perceptions of themselves and in students’ achievement was also explored. Math coaching was often shown to be effective in supporting teachers’ growth and in helping them to
advance their instructional strategies. The research supporting the claim that coaching improves teachers’ perceptions of themselves and their students’ abilities was presented; Herron (2010) found that a math coach’s support of pre-kindergarten teachers implementing a new program had positive results. Shidler (2009) reported that coaching for improvements in instructional effectiveness benefitted children in Head Start programs. Campbell and Malkus (2011) demonstrated that third, fourth and fifth grade students’ scores on standardized tests were higher in classes where teachers received support from math coaches.

Based on the research reviewed, there is a general consensus that various types of professional development can enhance teachers’ content knowledge, increase their confidence levels, and improve their teaching practices. The findings of the research included herein suggest that professional development in the form of standalone training seminars and workshops has had some positive results but that teachers reap greater benefits when the training seminars are followed by some form of coaching (Bruce & Ross, 2008). Chval et al. (2010) indicated that professional development programs, training seminars and workshops alone were unable to help teachers make improvements in their teaching practices. Bonner (2006) agreed that attendance at training seminars and workshops did not appear to produce lasting professional growth in teachers.

One implication of the above research is that coaching may play an important part in the ongoing professional development of teachers, in their perceptions of themselves as effective teachers, and in teachers’ perceptions of their students’ ability to achieve. One implication for school districts and administrators is that adding math coaches to school faculties may serve to advance the quality of learning among both teachers and students. Further study is needed to
explore the various ways in which math coaches can support early childhood teachers, improve teachers’ sense of efficacy, and broaden teachers’ understanding of their students’ abilities.
Chapter 3 – Qualitative Design

Methodology

The problem of practice was based on the recognition of three issues. First, in an article entitled, “Elementary School Teachers’ Attitudes Toward Different Subjects”, Wilkins (2010) found that “mathematics and science were ranked among the least favorite subjects to teach” (p. 31). As one math and science coach (Zeller, 2006) wrote about his first encounters with his school’s faculty, “many of the teachers, when asked, would readily admit that math was not their strong suit or that it was a low point in their day” (p. 52). Second, the degree of confidence with which teachers approach teaching math can affect students’ own self-efficacy beliefs (Scarpello, 2010) and often their achievement (Bandura, 1997) Third, the support of ongoing math coaches can be invaluable to teachers (Herron, 2010), often offering them not only a greater sense of pleasure but also a decline in apprehension (Bonner, 2006). To explore these issues, I investigated the relationships between coaches and teachers, and delineated a selection of best practices used by math coaches that positively influence teachers’ sense of efficacy.

My research question was: How do the relationships between math coaches and early childhood math teachers influence the development of teachers’ self-confidence and sense of competence? The study sought to identify and explore the optimal methods math coaches used to support early childhood teachers and enhance their sense of efficacy. Particular emphasis was placed on the experiences of the teachers and coaches and on what they perceived to be the most noteworthy and effective aspects of their coaching relationship.

Because all research is conducted from a particular paradigm that includes worldviews and ontological perspectives (Miles & Huberman, 1994), identification of the researcher’s perspective is essential. Butin (2010) described these perspectives as theoretical frameworks that
form the paradigms or worldviews through which the researcher views a particular issue. Creswell (2007) identified four such worldviews: postpositivism, constructivism, advocacy/participatory, and pragmatism. The constructivist perspective lies within an interpretivist framework in which researchers are intent upon understanding others’ subjective meanings and interpretation of all they have experienced (Creswell, 2007). The research conducted in this study followed the constructivist paradigm inasmuch as the intention was to discern the meaning that each individual attaches to his/her experiences with math coaching. The interest in using open-ended questions to discern the meaning that teachers and coaches derive from their work together provided the rationale for using the case study approach, described in the research design section below (Creswell, 2007).

The theoretical framework of this research plays a large role in determining the role of the researcher (Grbich, 2007). In this as in any constructivist paradigm, researchers first acknowledge the importance and influence of their own backgrounds on their perspectives and interpretations (Butin, 2010). The researchers’ positionality is therefore of special interest. Second, constructivist researchers seek not to define the best strategy or the highest score but to discern the meaning that the participants glean from their experiences (Creswell, 2007). It is in this context that researchers strive to conduct a careful inductive analysis of the data collected.

Research Design

Qualitative research is necessarily inductive, gathering its data from various sources to construct theories, and it is richly descriptive (Merriam, 2002). “The function of [qualitative] research”, Stake (1995) wrote, “is not necessarily to map and conquer the world but to sophisticate the beholding of it” (p. 43). This research design was particularly appropriate for this study because of its focus on how teachers and coaches perceive their relationships and the ways
in which they experience the influence of those relationships on their work. Denzin and Lincoln (2000) likened qualitative research design to the art of quilt making: “The quilter stitches, edits, and puts slices of reality together. This process creates and brings psychological and emotional unity – a pattern – to an interpretive experience” (p. 5). In qualitative research, especially in contrast to quantitative work, the emphasis is on reality as it is socially constructed (Merriam, 2002), and on the “how” of what is experienced and understood, with special attention given to the role that the researcher plays in collecting, analyzing, and interpreting the data (Denzin & Lincoln, 2000; Merriam, 2002; Stake, 1995).

**Research Tradition**

Case study research offers the opportunity to conduct an in-depth examination, incorporating context and including varying sources that allow for the triangulation of data. Yin (2009) described case studies as particularly appropriate for those seeking to explore “a real life phenomenon in depth, but such understanding encompassed important contextual conditions” (p. 18). Yin (2009) also identified case study research as the method of choice when managing many variables that are best investigated through a variety of sources. “The case study inquiry,” Yin explained, “relies on multiple sources of evidence, with data needing to converge in a triangulating fashion” (p. 18).

Additionally, case study research offers several advantages when investigating particular isolated circumstances or relationships. Creswell (2007) defined case studies as the methodology of choice when the researcher “has clearly identifiable cases with boundaries and seeks to provide an in-depth understanding of the cases” (p. 74). The study of math coaches and teachers’ sense of efficacy fits this description. Both Creswell (2007) and Stake (1995) make an important distinction between intrinsic case studies, which focus on the case itself, and instrumental case
studies, in which the researcher’s primary focus is on a particular issue and the case is chosen to demonstrate that concern. This study can be described as an *intrinsic case study* in which the researcher was able to focus on and learn about one particular case at a time and in which one of the goals was to understand and “come to know it well, not primarily as to how it is different from others but what it is, what it does” (Stake, 1995, p. 8). For my purposes, the focus was on the case itself and on the characteristics of the coaching relationship, the coach and the teacher.

Three other elements of my research fit case study research design. First, my research questions sought to ask and answer the “how” and “why” of math coaching (Yin, 2009). The questions were intentionally designed to explore how a math coach’s support might affect a teacher’s perception of her own competence, confidence and sense of self-efficacy, why certain coaching techniques might influence a teacher more than others, and how a teacher gains confidence through a particular style of coaching.

Second, the study of coaching relationships is well suited to case study research because there is no intention to control or manipulate behaviors or circumstances during the study (Yin, 2009). Instead, the goal is to explore the immediate circumstances in their current state without researcher intervention, and to ascertain how those circumstances support or hinder a teacher’s own sense of efficacy.

Third, given the concentration on each teacher’s present circumstances, the bounded system of the coach and teacher dyads fits the model of case study research. In my case, the focus was on three coaches, three teachers, and their respective experiences of their professional relationships. As Merriam (2002) pointed out, “the unit of analysis, not the topic of investigation, characterizes a case study” (p. 8). In my case, the unit of analysis, the coaches, the teachers and their relationships, was the focus of my research.
With respect to the context of qualitative research, the case study approach is used to conduct an in-depth analysis of a person, place or phenomenon (Merriam, 2002). This approach incorporates several sources of information including interviews, field notes, observations, documents, participant observation, and physical artifacts (Yin, 2009). The case, chosen for analysis for particular reasons, is a bounded system that serves as the unit of analysis (Creswell, 2007). The case study approach was chosen for this particular research project because the design allowed for intense analysis into the details of a single phenomenon, math coaching (Merriam, 2002).

Historically, in the earlier stages of self-efficacy research, the most prominent theorists tended to use quantitative studies to explore teacher and student self-efficacy, using instruments that measured student and teacher self-efficacy, and student achievement (Bandura, 1993; Saigh, Mroueh, Zimmerman, & Fairbank, 1995). Recently, however, researchers have found the case study approach helpful in delving into the functions of math coaching (McGatha, 2008), particularly as it pertains to kinds of efficacy (Bruce & Ross, 2008). My interest in exploring the connections between coaching relationships and teachers’ sense of efficacy, and the meaning that both teachers and coaches ascribe to those relationships, made the case study approach an appropriate method of study.

**Participants**

The sample population studied was comprised of early childhood teachers and their math coaches in independent schools in a large metropolitan area of the northeastern United States. Convenience sampling was used, with the intention of working with three coaches and their elementary school teachers. In addition, two coaches who were colleagues were contacted for participation and for referrals, using a form of snowball sampling. The goal was to keep the
sample size of total participants small, using three pairs of participants, to allow for in-depth explorations into the details of the nature and meaning of three coaching relationships and the corresponding teachers’ sense of efficacy.

My intention was to work with three coach-and-teacher dyads who had a history of working together that encompassed several years, who had established a rapport together, and who were aware of coaching strategies that have been particularly effective. This sampling strategy was limited to independent schools in an attempt to minimize the confounding variables that might affect the study’s trustworthiness.

Context

This research was conducted within the independent school network in a large metropolitan area. The sampling population’s socio-economic status was relatively high and homogeneous. There were different genders involved, and there was a difference in years of experience among those I interview. I chose to limit my sampling to independent schools because the job descriptions of the coaches tend to be similar within the independent school systems. I have found that there is greater variety among the roles assumed by coaches and math specialists in the public school system.

Recruitment and Access

In order to assemble a list of teachers and coaches willing to participate in this study, recruitment letters were sent to math specialists at metropolitan area independent schools in addition to the names given as referrals from two acquaintances. The recruitment letters did not result in adequate sample size. One specialist, however, provided access to a website for area math coordinators and specialists, and a recruitment letter was posted on that site. She offered to participate, though she worked with older elementary school students. However, her colleague at
the same school who worked with younger grades was willing to participate. Two sets of interviews were arranged through the website contact, with emails and phone calls used to established dates, times and locations. The other set of interviews was arranged through mutual acquaintances, followed up by emails and phone calls. While no incentives were planned, tokens of gratitude in the form of flowers were sent at the end of each interview and observation process.

Creswell (2007) described the importance of attending to the safety and welfare of all participants involved in any kind of research. Yin’s (2009) outline below details several of the aspects that such protection involves (p. 73). The Northeastern University protocols are included as well in this list:

1. Informed consent must be received from all who participate. This consent includes an explanation of the case study, a formal request for their voluntary participation, a notice that they are free to terminate their agreement to participate at any time, and a signed document attesting to their understanding of all of the above.

2. Every effort must be made to ensure no harm comes to those who are involved in the study and, as Yin (2009) reminded his readers, this includes harmful deception.

3. Participants must be assured that their privacy will be protected, that pseudonyms will be used, that any identifying characteristics will be disguised, and that every effort will be made to ensure that no one has access to any documents, interview transcripts or field notes (Yin, p. 73).

4. The Institutional Review Board at Northeastern University must review the study and approve the design and plan of action (recruitment letters and consent forms are provided in appendices at the end of this document).

Data Collection

Seidman (2006) recommended a three-interview series, spaced three or more days apart, offering the interviewer and participant the opportunity to establish a comfortable rapport. The first interview, Seidman (2006) wrote, is intended to gather information about the participant’s personal history, about how the participant became involved in a particular program or school, and about how his/her personal background might have influenced choices and behaviors.
Seidman’s (2006) second interview is designed to gain an understanding about all that might be involved in the teacher’s or coach’s daily work life, and about all that the participant encounters in a typical day. In the third interview, “we ask the participants to reflect on the meaning of their experience… address[ing] the intellectual and emotional connections between the participants’ work and life” (Seidman, 2006, p. 18).

My intention was to conduct these types of interviews for as long as possible (Seidman, 2006) with individual coaches and teachers. It was not feasible to conduct long and multiple interviews however, so they were combined and shortened. Seidman (2006) allowed for such circumstances, indicating that the most important consideration “in designing interviewing projects might well be to strive for a rational process that is both repeatable and documentable” (p. 22).

These interviews were conducted in person at a location most convenient for each participant. All participants chose to be interviewed at their schools of employment. The sessions were taped on two digital recorders so that the potential for the loss of data due to equipment malfunctioning would be minimized. With each participant’s permission, the recorders were positioned between the interviewer and participant, and sessions were recorded in their entirety. Additional interview protocols are listed in the appendices.

I transcribed the interviews from the recorder to a computer document. I compared the transcripts with the recordings for accuracy and then sent the documents by email to each participant. The interviewees were asked to review the documents, comment on their accuracy, and return them with corrections. Each interviewee wrote back and confirmed the accuracy of the transcripts. One teacher asked about the frequency of question marks at the end of many of
her sentences, saying that she had not intended to pose questions, but that her voice often goes up at the end of a thought. I changed the question marks to “…” and she was satisfied.

While interviews comprised the bulk of the data collected, documents, field notes, and artifacts were sought as well. “The most important use of documents is to corroborate and augment evidence from other sources” (Yin, 2009, p. 103). Notes from teachers and coaches about their coaching sessions were not available, though each specialist and teacher gave me a great deal of information about all that transpires during their sessions. One specialist showed me her schedule. Other written documents in the form of mid- and end-of-year evaluations, often written by specialists, were not available. Lastly, field observations were made. These included noting the appearances of the schools, offices and classroom surroundings. The goal was to reach “saturation”, the point at which no new information was found from data (Creswell, 2007).

Yin (2009) specified three principles of data collection and maintained that they address questions of construct validity and reliability. First, Yin (2009) recommended using several sources of evidence. The variety offers the opportunity for triangulation, defined by Stake (1995) as “working to substantiate an interpretation or to clarify its different meanings” (p. 173). Yin (2009) further explained that triangulation can help provide greater accuracy and conviction, so this study sought out different sources of data. Second, Yin (2009) described the importance of establishing a database that other researchers can access, which can provide opportunities for additional sources of feedback. Third, Yin (2009) proposed a principle that increases a study’s reliability: maintaining “a chain of evidence” (p. 122) in which the goal is to enable a reader “to trace the steps in either direction (from conclusions back to initial research questions or from questions to conclusions)” (p.122, parentheses included). Each of these principles was followed.
Data Storage

Because confidentiality was essential, pseudonyms were used for all participants. Any identifying descriptions, details or conversations were disguised or removed. Recordings were made on two separate pieces of equipment to prevent data loss. All transcripts of recordings and documents were kept in locked drawers and on a password-protected laptop in my home office; I was the only one who had access to the laptop. All journals and observation notes were also kept in a locked file in my home office. Three years after the completion of this project, the interview recordings will be erased, the transcripts files will be deleted from my laptop, and all hard copies of pertinent documents will be destroyed unless otherwise instructed by my advisor.

Data Analysis

The analysis process began with multiple extensive reviews of the interview tapes and of the transcripts. The reviews were repeated several times both to ensure accuracy and to familiarize myself with the content. Next, there was a process of conducting various levels of coding. Saldaña (2009) defined a code as a “word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data” (p. 3). Saldaña (2009) outlined several forms of first cycle coding methods to use in the process of analyzing the data: Descriptive codes for applying general labels, In Vivo codes for using participant’s actual words, Process codes for providing a sense of the flow of actions, and Initial codes for maintaining details and dimensions of participants’ words.

After the first cycle of coding was completed, a second cycle was conducted, during which time broader thematic categories were applied to summarize first cycle codes. Second cycle codes included Pattern codes, Focused codes, and Axial codes. The final step in the coding process involved Theoretical or Selective codes which enabled a shift toward “the confirmed
central/core category and its related categories” (Saldaña, 2009, p. 164). All cycles of coding were done manually and then the transcripts were transferred to MAXQDA 11, a qualitative data analysis software program that allowed for additional forms of analysis.

Though interviews constituted the majority of the collected data, other documents such as curriculum manuals and coaches/teachers’ notes from coaching sessions were sought. The documents that were available were a weekly schedule and a series of textbooks and supplemental materials offered by the specialists. The constant comparative method, which Creswell (2007; 2012) described as being used in grounded theory approaches, were employed to check for consistencies and/or contradictions of categories throughout all collected data.

**Trustworthiness**

Because qualitative researchers have particular perspectives on epistemology, they often prefer to discuss matters of “trustworthiness” instead of referring to the issues of “validity” that concern quantitative researchers (Seidman, 2006). Stake (1995) asserted that establishing trustworthiness involves a variety of techniques designed to help acquire the necessary confirmation, improve credibility, and provide evidence that supports an assertion (p. 112). Stake (1995) cites four kinds of triangulation, first identified by Denzin (1984): data source, investigator, theory and methodological triangulation. Stake (1995) maintained that each of these methods helps confirm the accuracy of interpretations. Accordingly, this research was designed to determine if elements of the case remained consistent throughout the study (data source triangulation), and to check on the alignment of past and present researchers (theory triangulation). In addition, several different sources of data were sought – interviews, documents, field observations – to ensure saturation. Stake (1995) also mentioned member checking as a
way of checking the accuracy of transcripts. As mentioned above, transcripts of interviews were sent to participants for their review.

**Limitations**

This study was restricted to independent school settings and as such, was limited in its generalizability. The job descriptions for math coaches in independent schools and in public school districts often differ from one another and therefore it is possible that only some of what was discovered will apply to other settings. Furthermore, this study was limited to three pairs of coaches and teachers who participated on a volunteer basis. Though the intention was to probe deeply into those relationships, the study was small in scope. It was also limited in its time frame. The interview and observation processes took only a few weeks; the participants were not studied over a prolonged period of time. Lastly, this study was conducted within a small geographical setting and culture. Conclusions drawn and inferences made may apply most immediately to specialists and teachers in circumstances similar to those of the participants.

**Protection of Human Subjects**

For the purposes of this study, as is true for all research involving human subjects, special attention was paid to treating all participants ethically and safely. The Belmont Report established three essential considerations to be observed by those conducting such research: respect for persons, beneficence and justice (Seidman, 2006). Toward this end, I provided the participants with a description of the study and requested permission – the informed consent mentioned above – before conducting any interviews or observations and before viewing any documents. “Most educational case data gathering involves at least a small invasion of personal privacy” (Stake, 1995, p. 57), but every effort was made to see that the data collection process was minimally invasive. Care was taken to ensure that no one was harmed, all forms of data
were locked securely, and confidentiality and anonymity were maintained. Application for approval from the Northeastern University Institutional Review Board was made using the forms provided by the University and approval was granted.
Chapter 4 – Data Analysis

The purpose of this study was to explore the relationships between math coaches and teachers. Special emphasis was placed on the strategies math coaches used in these relationships to support early childhood math teachers and to help them develop strong perceptions of confidence and competence (teachers’ sense of efficacy). The central question for this research was: How do the relationships between math coaches and early childhood teachers influence the development of teachers’ sense of efficacy? Two sub-questions helped guide the interviewing process: What elements of the relationships between coaches and teachers do coaches identify as most effective in influencing teachers’ sense of efficacy, and what aspects of these relationships do early childhood educators identify as influencing the development of their own sense of efficacy? The goal was to explore the relationships and strategies that support the development of teachers’ sense of efficacy. The data for this study were collected by conducting interviews of coaches and teachers at three urban independent schools. This fourth chapter provides a brief description of the specialists, the teachers, and their schools. An analysis of the six themes that emerged is then presented followed by a conclusion summarizing the nature of the relationships and the strategies used both to develop those relationships and to expand teachers’ sense of efficacy (Saldaña, 2009).

There is one difference in the titles used in this fourth chapter. The coaches interviewed were titled “math specialists” by these three independent schools though they functioned as coaches according to the descriptions outlined in the previous chapters. As mentioned at the end of Chapter 1, the terms “math coaches” and “math specialists” are often used interchangeably in
the literature. In these next two chapters, out of deference to the participants’ titles and the terminology used by the teachers and coaches, the term “specialist” is used to refer to these “coaches”. Campbell and Malkus (2014) provided some clarification of the terminology:

The assumptions are that the specialist or coach is a knowledgeable colleague who has pedagogical expertise and an understanding of mathematics and of how students learn and that this person is qualified and capable of serving as an on-site resource and leader for teachers, providing school-based and content-specific professional development…The intent is for the mathematics specialist-coach to serve as a collegial mentor who helps foster and then works to sustain a practice-based professional community in the school. (p. 214)

The Participants and their Schools

The three dyads of math specialists and first grade teachers are represented respectively as Dyad 1: Sarah and Esther; Dyad 2: Terri and Michael; and Dyad 3: Ellen and Roberta. Each dyad worked in separate independent day schools in affluent sections of a large metropolitan city in the northeastern United States. The three schools were within a 10-mile radius of one another. Two of the three schools were co-educational, and two schools went up to the twelfth grade. Two specialists were responsible for prekindergarten through second grade, while one specialist covered kindergarten through fourth grades. In each case, I interviewed the specialist first and then the first grade teacher. Each interview lasted under an hour. The demographics of each school are given in the following table.

3 For more information on this topic, see Campbell and Malkus (2014).
4 All names and titles are pseudonyms. All other demographic information is accurate.
Table 1

*Names, School Details, Demographics, Grades, and Lengths of Relationships*

<table>
<thead>
<tr>
<th></th>
<th>Dyad 1</th>
<th>Dyad 2</th>
<th>Dyad 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Names of Specialist and teacher</td>
<td>Sarah and Esther</td>
<td>Terri and Michael</td>
<td>Ellen and Roberta</td>
</tr>
<tr>
<td>School Demographics</td>
<td>Co-educational Nursery-Twelfth Grades Student Population: Approx. 400</td>
<td>All-girls Preschool-Twelfth Grades Student Population: Approx. 690</td>
<td>Co-educational Nursery-Eighth Grades Student Population: Approx. 400</td>
</tr>
<tr>
<td>Specialist’s Grades</td>
<td>Prekindergarten-Second grade</td>
<td>Prekindergarten-Second grade</td>
<td>Kindergarten-Fourth grade</td>
</tr>
<tr>
<td>Teacher’s Grade</td>
<td>First grade</td>
<td>First grade</td>
<td>First grade</td>
</tr>
<tr>
<td>Length of Relationship</td>
<td>1+ years</td>
<td>8+ years</td>
<td>4+ years</td>
</tr>
</tbody>
</table>

The interviews took place at each dyad’s school in November (Dyad 1) and December (Dyad 2 and Dyad 3) of 2013. The members of the dyads were interviewed individually. All three of the schools were in the midst of math curriculum adjustments and changes of some sort, resulting in additional dimensions of responsibilities and relationships among the specialists and teachers. What follows is a presentation of the six main themes that emerged from the data. These themes were derived from conducting a qualitative analysis of the interviews. The themes are listed in order by frequency of occurrence and by emphasis given by the speakers. Some themes were mentioned by all participants. Often, themes were mentioned several times throughout the interviews. The six themes are divided into sub-themes for clarity.
Theme 1: Collaborative Environment

The most frequently mentioned aspect of the specialists’ work described by both specialists and teachers alike as providing teachers with more confidence and sense of competence concerned the ways in which specialists helped to establish collaborative environments. Some specialists were involved in providing demonstrations of how to introduce a lesson, referred to most often as modeling or giving ‘demo’ lessons. For others, teaching alongside the classroom teachers was their preferred style. For instance, at the Ribaldi School, Sarah taught in five classrooms a day, giving demo lessons and teaching alongside the classroom teachers. She worked with Esther who was fairly new to the teaching profession and to The Ribaldi School, having taught for one year as head teacher in a public school classroom before coming to The Ribaldi School. Esther was quite emphatic as she spoke of the contrast between her experience in the public school and her present work. Her previous school was, she said, “very very different from this school…we didn’t have as much support; we didn’t have someone like Sarah who’s coming into the classroom…so this is a new experience…it’s amazing.” Sarah and Esther worked together very closely; Sarah came into Esther’s classroom every day and co-taught a small group of math students with her.

Modeling. When asked to identify what her teachers would describe as important contributions to their teaching confidence, Sarah conjectured that “some of the modeling in the classroom” would be mentioned by the teachers. For her, such modeling took the form of teaching both whole group and small group lessons with the teachers in the classrooms. “I do some whole class, some small group, whatever.” Esther spoke about Sarah’s role as a model and co-teacher: the two of them often taught a small group together within the classroom: “There are three of us and then Sarah pushes in…Sarah and I…will introduce whole concepts
or…introduce, like today, we introduced a game.” Sarah prepared the homework for the groups, Esther said, because the small group’s lesson was not always aligned with the workbook assigned. When considering all this, Esther said, “I definitely think there’s more support for math [than for other subjects]…Sarah and I will sometimes work together and the other half of the class works together.”

Ellen had been at the Wilton School for over four years and had worked closely with Roberta throughout her time there. Ellen described her modeling as something that had not been done in earlier years and as something she did upon request. “I’ve gotten feedback from teachers that they like to see me teach…specifically they like to see me…unpack a lesson. So, [I] have them hold the discussion afterwards…when I first came here, that wasn’t something that was done regularly.” She went on to identify what she considered were the two most important components of her relationships with her teachers: “I would say those are the probably…the two biggest…impacts…on their day-to-day practice…the planning meetings and watching me model some.”

Terri and Michael had worked together at the Uptown School for over eight years and were quite familiar with each other’s styles of teaching. During the first year of implementing the new curriculum, Terri had supported her teachers by modeling a lesson’s nuances. When wanting to demonstrate the best ways to use a material unique to the new program, for instance, Terri had led the lessons herself: “Kindergarten through fourth grade [had] me assigned to their class at least once a week…[to do] a lot of modeling last year, of [specific curriculum] strategies…I modeled a lot [on the use of a particular material] in kindergarten and first grade, the first two years, because [committing to the new curriculum and its specific materials] was a huge investment”. Michael expressed his appreciation of Terri’s occasional modeling. When
asked how he liked to make use of the math specialist, Michael said that some of the most helpful activities, in his eyes, included her modeling:

I think when she comes in and does a whole-group lesson… I think because she’s a math specialist, I think sometimes when it’s a new concept, new approach, that it’s great [to have her model]. She’s a resource for introducing that [new material] to the girls. She has some great approaches, some tried-and-true approaches that she’s used.

Michael seemed to value the specialist’s expertise and felt he benefitted from observing her:

“She’s…had more training in math as well so, again, just to see her…strategies or techniques that she…employs in teaching it…I learn, I learn from her…definitely.”

A reassurance thing. Teachers and students had adjusted to Terri’s new way of joining Michael during math lessons:

You know what’s nice, too, is that I think the girls, just from seeing how we all work together…almost expect, like, a co-teaching situation when I, when I show up…Michael just loves me coming in and both of us talking through the lesson together with the girls.

Terri described Michael as preferring the back-and-forth that characterized their whole group discussions. Even during this second year of the new curriculum, Terri found teachers still occasionally wanted her to show them how to present a topic. “And, a lot of times, it’s like either feedback or sometimes, it’s just…‘Do the lesson and I’ll ask you some questions!’” She continued: “But it’s not so much modeling a new idea. It’s like I’m just doing what’s in the book…And they just want to see, make sure, it’s kind of like a reassurance thing…‘Ok, she did it the way I would have done it!’”

Coaching. In a similar fashion, Ellen referenced her presence in the classroom as a co-teaching effort. She remarked on the welcome that she got when she entered the classroom. Describing the teachers’ reactions, she said, “They’re, like, ‘Yay, Ellen is here! All right, we’re
gonna all teach together!?” Asked how she would describe her customary efforts in the
classroom, she said she often co-taught: “Yeah…actually just today…I co-lead a
discussion…[the teacher] started the discussion, I chimed in and got to a different part of the
discussion, so, yeah, it’s awesome…I love it…back and forth…It’s a great way to do it.”

Co-teaching, as described by these specialists and teachers, sometimes involved co-
leading a discussion with the whole class and at other times involved teaching a separate group
within the classroom. Roberta spoke of the format: “We would…sometimes break into
groups…into three groups so each teacher could take a smaller group, and…the specialist would
be responsible for working with one of those groups.” Ellen often took the struggling students
while she occasionally worked with the more advanced group of students. Ellen indicated that
her intention was to work alongside each set of classroom teachers, being responsible for groups
that changed according to the needs of the students. Roberta spoke of the seamlessness of Ellen’s
participation in the classroom proceedings. The students were accustomed to her weekly visits,
Roberta said. “It’s more, like, ‘Hmm, the math specialist is in the room, part of what we’re
doing’…the kids…view her as…another…math teacher.”

Sarah spoke of the first grade teacher I was about to interview and said that the two of
them taught lessons together daily. She described the co-teaching as a way in which she
instructed the teacher. It was valuable, she said, “because…then…next time, you know, later on,
she’ll be teaching on her own.”

**Feeling good about the program.** Sarah said she saw teachers gaining enthusiasm as
they worked closely together: “I find that teachers really enjoy teaching the math. I think because
we talk about it together and then we…come up with activities that are fun.” She later reiterated
her point about the importance of the activities she and the teachers designed: “I think
because…so many of the activities and the games are so much fun, that the teachers are enjoying getting into it.” “So, there’s some excitement” among the teachers, she said. The curriculum they used in the first grade classroom was actually a hybrid of several programs and Sarah attributed much of the teachers’ enjoyment of math to the variety and vibrancy of the choices she and the teachers had made.

Terri shared the perspective of wanting her teachers to have the necessary excitement and confidence to teach the new curriculum: “I think this year is more the teachers just need to feel good about the program, and making sure that the girls…are all getting it.” Terri suggested that her own enthusiasm affected the teachers as well as the students. She quoted another teacher remarking on her influence: “She’s just, like, ‘When you’re in here, the girls get more pumped up!’” Michael provided testament to Terri’s influence by describing the changes she had ushered in. Remark ing on the fact that Terri had helped the teachers make math fun by coordinating World Math Day and other events, Michael smiled as he described the antics of the first grade teachers; he and other teachers often dressed up as various math operations and he, as the only male in the group, often dressed up as “Mr. Plus”. When describing Terri’s help in implementing the new curriculum, Michael said, “I just, I feel…enthusiastic about teaching [the program], so hopefully the girls pick up on that.” Furthermore, when asked how Terri’s role affected his feelings about doing his job, Michael said, “I’m much more confident; my comfort level is so much greater.” This, he said, stood in sharp contrast to how he felt as a young student; he had been more comfortable with language arts and not “a super big fan of math growing up.”

I need feedback. Terri described the shift she had recently made away from modeling to either co-teaching or observing, now that they were in their second year of implementing the new curriculum. “This year…I don’t do as much modeling because the teachers want that experience
of getting their feet wet.” Often, Terri reported, the teachers wanted to be watched while they taught so as to get some tips on how they were doing. The teachers, Terri said, were sometimes more anxious to get her advice about their teaching than to get help with their students:

“Sometimes they’ll just say, ‘Don’t worry about the girls. Come in and I need feedback…Just observe me, let me know how I’m doing…if you think something’s missing’.” This was informal, she continued: “a casual invitation and… a casual follow-up.”

**Summary.** Being in the classroom in a variety of configurations was the most frequently mentioned method of helping teachers feel more comfortable and confident. The specialists remarked on both co-teaching and modeling as effective ways of helping teachers. In the early stages of introducing a new material or curriculum, Terri modeled lessons while teachers watched; later she co-led whole group classroom lessons or offered feedback after watching a teacher lead the lesson. Sarah was in the classroom daily, co-leading the instruction alongside the classroom teachers, while Ellen’s approach involved taking one of the small groups within a given classroom. Teachers remarked on the ease with which the specialists became part of the classroom and the benefits they gained from that presence. Roberta described Ellen’s co-teaching as a “pretty seamless” and “very collaborative” involvement while Michael talked of watching Terri teach and growing in his own understanding and confidence, saying, “I learn from her…definitely.”

**Theme 2: Shaping the Lessons**

When considered as a collection of sub-themes, content planning, pacing, helping with insecurities, and hosting big picture discussions ranked second in frequency and apparent emphasis among the specialists and teachers. These sub-themes are detailed below.
**Content planning.** Specialists and teachers mentioned planning sessions as the most beneficial facet of the relationship more frequently than any of the other lesson shaping sub-themes. Sarah, along with the other two specialists, mentioned numerous times that a major aspect of her role involved helping the teachers determine the content of the upcoming lessons. Sarah described her weekly meetings with teachers of each grade:

> I kind of plan out with them a rough draft of what we’re going to do the next week or two…content-wise…like, say, right now, we’re doing a whole unit that we planned. We kind of got together, planned the whole unit, and then we touch base with each other.

Coordinating the specific content of a given lesson was part of her role, Sarah explained:

> “Sometimes it could be that we say…‘We really need to work on different content’, like one group really…needs to extend and brainstorm about how to apply this skill, and one group really needs the…foundational basic facts.”

Esther affirmed Sarah’s description of the planning times:

> There’s a once a week meeting where we sit down…she kind of gives an overview, she comes with, ‘This is what we did last year at this point, this is where we are in the year, what we need to follow for the scope and sequence of everything’.

Esther provided her thoughts about the specialist’s availability to address content issues or just to talk. She mentioned frequent impromptu conversations that arose in the specialist’s office partly because of its proximity to the lunch room: “Yeah, people are always in there and so I sometimes eat lunch there, and we can just talk about either the students or what happened in math, or what we should be doing, or we’ll plan during lunch then.”

Esther mentioned one drawback to having multiple teachers, specialists and aides invited into the planning and differentiation process:
Sometimes there can be too many cooks, too many chefs in the kitchen...but...it’s a blessing and a curse...it’s definitely more of a blessing in that way...like sometimes there’s miscommunication or...things happen whenever you’re working with people...you have so much support, and you have all the people around you...sometimes there are...glitches...but that happens.

While describing this occasional “glitch”, Esther reiterated her preference for her present situation compared to working alone, and being responsible for all the planning and differentiating herself, the way it had been for her at her previous school.

**They feel a little insecure.** Content support, specialists said, was often necessary because the teachers were not always comfortable and confident about the math they were asked to teach. Sarah saw this as being especially true of younger teachers: “they come in actually much better trained in language arts than they are in math and they also, they feel a little insecure about math in the beginning.” She went on to say she thought they felt insecure because “they feel like they have lots and lots of training in reading and not as much training in the math.” Ellen was even more direct about teachers’ insecurities when faced with teaching math: “It’s like the trajectory of the math, I think, is what they’re not comfortable with.” She noticed teachers were “more confident working with the struggling math students...but the first grader who may need enrichment, they’re not quite sure what to do with them.” Ellen attributed teachers’ lack of confidence to a kind of arrested development in math:

> You never stop reading...even if it’s a manual or a website...but you stop doing math...you don't lose...that problem-solving part of your brain. But you definitely don't fiddle with the numbers, or the concepts, on a daily basis...but you read on a daily basis.

The other two specialists identified planning as a key component of what they offer teachers to help their comfort levels, particularly in light of the specialists’ efforts to implement new or complicated curricula. Terri conjectured that the planning meetings helped with the steep
learning curves that come with implementing a new curriculum and determining how much time to allot for each lesson. When asked what transpires in her semi-monthly planning sessions, Terri indicated that the sessions were a time of sorting out the complexities of the newly-adopted curriculum: “there’s some trouble-shooting…especially if something comes up in [the new curriculum] that is foreign, that we haven’t covered in a…training session.” Terri imagined that her teachers would describe the planning sessions as her most important contribution to their work as she attempts to provide a sense of the road ahead:

I think the heads-up…especially with the adoption [of the new curriculum], the heads-up, so it’s, like, ‘These are the things that I think are going to be our loopholes’…just having someone…being a little bit ahead of the game so that…there’s no surprises.

Michael agreed that the planning meetings served a vital purpose. The meetings, he said, were “very helpful because it’s…basically her checking in with us…just to kind of get a pulse…of how things are going…just working out the kinks…she’s there to…help us in any way.”

Terri often used her planning sessions to offer feedback to teachers about their pedagogical choices relating to homework content. With her first grade teachers, she challenged their pattern of giving unequal homework assignments:

When I first started…I was, like, ‘Look at the message you’re sending. There’s reading homework but there’s no math homework?!’ I could see if there was no homework. I could see that message. But…if you have two academic subjects and one [has homework], there’s a message there.

Michael shared his specialist’s perceptions of the importance and character of the team meetings when he affirmed the value of the planning meetings for assurance that the content was appropriate. When struggling with assessments that did not seem aligned with the classroom instruction, the first grade team of teachers brought their concerns to the coach. Terri helped the teachers determine what was relevant and necessary and what was extraneous. Michael talked of
the relief he felt with the specialist’s assurance that they were on the appropriate path: “so it was
good to know that…we weren’t expected just to follow this in a rigid fashion.”

**Big picture discussions and "Ah-hah!" moments.** At the very outset of the interview,
Ellen identified her planning sessions as extremely valuable. When I indicated that I was
interested in learning what she did with the teachers that she thought helped them, supported
them and made them feel comfortable with all they were doing in the classroom, Ellen said,
without hesitation, “I would say Number 1 would be our planning meetings, our weekly planning
meetings.” During her tenure as math specialist, she said she had adjusted the agenda of the
meetings to go beyond basic sequencing of lessons, of “Ok, this lesson, this lesson, this lesson.”
She had begun to design the meetings so as to enable the sessions to “become more big-picture
discussions on the math that we’re teaching.” She felt the shift had definite value: “having those
discussions…in planning meetings I think has led to some ‘Ah-hah!’ moments, or led to more
questions, or has led [the teachers] to…just look at the…material they’re teaching differently.”
The teachers, Ellen said, “feel very comfortable with literacy…they can teach the [math] lesson
but they don’t really know where the math is going!” Roberta concurred with the specialist,
saying that Ellen was in their classroom for several days a week, “and then…we also plan with
her…and do any of the kind of behind-the-scenes work with her.”

**Pacing.** While some specialists used the grade-level meetings to identify the content of
the lessons, others used the sessions to focus on the overall pacing of the lessons. Terri was
attempting to use this year’s implementation of their new curriculum as a baseline: “In order to
protect that,” Terri said of the baseline, “a lot of [meeting time] is dedicated to the
pacing…we’re pacing for two weeks at a time.” It wasn’t uncommon for Terri and her teachers
to make adjustments along the way: “Sometimes we’ll say, ‘Oh, this lesson should take 2
days’…but we’ll…really look at it during that meeting and we’ll be, like, ‘Oh, there’s no way! This is going to be a 3-day lesson!’” Michael remarked on Terri’s focus on the pacing and the need for occasional changes: “She’s actually putting together our timeline for each chapter…but already we’ve…made changes to the timeline on several of the chapters…We decided we need to spend more time on subtraction. So we adjusted the timeline there.” When asked about having the freedom and flexibility to make changes like that, Michael said the school “really treats us as professionals that way.”

**Summary.** One specialist identified her planning sessions as the most important contribution to her teachers. Such sessions were opportunities for the coaches and teachers to select the content deemed most appropriate for the flow of the curriculum and for the needs of the students. Though one teacher described the miscommunication that can arise when many teachers, specialists and aides are involved in discussions, she indicated a preference for her present circumstances over her previous job. During her meetings, one specialist took the opportunity to ask the “big-picture” questions rather than simply to decide who was going to teach which content, while another used them to establish timelines and provide short- and long-term pacing of the curriculum.

**Theme 3: Keeper of More Knowledge – A Big Resource**

“She obviously is the keeper of more knowledge…and so she does have some authority in the sense that she knows her things”, said Roberta of her math specialist, Ellen. “She’s a big resource.” Serving as a resource support and “the keeper of more knowledge” was the third most frequently mentioned set of sub-themes among specialists and teachers. When asked about the kind of support Ellen was hoping to provide as she made adjustments in her role, Roberta said she thought Ellen would continue to be in the classroom, monitoring students’ progress, but that
she would also “continue bringing in the outside research, current thinking, and ideas.”

Considering Ellen’s involvement in the classroom, Roberta focused more on Ellen’s role as a support and observer. She described Ellen’s work, as she returned from maternity leave that week, as serving as “more of a resource and a support for us.” This complemented Ellen’s plan to bring in more “big-picture thinking”. With the previous curriculum, the teachers had begun to feel that the material was inadequate when it came to directing the students to the essential skills. With the new curriculum, Ellen said she was finding a higher level of interest and satisfaction among her teachers: “So, right now, we’re feeling like it’s a nice breath of fresh air. So, you know, we’re not too far into it, but…when I’ve asked teachers for feedback, they feel like they understand their students better than they ever had.”

**Reflecting on the “math that’s embedded.”** Ellen said that, in her experience, she had found that for many early childhood educators, “It’s been a long time since they’ve studied what’s down the road.” Ellen indicated that she considered her role to include preparing thoroughly for her meetings with the teachers so as to take the opportunity, with the new curriculum, to ask them to reflect on the upcoming lessons and “the math that’s embedded in that activity.” Roberta, in turn, saw the relationship as multi-faceted: “We are colleagues, peers, we work together…and she’s a resource, a consultant, advice-giver…and we really collaborate.” Similarly, Terri was instrumental in bringing in a new math curriculum, and Michael remarked on the changes: “She has done so much to improve the curriculum…I’ve been here twelve years now…it’s night and day…from when I started to now…it’s been beefed up so much.”

Two specialists, Terri and Ellen, mentioned that providing support for their teachers in the form of professional development opportunities was essential given the intended implementation of a new curriculum. Terri said that each of the teachers took some sort of
training in the new program, whether they went to conventions, workshops or online training seminars. The math conventions in the summer were a bit more comprehensive, said Terri, “so, it’s been nice that the teachers had the more in-depth training over the summer.” Ellen said she followed up on the summer training with training sessions throughout the year: “now, there’s a math meeting, like, every other Friday…to just keep…reflecting.”

**Materials and activities.** “Tons of books…we have a closet with math material and…our classrooms are very well stocked…yeah, she’s got all the books”, said Roberta when asked about the materials Ellen has. Terri maintained a good supply of materials for the teachers’ use as well; she said she thought that was one important way she supported her teachers. She indicated that the teachers were well aware that she was the keeper of many of the “manipulatives” used to introduce and reinforce math concepts common to this particular curriculum. “If they need any resources, I’m the girl [to call].”

Terri told me at great length about the engaging activities she arranged for the students. She coordinated student participation in several competitions and online contests: “I do big umbrella things, too, like…I set up IXL and Sumdog” and other activities. Her school was particularly generous, she said, in funding her purchases of trinkets to give the participants and visors for the students to wear while being involved in these events. Terri initiated a particular project that enabled students to enroll in an online international math competition. They logged into a particular website, she said, and,

They’re just asked computation problems…they’re competing [with other students] in live time…So, it’s, like, ‘So-and-so, from the United States, is playing so-and-so from Uganda!’…It happens all the way around the world…The company that…they all log into keeps track of…the rounds and which school gets the most points…[The students] get so excited…It just got the girls really jazzed and excited about math. So…that’s one of the other little extra things that I do.
Terri also described the assembly that the school hosted to celebrate the students’ participation. In addition to arranging these competitions, Terri’s commitment to the teachers included ensuring that teachers had the books and “manipulatives” that they needed to conduct their lessons. She took it upon herself to order the materials from the distributors that were specific to the new curriculum: “so I try to make…that stuff painless, I’ll just do it. I have more time. They have so much on their plate.”

Sarah’s work also involved gathering “all kinds of games and strategies” for use in the classrooms’ small groups. In fact, she identified one of her three most important contributions to the teachers as giving the teachers an assortment “of materials and ideas”. Sometimes her “materials” were books she brought in to enhance lessons. For one particular unit on place value, for instance, Sarah selected some lessons from a particular curriculum and then added an illustrated book to the lesson. At other times, Sarah’s gifts to her teachers were suggestions and brainstormings about various methods: “We do all kinds of strategy work in the beginning of the year with basic facts.” She described how the team of teachers would gather with her to explore and share technological resources: “When we get together on our meetings, we say… [let’s] divide up the responsibilities, and the teachers say, ‘Oh, I’ll do this, and I’ll do that.’ Because…if you’re doing a Smart Board that we all could use, [we] pass it around.”

At another point in the interview, when asked what the teachers might identify as her most helpful contribution to their work, Sarah conjectured that teachers would mention her help with both content planning and materials management: “I think they would say that…I help give them a…structure for what’s important to teach in math…that I help them with creative ideas…and give them lots of materials and ideas.” Esther validated this assessment when she described Sarah’s involvement: “She also brings lots of materials…activities and games.” In
addition, Sarah provided the various groups of students with homework tailor-made for their levels; it was not uncommon for Sarah to create three or four distinct homework assignments for the different groups in a classroom.

**Summary.** Ellen sought to lead her teachers to see the larger picture, especially in the new curriculum, and to understand “the math that’s embedded” in given activities and lessons. Many teachers, Ellen said, had less experience in math concepts than those of other disciplines, and they benefitted from the opportunity to explore the topics in greater depth. Sarah brought a wealth of activities and lesson plan ideas to her teachers with the intention of making their jobs easier. Terri, like Ellen, was instrumental in introducing a new curriculum and saw her role as enabler and provider of resources and information regarding the new program. Michael described the difference that Terri had made in the math program as “night and day” from his earlier days at the school. She had “beefed up” the curriculum, he said, and he was appreciative of her involvement.

**Theme 4: Not “the heavy person”: More encouraging**

A little more than halfway through our interview, Sarah alluded to a feature of her job that emerged as the fourth most frequently mentioned theme among all the specialists and teachers. In response to my commenting that she seemed to have established a rapport with the teachers that was a “combination of a peer and an advisor or consultant,” she said,

Yeah, and what’s really nice is that I don’t have to be the heavy person because the Curriculum Coordinator is the one…they really answer to…In terms of…accountability, in terms of…evaluation? I don’t have to do an evaluation [of the teachers].

Sarah went on to describe how not being “the heavy person” affected her work with the teachers: “it does allow me to be a peer and an advisor…it gives me the…freedom…to just be helpful…to work alongside them and to be another teacher.” I interviewed Esther separately, after talking
with Sarah. Esther confirmed that she worked with Sarah daily and described how the absence of a formal evaluation process affected her. It is “nice”, she said, “because…she’s really there to genuinely help and not to judge…like, ‘Oh, you don’t already know how to teach this?’ [She’s] a really good person to brainstorm with”.

**It makes the relationship.** Similarly, the other two specialists commented on the fact that their responsibilities did not include writing any form of evaluation. Terri indicated that she imagined that having to serve as an evaluator or supervisor would cast a negative shadow on their relationship:

> I don’t think they [the teachers] would be as open to me coming in and observing...you know, just like on the fly... Everyone with those kinds of set ups wants to give you their lesson plans with all their ducks in a row! And...with the way in which my position works now, they’d be like, ‘The girls are doing fine; it’s actually me...Just come in, just come in and tell me what you think’.

Having another administrator responsible for providing formal evaluations of the teachers “makes the relationship, I think”, said Ellen, who had worked with Roberta for more than four years at the time of the interview:

> I think that’s huge...because...if I was going to say, honestly, without sounding like an egomaniac, I think I have a positive relationship with every teacher I work with...And I think that part of it, a huge part of it is that I don’t have any say in, like, evaluation...I’m unique to them...I wouldn’t want it any other way!

When asked to elaborate on the evaluation and supervision process, Ellen said, “My...job isn’t to go talk to either Division Head and give them performance updates.” Roberta, in her work with Ellen, did not view Ellen as a superior or authority figure: “she’s definitely coordinating things...but it definitely does feel collaborative, not hierarchical.” She also stressed that she did not relate to Ellen as an evaluator:
I don’t feel like that; I can say to her, ‘Oh my gosh, that lesson didn’t go well!’ … And she’ll be very honest … There is a constant back and forth, and we talk about things … There’s never that feeling of … ‘I’m watching you, I’m evaluating you!’

**Very safe.** One specialist painted a picture of hosting teachers for lunch: After describing her role as a non-evaluator, Sarah went on to say,

The other thing that happens is, this is very beautiful; this room is right near the lunch space, there’s the lunch … cafeteria right there [pointing next door] … So, the teachers all come in here at lunch and just chat … we do a lot of spontaneous math here or … talk about different kids, but I get to know [the teachers] too … They feel very comfortable a lot … there are these nice round tables … that’s the other thing that makes it very nice in that everyone can come in here and just kind of hang out during lunch.

Her teachers continued to seek her advice, Sarah said, “but I’m still a teacher … like them.”

Esther indicated that she felt comfortable with Sarah, describing her as someone “you can really feel open with.”

Similarly, Ellen identified the comfort level within the relationships she established with her teachers as vital: “We feel very safe in front of each other … It’s huge!” Roberta offered parallel observations, saying, “We are colleagues, peers, we work together … I would venture to say she would say the same thing.”

Terri attributed the ease of her relationship with Michael in part to their long history together: “We just work off each other because we’ve known each other for years now.” The relationship included a dynamic in which the teachers felt comfortable asking Terri to critique their teaching. Sometimes that feedback was part of the grade-level meetings with Terri and sometimes the feedback was given on an individual basis. Referring to the teachers, Terri said, “my schedule really lends itself to those private one-on-one meetings and they’re used to having them.” Michael mentioned Terri’s availability as helpful to him: “Of course, you know,
anytime…I need to visit with Terri because I have concerns about a student…or I have some ideas or suggestions, she has a wonderful open-door policy.”

**Developing strong math teachers.** Partly because of such discrepancies in language arts and math backgrounds among the teachers, Ellen was intentional about helping her colleagues see that they were capable of being “strong math teachers”.

I think that I used to err on the side of just answering all their questions and giving them everything that they need but…I’ve been trying to help them see that they are strong math teachers…And give them, kind of, the skills that empower them…That’s why I don’t always make the agenda anymore, I don’t always answer the questions, I have them bring it to the group…so that it’s not just that I’m the all-knowing math guru.

Whereas in the past she had led discussions and answered questions, Ellen had changed her methods. She had begun to encourage the teachers to add items to each meeting’s agenda; she wanted to give them a chance to have a voice during their time together. With the support of her Division Head, Ellen focused on challenging her teachers with provocative questions to get them thinking more deeply: “So that, I think, is helpful, that part that I do…Because…we [she and the Division Head] definitely are doing a teacher-empowerment.” While discussing how the new curriculum was instrumental in developing teachers’ abilities to get an immediate sense of their students’ progress, Ellen said,

So now, with this curriculum, people are feeling, like, ‘Oh my gosh, I have so much data by the end of one period!’ So they’re feeling great about that. They’re feeling like they ‘get’ their students, and they know where to take each individual student.

Giving over more responsibility and ownership of the curriculum was especially important to Ellen with respect to teachers’ relationships with parents: “parents should also feel comfortable and confident that their, their child’s teacher knows their stuff.”

Roberta noticed that the specialist’s role was shifting, remarking on a change in the
meetings with the specialist. Rather than using the time to discuss the pacing of the curriculum, Roberta said the meetings had become “more now about logistics, or prepping materials, or what do we need, or are there any questions coming up with assessments, or how to take notes, or how are we documenting what we’re seeing…more big picture issues.” The specialist, Roberta continued, had begun to bring up “big-picture issues that we might need to discuss or maybe that we’re not thinking about but we want to or need to.”

**Teachers in charge.** Terri was very intentional about empowering the teachers as she planned a sequence of events that began with her presentation at Curriculum Night; it was a time dedicated to giving teachers the opportunity to provide the parents with more information about the school’s programs. After she introduced the math curriculum with an extensive Power Point slide show, she then scheduled a “coffee” for the teachers to present samples of their lessons for the parents, “so that the teachers were in charge.” Like Ellen, Terri was concerned that the teachers be well versed in the curriculum so their conversations with parents could be informed and substantive.

Michael indicated that he had a say in how the specialist might be helpful on a given day. During the specialist’s scheduled time in his classroom, Terri left it up to Michael and his assistant to decide whether they wanted the specialist to teach a whole group lesson or a small group: “So, it’s up to us how we want her…to be used in the classroom or to pull some girls during that one period a week.” Michael spoke about the specialist’s willingness to teach a particular lesson out of sequence, before she left on maternity leave, saying that lesson “wasn’t supposed to happen until later in the school year, and she was very willing to do that.”

**Summary.** Specialists and teachers alike remarked on the fact that the specialists did not function as a supervisor or evaluator. In all instances, other people in the administration were
responsible for writing formal evaluations of the teachers. The specialist’s role involved providing support and serving as a resource. It did not involve being “the heavy person”, as one specialist described it.

Specialists and teachers described feelings of safety and comfort within the relationship. Teachers indicated feeling safe enough to seek feedback from the specialists when presenting topics for the first time. Specialists, in turn, offered their suggestions privately and in grade-level meetings, sharing their enthusiasm for math with the teachers in conversation and in the classroom. Specialists also spoke of designing their effort in ways that encouraged and empowered teachers; in analyzing their efforts, the specialists described it as “a reassurance thing”, having the “freedom to just be helpful”, and using time together to “brainstorm”, to generate “excitement”, and to enable “exchange”. Similarly, the teachers spoke about their supportive relationships with the specialists as including “flexibility”, having the ability to “brainstorm”, maintaining a “constant back and forth”, and receiving “guidance”.

**Theme 5: Contact Person**

This fifth most frequently mentioned theme contained two main elements. Not only did the specialists remark on their help in coordinating ideas and activities among teachers but they also mentioned the role they played with parents.

**Among teachers.** Sarah spoke often about planning with the teachers and then making sure everyone stayed in close contact with one another. Ideas about content were shared in the hallways, online, and via emails, and were subsequently passed around the groups. She reiterated the ways they helped one another: “If someone makes a Smart Board, we share it; if someone makes something else, we share it.” Teachers sought Sarah’s stamp of approval on new ideas: “I’m, like, ‘Fine! That’s great! Then you send it back to me, I look at it.’” Terri indicated that she
enjoyed this aspect of her role especially when she was able to provide smooth transitions between grade levels: “it’s nice to be the contact person.” Another specialist also referenced the value of serving as the contact person among teams of teachers; Terri said, “it’s kind of nice to have someone …for a subject matter, just pull…everyone together,” especially when there was less frequent communication among certain sets of teachers. Roberta spoke of the value of having the specialist in contact with the various members of the faculty: “She’s definitely coordinating a lot of other efforts cuz she’s also working with the Curriculum Coordinator and the Division Head [and the third/fourth grade math coordinator]…so…she’ll often bring back information from that respect.”

**Between teachers and parents.** Specialists served as liaisons between parents and teachers. Sarah told me that, before our interview, she had been writing an email to a parent on behalf of the teacher, regarding their intention to switch a student from one group to another: “We’re just saying, ‘She needs a little more foundational…knowledge’.” Sarah said they often moved students without consulting parents, “but every once in a while, we have a parent that’s very, very…concerned…[so] we make sure we give them an email and say, ‘We’re just going to switch math groups this week’.”

When asked what she thought teachers might pinpoint as the most valuable aspect of her work with them, Terri identified being the contact person who provided the teachers with a “heads-up” about upcoming curricular challenges, “just to have someone…be like a step ahead.” She immediately linked this support with parent-teacher concerns: “I think it definitely helps with parent communication. I get invited to the really difficult conferences and…it’s another face and it shows the family that all stops are being pulled to…get this kid on board.” Teachers occasionally asked Terri to meet with parents separately, she said, by saying, ““I know this isn’t
typically what you do, but can they come and meet with you at conference time?”” Terri indicated she thought her availability and willingness served as a support to the teachers: “Then the teachers are, like, ‘Thank God they’re gonna talk to you! I’m so tired of answering their questions!’” Michael remarked on Terri’s involvement with parents especially with the coffees and the gatherings they called “First Friday”. The upcoming “First Friday” involved the students teaching their parents specific math lessons. It was all coordinated, Michael said, by Terri.

**Summary.** The specialists were helpful in coordinating ideas and activities among teachers, as well as facilitating contact with parents. One specialist highlighted her role in providing final approval on teachers’ communal brainstorming and then making sure all parties had the same information and resources. Another spoke about maintaining contact with parents about classroom changes, and even sitting in on conferences when teachers felt her presence would serve as a support. Serving as a contact person was yet another way specialists enabled their teachers to feel more comfortable.

**Theme 6: One-on-one TLC.**

This final theme pertained to the kind of student support the math specialists offered to help the teachers. Each math specialist indicated she provided some form of direct assistance to students in need of academic support. Sarah worked with students during class time, pulling them into her office and teaching them separately from the rest of the class. Ellen worked with students in their classrooms, during the regularly scheduled math lesson. Terri set aside time in her morning schedule, before school officially started, to work with students needing additional support.

**Guidance for students.** Sarah found that she was more often called upon to teach the advanced groups of students: “It turns out that it’s really the extension [group of students]
that…needs a lot…more guidance.” She had recently completed a particular unit with a group of advanced first graders, and she had gotten excited as she taught it. “We were trying to figure out how many different combinations of odd numbers you would use to make nine, and make eleven, and make thirteen, and make fifteen…I mean, there was so much I learned!” Sarah reported that designing lessons for the enrichment groups was more challenging than handling the grade-level or struggling students, and she opted to take on that challenge and manage those groups when she was in each classroom. Sarah reported that on-staff learning specialists worked with students who were really struggling and needed specific kinds of remedial support. She assisted the teachers by focusing on the more advanced students, saying those students required a bit more math expertise than the grade-level groups.

Terri, on the other hand, handled the remediation sessions herself. She scheduled them to be held before school each morning by grade level. In order to provide some structure to the time, she organized the schedule to accommodate one class each morning: “We’ve had issues with the fourth graders because of the transition to [the new curriculum], so I gave [Mondays] to fourth grade…so now fourth grade has Mondays and Fridays…and then first, second, and third in the middle of the week.” Terri also set aside half an hour at the end of each school day for struggling students to come for homework help but found that the students did not take advantage of her offer: “I think the teachers are just dealing with it child by child.”

When asked what she viewed as the most effective ways she enhanced teachers’ confidence and sense of competence, Terri said it was the support that she provided to the struggling students. She described how she thought the teachers felt in response to that support: “Just having another person to call and just be, like, ‘She tanked…the test, can she re-do the whole thing with you, and just get a little one-on-one TLC?’ I think that’s been huge for those
teachers.” Terri said she felt she eased the teachers’ burden by taking the struggling students: “I think…a lot of stress is alleviated when [the teachers] know that…there’s going to be some opportunity for me to see the ones that they’re really worried about.” At times, she worked with struggling students, she said, and at other times, her focus was on students needing enrichment: “whatever support they need.”

**Class by class basis.** Ellen found her role varied depending on the needs of the individual classrooms. She and the teachers constantly assessed the students and made decisions on the spot. The day of the interview, Ellen had been in one of the first grade classrooms and had noticed three students having difficulty organizing their work.

> So, I said, ‘Well, let me work with those three.’...And then [one of the teachers]...felt like there were about five kids who really got it...so she took those five, and the co-teacher took the remainder of the group. We’re calling it...Guided Math. So we’re really focusing and honing in on what the exact...struggle is.

Ellen described herself as being responsive to the specific needs of each classroom: “It kind of is [on] a class-by-class basis...I’m trying to tailor my work toward what the...teachers and what the class...feel like they need.” She went on to say that one first grade classroom needed her help with struggling students while the other classroom needed her help with “some really bright kids who need that push.” All this work with students was, she said, in the classroom; she did not take students out of the classroom as had been done in the past.

Roberta remarked on Ellen’s shifting role that allowed the needs of the students to dictate the nature of the specialist’s involvement. Roberta said Ellen served as

> a resource in terms of...for the children...looking at kids who are struggling, kids who are more advanced. And...the idea is to give it more fluidity, so it’s not necessarily one group of children that becomes the focus...but to make sure all the needs are being met...more carefully.
**Summary.** Providing academic support for students took different forms but had similar outcomes among the specialists and teachers. While Sarah dealt primarily with students ready for enrichment and advanced learning, Ellen offered help to students who were struggling with the content of the new curriculum and to those needing an enriched “push”. Terri used something of a hybrid approach; her role in the classroom depended on the need during that day’s lesson. However it was configured, it seemed that teachers strongly welcomed the support.

**Conclusion**

Six interviews were conducted to explore the relationships between math specialists and teachers. One focus was on the strategies math specialists used in those relationships to support early childhood math teachers and to help them develop strong perceptions of confidence and competence (self-efficacy). The second focus was on teachers’ experience of that support. Throughout the interviews, specialists were asked to reflect on what they felt served to foster self-efficacy among their teachers; teachers were asked to describe whether the specialists helped them feel more confident and competent in their work, and if they did, how they did so.

The establishment of collaborative environments was expressed by each dyad as a central component in specialist-teacher dyads. Modeling, reassuring, co-teaching, and giving constructive feedback were cited as the essential ingredients for relationships that helped teachers feel more confident about their responsibilities. Another strategy involved helping teachers shape the lessons and it took many forms: adjusting the content, helping with insecurities, asking big picture questions, and strategizing about how to pace the lessons. Teachers indicated they felt well provided for and supported as the specialists managed different sorts of resources, both cognitive and material, and served as a guide for students as needed. Specialists spoke of lightening the teachers’ load in several ways: modeling lessons, co-teaching,
and helping out in the classroom in mutually agreed upon ways. Specialists also mentioned they served as the contact person within the teachers’ circles and between teachers and parents.

The fact that specialists’ job descriptions did not include serving “as the heavy person” emerged as another theme among the interviewees. The specialists described their relationships as casual and congenial; teachers, in turn, indicated they felt safe with the specialists. They said that they felt comfortable with the specialists and that they could seek their guidance especially as they grew to feel more familiar with the curriculum in use.

Before continuing on to Chapter 5, it is important briefly to examine the uniqueness of the independent school environment and culture. These teachers and specialists appeared to view their collaborative environment as a normal, even assumed part of the culture; teachers described welcoming the specialist into their classrooms and feeling quite comfortable with her presence. Specialists, in turn, considered themselves part of the teaching team as they modeled, co-taught, and worked with groups of students within and outside the classroom. Such an collaboration and partnership model seemed embedded in the culture of these independent schools.

Perhaps there is something specific to the independent school setting that fosters such a culture of collaboration. From my perspective, it seems that the absence of formal evaluation processes contributes to the camaraderie; at the schools involved in this study, teachers did not fear specialists as evaluators but instead looked to them with respect as they anticipated their participation in a day’s lesson. Additionally, because the specialists were part of the school’s faculty, teachers joined the staff with the understanding that partnering with specialists includes direct classroom interaction and lesson planning; the partnership was already in place and teachers adjusted to it. Lastly, my impression is that, without having to comply with new and often confusing state standards, the teachers were less fearful about opening their doors to
coaches/specialists and less threatened by feedback; trust grew among colleagues. These factors have far-reaching implications for practice that will be discussed at length in Chapter 5.

These factors, the participants’ answers to my questions, and these themes that emerged from their answers point us to some of the qualities of the specialist-teacher relationships that foster and support teachers’ self-efficacy. The following final chapter explores the implications of these themes and strategies for practice. Suggested conclusions are compared with the reviewed literature to identify areas of consistency and of divergence. The limitations of the study and some recommendations for further research are discussed as well.
Chapter 5

Many educators find themselves feeling uncomfortable, fearful, or ill equipped to teach math to elementary school children (Wilkins, 2008; Zeller, 2006). The research detailed herein was conducted to address this particular problem. The purpose of this case study was to explore the relationships between coaches and early childhood teachers and to identify strategies used to support teachers as they strive to educate young mathematicians. The main research question that drove this study was: How do the relationships between math coaches (specialists) and early childhood math teachers influence the development of teachers’ self-confidence and sense of competence, teachers’ sense of efficacy? Two sub-questions influenced the interview questioning: first, what elements of the relationships between coaches and teachers do coaches identify as most effective in influencing teachers’ self-efficacy beliefs; second, what aspects of these relationships do early childhood math educators identify as influencing their own self-efficacy? Throughout the interviews, math coaches, commonly referred to as “math specialists” in independent schools, and teachers were asked to describe the components of their work together that affected the teachers’ self-efficacy. The transcripts of those interviews were then analyzed for recurrent themes. This chapter reviews those themes in brief, explores possible interpretations of these findings, relates the findings to the existing research, and discusses a number of implications for research and practice. A review of some limitations of the study and recommendations for further research concludes the chapter.

Brief Overview

My analysis of the six interviews revealed a total of six themes, the first two of which figured most prominently in the interviews. First, specialists and teachers all pointed to a

5 See Campbell and Malkus (2014) for further discussion about these interchangeable terms.
collaborative environment as being one of the main ingredients of the encouragement that enabled teachers to feel confident and competent in their work. When specialists modeled lessons, provided reassurance, co-taught and gave congenial but constructive feedback, teachers said they felt supported and comfortable in the classroom. Teachers seemed to attribute many of their positive self-efficacy beliefs to the work of their actively engaged specialists. The specialists, in turn, pinpointed such engagement as one of the main ways they felt they enhanced their teachers’ self-confidence and sense of competence: their self-efficacy.

Second, participants in the study identified having regular meeting times as another major source of support and encouragement. Content planning, big picture discussions, and pacing were the main features of these meetings that seemed to reduce insecurities and bolster self-confidence among teachers.

The third and fourth themes concern the ways in which the teachers and specialists valued their time together. Specialists reported that leading the teachers to reflect on the “math that’s embedded” in the lessons, as Ellen said, and providing them with helpful materials and activities enhanced their confidence. It was vital to all participants that the specialists served as peers, advisors, and colleagues, not evaluators. One specialist remarked that feeling “very safe” in her relationships with the teachers was “huge”.

The final two themes incorporate the help that specialists offered teachers in other areas of their work. Specialists reported improving teachers’ self-efficacy when they lightened teachers’ loads by serving as the central contact person among teachers and between teachers and parents. Specialists also worked to provide remediation and enrichment for students as needed, either during math class or at other regularly scheduled times.
Interpretations and Relevance to Literature

These themes suggest that the specialists and teachers believed that having the specialists in the classroom, modeling appropriate ways to teach a lesson, and working alongside the teachers are strategies that enhance self-efficacy. Watching a specialist “unpack a lesson” helped teachers a great deal, according to Ellen. “I learn from her, definitely!” reported Michael about his specialist’s modeling in his classroom. In other words, teachers reported experiencing positive feelings of what Bandura (1997) would describe as self-efficacy beliefs when the specialists used a hands-on approach in the teacher-specialist relationships.

Teachers’ self-efficacy was further enhanced by the planning sessions with specialists: Michael described them as times when the specialist was “just working out the kinks…she’s there to…help us in any way”. Ellen considered the meeting times as opportunities for “more big picture discussions on the math that we’re teaching”. She continued by saying, “Having those discussions has led to some ‘Ah-hah!’ moments” when teachers come to new understandings of the meaning behind particular lessons. Research done by Vogt and Rogalla (2009) confirmed this finding when they determined that planning meetings had positive effects on teachers’ planning competencies. Shidler and Fedor (2010) also concurred when they emphasized the importance of helping teachers “become reflective” about “practices as well as beliefs” (p. 71).

Each of the participants in this study was involved in some sort of program change. Implementing new curricula can be difficult for teachers. Teachers often need ongoing support especially since professional development alone has been shown to be ineffective in supporting teachers as they implement changes (Joyce & Showers, 1982). Terri expressed gratitude that her teachers were able to get to various workshops and seminars during the summer months, but she also said she realized that continued support was essential. Chval et al. (2010) supported this
observation, stating that professional development alone was not enough to enable teachers to make improvements in their teaching practices. Furthermore, researchers found that teachers’ self-efficacy can weaken when faced with curriculum changes, but that “the professional development format that supported mastery experiences through follow-up coaching had the strongest effects on self-efficacy beliefs for reading instruction as well as for implementation of the new strategy” (Tschannen-Moran and McMaster, 2009, p. 228).

Interpreting these findings is, in one sense, fairly straightforward. Specialists and teachers both expressed that having specialists working in the classroom, demonstrating, co-teaching and planning with teachers, enhanced teachers’ self-efficacy. Teachers said they felt supported when there was someone helping them, leading them to reflect on the material, and managing the various resources needed to put together a math lesson.

In another sense, these findings are complex. As mentioned above, when asked about the role of the relationship, one specialist described the positive nature of the relationship as “huge”. When asked for elaboration, both specialists and teachers indicated that an essential ingredient in the relationship involved engendering feelings of trust and safety. In fact, all three specialists remarked on how close they felt to their teachers and how much they appreciated not having to evaluate or supervise them. One specialist appreciated having “a positive relationship” with her teachers. Another specialist remarked on not having to be “the heavy person”, and how that made her relationship with the teachers much more congenial. A teacher reported she felt the specialist was, “there to genuinely help and not to judge” in any way. Although this theme was discussed relatively briefly by each participant, it was also shared with a sense of great conviction. The safety these teachers felt with the specialists seemed to encourage a relationship
of trust and mutual respect. That safety and congeniality, in turn, appeared to contribute to the specialists’ ability to enhance teachers’ self-efficacy.

While this theme was identified in the literature (Obara and Sloan, 2009; Heineke, 2013; Sheffield, 2006; Woleck, 2010; Slater and Simmons, 2001), its emergence in the interviews as such a vital component of the relationships strongly supports the research. Sheffield (2006) listed “trust [and]…friendly working relationships” as the highest priority for coaches working with teachers (p. 46). “Without a doubt,” concurred Heineke (2013), “the teacher-coach relationship was discussed more ardently by coaches and teachers than any other factor related to successful coaching” (p. 427). This coaching must have a foundation of “a respectful/listening attitude”, “credibility”, and “trust/confidentiality”, Heineke (2013) continued, otherwise “productive coaching” is not likely to occur (p. 427). Helmer et al. (2011) added to the dialogue: “The researchers’/coaches’ biggest challenge was to build strong interpersonal relationships that were built on professional trust…Maintaining confidentiality is of utmost importance to the success of the coaching relationship” (p. 208). Thankfully, these teachers seemed to experience their specialists as respectful, safe, and trustworthy. In the words of one specialist, “I wouldn’t want it any other way.”

**Implications for Research**

How do these findings contribute to existing research? Current research encompasses coaching and peer coaching among older elementary (Bruce and Ross, 2008; Latz et al., 2009; McGatha, 2008), middle (Cave and Brown, 2010), and high school teachers (Slater and Simmons, 2001). Much current research also focuses on coaches working with teachers primarily in language arts. This study extends those findings to early childhood math settings and supports
a growing consensus around the importance of a collaborative environment that includes modeling and co-teaching (Shidler, 2009; Vogt and Rogalla, 2009).

Over 30 years ago, Joyce and Showers (1980) determined that peer coaching that involved a “combination of modeling, practice or feedback” would give teachers the optimal conditions for learning new concepts and pedagogical skills (p. 381), while Sailors and Shanklin (2010) actually included modeling in their definition of coaching. The findings of this study support such earlier research.

However, not all researchers are in complete agreement about the importance of modeling. McGatha (2008) focused on what she called “three support functions of a coach: consulting, collaborating and coaching” (p. 139). She conducted a case study of two full-time professors of mathematics at local colleges who met with two elementary school teachers several times over the course of a school year. The professors concluded that “model teaching was not the best vehicle for supporting teachers’ professional growth” (p. 148). McGatha (2008) called for more research – case studies in particular – “to begin to understand how coaches can support teacher professional growth” (p. 148). While the demographics of the two studies are not identical, this case study offers another perspective on the value of modeling.

**Implications for Practice**

This study and the current research would support the idea that specialists need to be proactive. They need to take the lead in establishing collaborative environments and being engaged participants in their teachers’ daily work. Specialists’ participation needs to include helping teachers learn new material and methodologies by modeling, co-teaching, planning, pacing, and managing the necessary materials.
The findings of this study and current research further suggest that specialists’ support needs to be non-evaluative and non-judgmental. According to Tschannen-Moran and Tschannen-Moran (2011), “Evaluation and coaching can work at cross-purposes if schools blur the distinctions between them” (p. 10). Specialists reported that they did not want to evaluate those whom they guided, supported and counseled. Teachers, in turn, said they felt most supported and most confident about their own teaching particularly because specialists were with them not to supervise or evaluate but to offer feedback, guidance and affirming support. Optimally, it would appear that specialists’ job descriptions should not include formal evaluations of their teachers lest it hamper their ability to work alongside them and lead teachers to feel judged or graded.

While it is important to note that Obara and Sloan (2009) agreed that trust was “an important component” (p. 20) of a coaching relationship when curricular changes were being implemented, it is equally important to note – and echo – the call for more professional development for coaches. As of this writing, there are only a few small-scale training centers. One such institute is in Baltimore, MD, hosted by McDaniel College: the Elementary Mathematics Specialists and Teacher Leaders Project (ems&tl). It offers specific training for math specialists in the Maryland region and at/before meetings of the National Council of Teachers of Mathematics (NCTM). This initiative is funded by The Brookhill Foundation but it will continue only until June 2015. There is also the National Council of Supervisors of Mathematics (NCSM), which publishes a journal and holds annual meetings. More of these kinds of institutes and seminars, aimed specifically at math specialists/coaches, are needed to disseminate information and offer essential training to math specialists/coaches in all parts of the country.
The recent introduction of the Common Core standards, according to a New York Times article (Green, 2014), has brought confusion and anger among teachers, students, and parents:

The trouble always starts when teachers are told to put innovative ideas into practice without much guidance on how to do it. In the hands of unprepared teachers, the reforms turn to nonsense, perplexing the students more than helping them… the reforms have arrived without any good system for helping teachers learn to teach them. (p. 24)

It is therefore especially important that, at the state and national level, math specialists be part of elementary school faculties so that they can support the teachers and the implementation of new curricula and standards. Specialists need training, however; universities and national organizations need to establish training programs for teachers with classroom experience wanting to become math specialists. These could be degree or certificate programs in math education with a specialization in coaching. The specialists in this study had a minimum of 12 years of teaching experience; while they may or may not be interested in additional degree work, they might benefit from university or national conferences’ training seminars and workshops.

At the local level, specialists should be encouraged to attend to the quality of the relationships they establish with their teachers, since it makes a demonstrated difference in their ability to enhance teachers’ self-confidence and competence. School administrators should include and support full-time math specialists on their staff, especially at the elementary level where children’s early experiences of math are so formative and where the need for classroom teacher support is great. Journals need to publish more studies and articles about the importance of math coaching for the advancement of teachers’ self-efficacy. It is hoped that this study will encourage others to explore these areas of research further.
Postscript

In over 20 years of teaching, I have encountered a variety of elementary education environments. In many cases, teachers are happy to be observed in their classrooms; they teach with an “open door” policy, welcoming specialists and even visitors such as tour guides and administrators. In other cases, teachers are much less comfortable in having visitors in their classrooms, even those visitors who, as specialists, could provide supportive, constructive feedback. It takes courage to have one’s practice observed and critiqued and many teachers seem happier to be left alone.

The participants in this study were teaching in environments in which observations, partnership and feedback were both welcome and commonplace. Teachers taught with their doors open, literally, and welcomed specialists into their rooms. Administrators, supported by collaborative and collegial specialists, had enabled an environment in which teachers learned to teach with their practice open to observation and suggestion. In such a culture, teachers can develop relationships with specialists and with their co-teachers that enable them to grow in their own profession. This is particularly important in light of the recent changes in standards and curricula that teachers are expected to implement. Specialists need to be delicate and respectful as they provide guidance and as they serve as resources; teachers need to be courageous enough to open up both their classrooms and the practice of their craft

Relational Dimensions of Self-Efficacy

As this study has suggested, the relationship between specialists and teachers represents an important component of building teacher self-efficacy. Even beyond the deployment of specific tactics such as modeling, resourcing, and co-teaching, teachers’ sense of their own abilities appeared to rest, at least in part, on their relationships with the specialist. Support in the
form of ongoing availability was one of the components of the partnership; as one teacher put it, “Of course…anytime we need to…visit with [the math specialist] because we have concerns about a student…or I have some ideas or suggestions, she has a wonderful open-door policy…she’s very available…[and] she really makes math fun!” One specialist said, “They know I’m around and how…to get to me.” To the extent that teachers may have felt insecure with the new curriculum, they felt confident about the support available from the specialist. With the advent of a new curriculum, one specialist said, she concentrated on being there for the teachers: “Now it’s…really focusing in on what the teachers need or what the [students] need.”

From this perspective, it would appear that there is a dimension of self-efficacy that goes beyond measuring teachers’ confidence in their skills or abilities. These teachers’ sense of efficacy was clearly enhanced as a result of the relationships formed with the specialists. As the teachers and specialists in this study collaborated with one another, and as they developed genuine partnerships, they demonstrated this relational dimension of the development of self-efficacy. For these dyads, teacher self-efficacy included an interpersonal dimension that was enhanced by the trust, confidentiality and mutual respect in the relationship.

Teachers also expressed their comfort with the specialist’s presence and how she was viewed by all: “It’s more, like, ‘Hmm, the math specialist is in the room, part of what we’re doing’…the kids…view her as…another…math teacher.” A teacher’s beliefs in his or her ability to open up their classrooms can lead to a welcoming space for all kinds of learning, including teacher-learning. This collaboration and availability for learning among teachers can, in turn, encourage a similar partnership in the classroom.
Strategies beyond the Context of Independent Schools

The context of this study warrants additional attention because of the role it played in these findings. For example, in independent schools, teachers are not required to use the new Common Core Standards. The independent school specialists offer guidance and support as the teachers implement new curricula, but unlike public schools, teachers are not being assessed regularly based on their students’ performance on standardized testing. In such an environment, teachers are able to feel less threatened by the specialists’ presence, observations, and feedback. In this study, one teacher described the specialist as “a consultant, an advice-giver”. Specialists were not seen as adversaries or worse, as judges. They were seen as part of a support system.

In the public schools, it would be helpful if specialists could build similar relationships without being involved in evaluation processes so that teachers could feel freer to seek their help without fear, especially as they strive to put new standards into practice. Therefore, my first suggestion would be that curriculum coordinators and other administrators bear the responsibility for teacher evaluations. Second, specialists need to find ways to establish and develop strong and trusting relationships with their teachers. This is more easily accomplished in schools with small faculties and it is optimal to have one specialist assigned to each school in a district. In larger settings, or where specialists are responsible for supporting teachers in several schools, they would need to devise alternate strategies for developing relationships with teachers. Planning and modeling lessons with teachers in small groups, inviting teachers to observe co-teaching sessions in classrooms, offering videos of modeled lessons, and providing leadership for professional learning communities are just some of the methods specialists could use to provide a sense of partnership and to establish collaborative relationships. Finally, because specialists are so instrumental in enhancing teachers’ sense of efficacy, we need to be sure to provide them with
ample support by enabling them to attend regional and national conventions that offer valuable professional development opportunities. Further exploration into ways to optimize a specialist’s time and energy is needed.

**Limitations of the Study**

Because the intention of this study was to focus on specific relationships and sets of strategies, it is necessarily limited in both scope and breadth. The homogeneity of the group of participants limits the generalizability of the findings. Affluent urban schools provided the context; studies conducted at lower socio-economic settings and/or in rural areas may not yield similar results. The focus was on independent schools; public schools have different staffing situations and these results may not apply to those settings. This study was a cross-section of time; a longitudinal project might provide different data. Finally, only three dyads were interviewed. A broader range of participants may yield different results.

**Suggestions for Further Research**

“There is a lack of research on coaches’ interactions with teachers in coaching situations and how they can support teacher professional growth…How the roles are enacted…seems to be a critical missing piece in the literature” (McGatha, 2008, p. 149). The intention of this study was to begin to address that missing piece: to explore the relationships between specialists and teachers and to identify strategies used by specialists as they supported and enhanced teachers’ sense of efficacy. As McGatha (2008) pointed out, more studies need to be conducted to determine best practices among specialists and teachers in a variety of settings. Do early elementary public school math specialists experience the same needs among their teachers as their independent school counterparts? Are such specialists able to serve the teachers in non-
supervisory roles? What needs do math specialists or coaches in rural and urban lower socio-economic settings find most pressing?

Additional studies on the effects of teachers’ sense of efficacy on their instructional efficacy and, in turn, on student experience and achievement, could also be extremely helpful. If researchers were able to compare math teachers who were supported by math specialists with those who were not, they might hear those teachers report different senses of efficacy. Do teachers find their students responding positively to their approaches to teaching math as a result of the specialist-teacher relationships and the implemented strategies? Does student achievement fluctuate depending on the nature of the relationships between math specialists and teachers, on the coaching strategies used by specialists, and/or on the teachers’ sense of efficacy? Researchers, elementary education leaders, and school administrators should feel encouraged to explore these and other questions in the pursuit of enhancing excellence among both teachers and students in early childhood math education.
References


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Appendix 1 - Interview Questions

Northeastern University, College of Professional Studies, Department of Education

Name of Principle Investigator: Dr. Billye Rhodes Sankofa Waters
Name of Student Investigator: Cilla Bercovici
Title of Project: Early Childhood Math Coaching: Relationships and Strategies

Teacher Interviews

1. How long have you been teaching? How long have you been teaching at your current school and what has it been like?
2. Tell me about your relationship with the math coach/specialist on staff.
3. What do you see as the coach’s/specialist’s role?
4. How often, where, when and how do you meet with the coach?
5. What kinds of things do you do with the coach/specialist when you get together?
6. What are some of the ways he/she has been most helpful to you?
7. How does working with him/her affect your teaching?
8. What sorts of things does the coach do that affects your belief in your own capabilities and competence to teach math to your students?
9. How does the relationship you have with the coach influence your own sense of confidence and competence to teach the material effectively?

Coach Interviews

1. How long have you been coaching? How long have you been coaching at your current school and what has it been like?
2. What aspects of coaching are you most passionate about?
3. Tell me about your relationship with the teachers on staff.
4. What do you see as the main characteristics of your role?
5. How often, where, when and how do you meet with the teacher?
6. What kinds of things do you do when you get together?
7. What are some of the ways you feel you have been most helpful to the teacher?
8. How do you think your work with him/her has affected his/her teaching, positively or negatively?
9. In what ways do you think you have affected your teacher’s beliefs in his/her own capabilities and competence to teach math to his/her students?
Appendix 2 - Unsigned Consent Form

Northeastern University, Education Department
Principal Investigator: Dr. Billye Rhodes Sankofa Waters - Student Researcher: Cilla Bercovici
Title of Project: Early Childhood Math Coaching: Relationships and Strategies

Dear __________,

We would like to invite you to participate in a research project. The purpose of this research is to explore the relationships between math coaches/specialists and early childhood educators. You must be at least 18 years old to be in this research project. The two interviews will take place when and where it is best for you. The interviews will last about an hour each. There are no foreseeable risks or discomforts to you for taking part in this study. I will avoid any questions that may make you uncomfortable. There are no direct benefits to you for participating in this study. However, your answers may help us to learn more about the relationships between math coaches/specialists and early childhood educators.

Your participation in the study will be completely confidential. Names and identifying words will be changed in the transcripts of the interviews. Only the researcher conducting the interview will know your identity. No publications will include information that can identify you in any way.

Your participation in this research is completely voluntary. You do not have to participate if you do not want to. You can refuse to answer any questions I ask. You may also quit at any time. You are welcome to ask me any questions at any time. I will give $5.00 gift certificates to those completing the interviews. If you have any questions, I can be reached by phone (914-494-6894). I can be reached by email (bercovici.c@husky.neu.edu). You may contact my advisor, Dr. Billye Sankofa Waters, the principal investigator (b.sankofawaters@neu.edu). If you have further questions, you can contact Nan Regina. She is Northeastern’s Director of Human Subject Research Protection. She can be reached by phone at 617-373-4588. You can also contact her by email (n.regina@neu.edu). You may contact her anonymously if you wish. Her address is:

Nan C. Regina, Director
Human Subject Research Protection
960 Renaissance Park
Northeastern University,
Boston, MA 02115

Thank you, in advance, for considering participating. You may keep this form for yourself. I wish you all the best for this school year,

All the best,
Cilla Bercovici
Appendix 3 - Signed Consent Form

Northeastern University, Education Department  
Principal Investigator: Dr. Billye Rhodes Sankofa Waters  
Student Researcher: Cilla Bercovici

Title of Project: Early Childhood Math Coaching: Relationships and Strategies

Dear __________,

This letter is intended to serve as a follow-up to my recent invitation to participate in a research study. It is also intended to provide you with some more information about the study. Please feel free to ask me any questions about this work. If you decide to participate, I will ask you to sign this statement. I will also give you a copy to keep for your own records.

My advisor and I are asking you to be in this study because you are either a math coach/specialist or an early childhood educator. The purpose of this study is to explore the relationships between math specialists/coaches and teachers. If you decide to participate in this study, we will ask you to sit for two hour-long interviews. These interviews will be held at a time and location most convenient for you. We hope to work with three pairs of coaches/specialists and early childhood teachers. These pairs will be chosen randomly from those indicating an interest in participating.

During the interviews, every effort will be made to ensure you are comfortable and at ease. There are no foreseen risks for those taking part in the study. However, the information learned from this work may help math coaches/specialists and teachers improve their relationships. Your participation in the study will be completely confidential. Names and identifying words will be changed in the transcript of the interview. Only the researcher conducting the interview will know your identity. No reports or publications will include information that can identify you in any way. In rare instances, authorized people may request to see research information about you and others in the study. This is done only to ensure that the research is done properly. We would permit only people who are authorized by the Northeastern Institutional Review Board to see this information.

Your participation in this research is completely voluntary. You do not have to participate if you do not want to. You can refuse to answer any question I ask. You may also quit at any time. If you decide not to participate, there will be no negative consequences. You are welcome to ask me any questions during our interviews. I can also be reached by phone (914-494-6894). I can be reached by email (bercovici.c@husky.neu.edu). You may contact my advisor, Dr. Billye Sankofa Waters, the principal investigator (b.sankofawaters@neu.edu). If you have further questions, you
can contact Nan Regina. She is Northeastern’s Director of Human Subject Research Protection. Her address is:

Nan C. Regina, Director  
Human Subject Research Protection  
960 Renaissance Park  
Northeastern University,  
Boston, MA 02115

She can be reached by phone at 617-373-4588. You can also contact her by email (n.regina@neu.edu). You may contact her anonymously if you wish.

I plan to give $5.00 gift certificates to those who participate. I will cover any expenses you might incur, including parking. I am looking forward to working with you! Thank you, in advance, for considering participating.

______________________________  ____________________
Signature of person agreeing to participate  Date

_______________________________
Printed name of person above

______________________________  ____________________
Signature of person who explained the study to the participant above and obtained consent  Date

_______________________________
Printed name of person above